SCIENCE AND MATHEMATICS EDUCATION CENTRE

HEARING THEIR VOICES: BUILDING A CAREER DEVELOPMENT MODEL FOR WOMEN IN ENGINEERING

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ABSTRACT

This study is an interpretive investigation of the life-career histories of 53 women in engineering; and a case study of one woman's account of present-lived career and her quest for identity in engineering over an eight year period (1992-1999). This study had two broad aims. First, it aimed to give voice to women's stories derived from their own reflective accounts, and to compare and contrast their perspectives with feminist writers' reviews of non-traditional girls' and women's career experiences, and with the organisational career story of itself. Second, it aimed to evaluate the adequacy of my convergence of a socialist feminist "unified systems" theory of social relations (Jaggar, 1983, 1989; Jaggar & Rothenberg, 1984, 1993) with Super's segmental life-span, life-space theory (Super, 1980, 1990, 1994) to explain women's career and personality development. Further to this theoretical convergence, I elaborated on Super's original models and evaluated their usefulness for my gender analysis of career from four perspectives. I conceptualised "career" as both "subjective" and "organisational" (Dale, 1972; Hughes, 1937) and, using Benhabib's (1986b) terminology, created four perspectives by further differentiating career into either "generalised other" or "concrete other" (see Figure 1.1).

Drawing on the findings of my exploration of the women's careers, I extended the range of Jaggar's/Super's explanatory theories of career and personality development (Figure 2. 2) in an elaboration of Super's archway model (Figure 8.1). I found that my combined Jaggar/Super career archway and spider web model (Figure 2. 3) represented the life-space tensions in each individual woman's career decision-making in engineering. The life-career rainbow was a valuable subsidiary model (Figure 2. 4) in highlighting the complexities of gender as an overarching socio-cultural factor for theoretical and conceptual analyses of career and its effect on salient role relationships and personality development at each life-stage. My convergence career ladder represented the organisational career statuses and the successive development of the subjective career and identity through the completion of developmental tasks (Figure 2. 6).

My case study Cecilia, in common with other participants, I found to be an accomplished "feminine ambivalent" (Douvan & Adelson, 1966) and "paver of the way" (Josselson, 1987), yet she (like several others) floundered in the milieux of engineering. Her story indicates the continued need for engineering educators: to acknowledge the significance of women's subjective constructs of career to effect transformative change by promoting equity and excellence; to recognise ways in which the subjective and the organisational constructs of career can complement one another; and to implement changes which facilitate such complementarity. This study fills a space in the research literature on non-traditional girls' and women's career development. It also has potential to assist those who wish to gain a better understanding of the career pathways of women in engineering.

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My appreciation of the late Donald Super, educator and counsellor, whose theory and models of career I used as a springboard to build a more gender inclusive theory of career and personality development.

Finally my admiration of Alison Jaggar's ability to synthesise feminist perspectives and her unified systems approach to changing conditions for women worldwide.

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GLOSSARY OF TERMS

Jaggar's "Unified Systems" Theory of Social Relations (Jaggar, 1983, 1989; Jaggar & Struhl, 1978: Jaggar & Rothenberg, 1984, 1993; Tong, 1992)

Jaggar viewed women's careers as a dialectically constructed and linked to the "on-going historical dialog" within the social order (Jaggar & Rothenberg, 1984). Her revised version of the Marxist theory of "alienation" attempted to inter-relate the myriad forms of women's recent oppression under the unifying concept of alienation (Jaggar, 1983, 1989; Jaggar & Rothenberg, 1984; Tong, 1992). She provided an interpretation for women's careers under patriarchal capitalism where "each and every woman is, in special gender-specific ways, separated from all those processes she needs to achieve wholeness as a person" (Tong, 1992, p. 187). Jaggar, like Super (1990), conceptualised career as past, present and future. She advocated three principles of action to counter women's "alienation" and to promote personal agency in women by encouraging them to deconstruct past career, reflect on present career, and voice future aspirations. She has also worked assiduously to make changes to the gender order and gender regimes of institutions.

Feminine Ambivalent

Douvan and Adelson (1966) defined "feminine ambivalents" as a newly emerging group of adolescent girls in the United States of America. These girls of ability characteristically scored "high on femininity" but choose masculine jobs in moves to improve status.

Josselson's (1987) Four Typologies of College Women's Career Pathways to Attain Identity

"Identity Foreclosers" live by the traditional domestic ideology of their mothers as "purveyors of heritage" with "little sense of self creating itself" (p. 68).

"Pavers of the Way" or identity achievers show a balance between "agency and communion" (p. 171) and achieve identity by healthy "separation and individuation" and connecting to a "new anchor" (p. 175).

"Daughters of crisis" or "Moratoriums" are full of contradictions, continue to be "alive to inner conflict" (p. 139), and lack "supportive others" to help them to "consolidate an independent identity" (p. 138).

"Identity Diffusers" are part of the most diverse and psychologically unhealthy group. They display neither crisis nor commitment to the finding of self and signify an "ego in distress" (p. 167).

Super's "Life-Career" and "Life-Span, Life-Space" Career Development

The life course of a person encountering a series of developmental tasks and attempting to handle them in such a way as to become the kind of person he or she wants to become, with a changing self and changing situations, the matching process is never really completed ... (Super, 1990, pp. 225-226).

Career

Hughes (1937), Barley (1989) and Dale (1972) conceptualised "career" as both "subjective" and "organisational": "… **subjectively**, the moving perspective in which a person sees *her*/his life as a whole, and interprets *her*/his attributes, actions and things which happen to *her*/him ... **objectively**, it is a series of statuses and clearly defined offices ... typical sequences of position, responsibility, even adventure" (Dale, 1972, p. 409 italics are my additions).

"Concrete Other" (CO) and "Generalised Other" (GO) Perspectives of Career

Use of Benhabib's (1986b) terminology to denote the way in which the "concrete other" subjective career of women participants may be placed in a broader socio-historical context of the "generalised other" review of the literature on non-traditional women's careers. Likewise, the terminology is used to clarifying how the women's careers are also constructed within the opportunity structure of the "organisational career" of their professors at the "concrete level" and within the broader context of the "generalised other" of engineering in Australia.

Gender as a Key Social Construct and for Analysis of Women's Careers

It is a concept that encompasses the notion of power relations and patterns of separation between males and females. These gender relationships are socially defined and constructed and are not biologically given. Hence gender is differentiated from sex which is based on biological determinants (Tardif & Atkinson, 1989, pp. 145-146). This definition does not discount that gender "power over" relations are the "property" of individuals, as well as institutions and "historical processes", and are fostered and/or changed by human agency (Connell, 1987; Gilbert & Low, 1994, December; Jaggar, 1983; Matthews, 1983; Walby, 1986, 1990).

CHAPTER ONE

INTRODUCTION

The experiences and underachievement of women once they gain access to higher education have been of increasing concern to feminists and educators of the 1980's and 1990's (Ellis & Willinsky & 1992; Jones & Davies, 1990; Josselson, 1987; Kvande, 1984, 1986, 1987; Kock, 1990; Lie, Malik & Harris, 1994; Mares, 1989; Powles, 1987; Reis, 1987; Rennie, Parker, & Hildebrand, 1991; Thomas, 1990). To some extent, this is also the case in Australian universities where the Commonwealth has provided an overarching systemic framework for change to provide "a fair chance for all" [Department of Employment, Education and Training (DEET), 1990a], especially with respect to the participation of females in traditionally male areas, such as engineering. The importance of the latter has been emphasised by key figures such as Sargent (1991), who in his address as president of the Institution of Engineers, declared that "the face of the future for the profession of engineering is that of the woman", particularly the need for women's "intellectual capital ... in terms of its use in technology-related areas". Similarly, a key report on women in male dominated professions focussed on the importance of "dismantling the divide" throughout the women's life-career span (Department of Employment, Education and Training (DEET), 1991, June). At the same time, feminists, both in Australia and elsewhere in the world, have argued that more women in engineering would increase the emphasis on moral responsibility and ethical concern for the implications of engineering and technology on people's lives (Carter, 1991; Cockburn, 1991; Hacker, 1989; McIlwee & Robinson, 1992; Rose, 1994).

Early attempts to dismantle the divide focused on the access of women to the field and on programs in high schools which would ensure that women with appropriate talents stayed in the "pipeline", or which addressed attitudinal and academic factors which appeared to be inhibiting the entry of women into engineering. While such research has been valuable in terms of recruitment policies and practices (eg, Evetts, 1993; Godfrey, 1991), it appears to have done little to enhance women's experiences of engineering education at university or college level. Problems continue to be identified in relation to the nature of women's participation, retention and success in the field of engineering

(DEET, 1991, June), particularly in terms of the kinds of the programs offered (Boman & Yasuwaka, 1994; Lewis, 1993; Lewis & Roberts, 1994); and the small number of females involved as students (Byrne, 1994, 1991; Cobbin, 1995; Lewis & Harris, 1995) and as professional engineers (Armstrong, 1991; Commonwealth of Australia, 1995; Donald, 1991; Institution of Engineers, Australia, 1996, 1991; Mitchell, 1993; Newhouse; 1989; Williams Report, 1988; DEET, 1990c, 1994). The purpose of my research was to address and explicate these problems.

I began this research by reviewing previous studies which had identified key factors associated with women's advancement within engineering, for example, factors related to lecturers' teaching and management styles, the cultural milieu, and curriculum in tertiary education (Anderson, 1992; Carter & Kirkup, 1990a; Hall & Sandler, 1982; Matyas, 1987); and with professional women's experiences of career in the non-traditional work-place (Carter & Kirkup, 1990b; Cockburn, 1991; Hacker, 1983, 1990; Robinson & McIlwee, 1989; Swarbrick, 1991). My review revealed a gap in previous research, namely, the relative lack of feminist s regarding existing theories of career development. In my view, the consequence of this gap is that few models of career have been used by women researchers to help them pinpoint situational and personal determinants for women in engineering. I therefore chose a socialist feminist/career development framework (Jaggar & Rothenberg, 1984, 1993; Super, 1990, 1994) for my research. Specifically, for reasons discussed in Chapter 2, I adopted Super's models of career development adapting his Career Archway and Spider Web, supplemented by his Life-Career Rainbow and Career Ladder (Super, 1980, 1990, 1994; Watts, Super & Kidd, 1981) to accommodate my socialist feminist perspective (Jaggar & Rothenberg, 1984, 1993; Jaggar, 1983, 1989).

Methodologically, my position was that the development of women's careers in engineering is best explored through a longitudinal narrative study. I believed, like Blair and Maylor (1993) that "one of the advantages of the life history ... lies in the opportunity it provides to view the range of factors that come together to influence and shape an individual's life" (p. 15). My choice of a narrative approach to the study of

career (Blair & Maylor, 1993), was affirmed by others (Cochran, 1990; Connelly & Clandinin, 1990; Heilbrun, 1979, 1988; Super, 1954, 1969a, 1969b) as "a synthetic form, a coherent pattern through time that is capable of representing a career ... the story of her life" (Cochran, 1990, p. 71).

OUTLINE OF THIS CHAPTER

Following this introduction, I present the focus and aims of my study. I justify the need for a contextualised approach to the study, particularly my adoption of "subjective" and "organisational" conceptions of career from both "generalised other" and "concrete other" perspectives. Following that, I provide reasons for the adoption of Super's models of career as my basic theoretical framework, and adaptation of Jaggar's "unified systems" theory in the conduct this narrative inquiry. I formulate my research questions to construct past, present and future career. I discuss the domain assumptions of my feminist perspective and methodology in researching women in higher education and professions, particularly my melding of Jaggar's assumptions and principles of action with socio-psychological theories of personality and career development. Penultimately, I provide a cameo of the participants; discuss the research strategies and on-going data analysis in the construction of life-careers; summarise the key findings from the subjective and organisational career perspectives; and highlight the findings, the significance of this study, and its limitations. At the conclusion of the chapter, I present an overview of the structure and content of the remainder of the thesis.

THE FOCUS AND AIMS OF THIS STUDY

In this study, I explored over a seven year period (1992-1998), the experiences of fifty-three women within the engineering faculty of two Australian universities and in their first professional postings. My study had two major aims. One aim was to investigate the career development of these women engineers, particularly with respect to on-going influences on their construction of their personal and professional identities. The other aim was to enhance understanding of the use of interpretive research paradigms of career.

As explained in more detail later in this chapter, I approached my research from a philosophical position anchored in a socialist feminist theory of social relations, based upon the "unified systems" approach of Jaggar (Jaggar, 1983, 1989; Jaggar & Rothenberg, 1984, 1993). "Career" was the focus and "gender" was the major social construct for my analysis. Because of its ground-breaking influence on career theory and research, I adopted Hughes' (1937) concept of career as both "subjective" and "organisational", which had been applied by Barley (1989) and Dale (1972), modifying his definition to be more gender inclusive:

> **subjectively**, the moving perspective in which a person sees *her*/his life as a whole, and interprets *her*/his attributes, actions and things which happen to *her*/him ... **objectively**, it is a series of statuses and clearly defined offices ... typical sequences of position, responsibility, even adventure (p. 409 italics are my additions).

As pointed out by Dale (1972), this definition provided an "excellent link between the individual and organisational levels of analysis" (p. 66). For people in any organisation, a "career" is, on the one side, a very personal subjective construct, which "sheds light on personal identity" and its progressive transformations; and, on the other side, "a series of statuses through which the individual progresses and this "sheds light on the organisational and other paths" she/he follows. Dale (1972) found in his research that some participants lacked success in or access to "officially encouraged careers" and became part of an "unsuccessful estranged group" (p. 68). I contextualised and juxtaposed the women participants' "subjective" career with the known "organisational career" perspectives of their professors to help me to understand "why [the] organisation is as it is by studying all the careers, official and unofficial", that I found in it (p. 67). I reasoned that contextualising the known women's "subjective career", within the known "organisational career" perspectives of their professors, (whose epistemological, ontological and aesthetic standpoints are critical to engineering education), would help me to gain a deeper understanding of the tensions between situational and personal determinants affecting non-traditional women's careers.

Within each of these (ie the subjective career and the organisational career), I further differentiated the generalised other and the concrete other perspective (Benhabib,

1986b). Using Benhabib's (1986b) terminology, I constructed my review of the literature (see Chapter Three) as a subjective "generalised other" career of non-traditional women. This provided the broader socio-historical context for women telling their "subjective career" stories as the "concrete other" (see Chapters Six and Seven). Likewise, I constructed professors' organisational career as the "concrete other" level of the gender regimes of particular faculties. I further contextualised the concrete other organisational career in the "generalised other" of engineering in Australia. I constructed the latter from the proceedings of a specific conference on engineering education, which coincided with the early years of my study (Parr & Johnston, 1994) (see Chapter Five). I considered that the degree of complementarity between the subjective and organisational career (and between the concrete other and generalised other) would provide an effective basis for planning changes and effecting real transformations in the structural organisation, curriculum and cultural milieu. Figure 1.1 (see below) represents this Career/Perspectives Framework.

	CAREER (after Hughes, 1937)	
PERSPECTIVES (after Benhabib, 1986b)	**Subjective**	**Organisational**
Generalised Other	**Chapter 3 Review of the literature**	**Chapter 5 Part 1 Australian engineering educators**
Concrete Other	**Chapter 6 Voices of 53 women** **Chapter 7 Voice of Cecilia**	**Chapter 5 Part 2 Voices of professors**

Figure 1.1: Framework of Career Perspectives

Synthesis of Super's Career Theory with Jaggar's "Unified Systems" Theory

As indicated earlier and as described in detail in Chapter Two, Super's models (1981, 1990), which are soundly based on a systemic theoretical perspective derived from his qualitative stage theory of personality and career development, provided my basic theoretical framework. His models emphasised an interactive "life-span" and "life-

space" approach to understanding the career of an individual or a similar group of individuals within a specific socio-cultural context. The life history approach advocated and practised by Super (Super, 1953, 1954, 1957, 1969a, 1969b, 1977, 1980, 1983, 1990; Super & Bohn, 1971; Watts et al, 1981) has been adopted as modern developmental approaches for the study of the contextualised career (Blustein, 1994; Herr and Cramer, 1992; Osipow, 1983; Savickas & Lent, 1994; Vondracek, 1990; Young, 1984; Young & Collin, 1992). Although Super's theory and models of career development had been developed on the strength of men's experience (Super, 1980, 1990), what held most appeal for me was their potential to aid my socialist feminist interpretation of women's narratives. Like Jaggar (1983) I assumed that males and females were not fundamentally different in their needs and aspirations for work that would have a humanising effect by connecting them to the products of their minds, bodies, nature, and to other people (p. 253). I was also attracted by his willingness to adopt ideas from a range of theoretical perspectives about how to construct a 'perfect' world that would encourage optimal growth in the potential of all individual at each life-stage; and to adapt both his theory and models in response to any newly discovered anomalies or trends from his own and others' research and practice (eg in Super, 1954, 1969a, 1969b, 1980, 1983, 1990). I also believed that I could strengthen the explanatory power of his theoretical perspective by incorporating my feminist framework that laid particular stress on the interdependence between a woman's development and the historical and cultural context of her past and present career and optimistic future-oriented decision making (Jaggar, 1983, 1989; Jaggar & Rothenberg, 1984, 1993). Finally, there was my concern that explanations and concepts had not been devised to deal with the special challenges of the career development of women (Herr and Cramer, 1992; Osipow, 1983, 1986; Fitzgerald & Betz, 1994). In a sense, my study was a test of how robust the Super/Jaggar convergence of theoretical /philosophical assumptions of career development and life-span, life-space models of life-career were as a basis for my critical socialist feminist analysis of women in engineering in Australia in the 1990's.

Research Questions related to Past, Present and Future Career

I addressed three key research questions, related to Super's fourteen (14) propositions about past, present and future career (see Chapter Two) and variables abstracted from my review of the literature (Chapter Three). The first question related to the women's *past* career recollections of the "growth" stage of early and middle childhood, the "exploration" stage of adolescence; and to *future* career expectations and aspirations:

- What are the key determinants of the individual's background and how are these events perceived as influencing her construction of her personal and professional identity as an Engineering student and her career development as an Engineer? ("Past Career").

The second research question related to the women's *present* career, still in the "exploration" stage, as non-traditional students in engineering education:

- What events in the day-to-day interaction in the Engineering Degree course are critical to the development of the woman's personal and professional identity and competence as an engineering student? ("Present Career").

The third question related to *future* career in the early "establishment" stage in the work-force or in academe pursuing higher degrees:

- What events in the day-to-day interaction in the Engineering work-place (final year or post-graduate studies) are critical to her development of personal and professional identity and competence as an engineer (and/or post-graduate student)? ("Future Career").

Each of these questions I addressed in terms of the four cells shown in Figure 1. The major focus of my study, however, was on the intersection of the subjective career perspective and the concrete other (see Figure 1.1) as reported through the voices of the 53 women in Chapter Six and of one particular woman in Chapter Seven.

Methodological Research Question and Super/Jaggar Theory and Models

I formulated a methodological research question to test the explanatory quality of my Jaggar/Super Convergence Career theory and models:

- How robust is the Super/Jaggar convergence conceptualisation of life-span life-space career in representing and facilitating the construction and interpretation of women's subjective life-career in non-traditional occupations in Australia in the 1990's?

Subsidiary methodological research questions are presented in Chapter Two and in Chapter Four. As criteria of quality, I focussed on (i) the theoretical soundness and integrativeness of my convergence career theory; (ii) the explanatory power of Super's propositions in generating questions; (iii) the accuracy of my elaborated models in representing career; (iv) the practical applicability of this type of research to empower people; and (v) its adaptiveness in responding to newly discovered anomalies (after Krumboltz, 1994, pp. 27-28).

Finally, as reported in Chapter Eight, I used the women's lived and contextualised life-career narratives to draw out, progressively over the years, specific recommendations that required the attention of engineering faculty members. Themes emerged from the women's stories regarding the curriculum, the cultural milieu, and structural organisation that required changes to encourage increased gender inclusivity, quality of participation, and retention of these women in the field of engineering.

MY ADOPTION OF JAGGAR'S PERSPECTIVE ON WOMEN'S CAREERS

Jaggar's Assumptions and Principles

Like others, Jaggar recognised that being born female made a difference to the quality of life-career development and fulfilment. Her "unified systems" socialist feminist standpoint (Jaggar, 1983, 1989; Jaggar & Struhl, 1978: Jaggar & Rothenberg, 1984, 1993; Tong, 1992) represented for me a blend of theoretical and methodological principles that aimed to give women a voice as a minority group. Like Oakley (1981), Astin (1984) and Branson (1991), Jaggar's theory was about putting women first and judging women's needs, interests and values to be important and insufficiently

represented within mainstream politics and academe. Jaggar's key premise focussed upon the social order and the powerful impact of the ideology of patriarchy and capitalism in Western cultures and particular historical context on women's development, and was based upon her critical and continuing analyses of the hindering effects of gender power relations in the social order and institutional regimes on women's life-career pathways (Jaggar, 1983, 1989; Jaggar et al, 1984, 1993).

Jaggar's unified systems theory of social relations, in common with other forms of critical socialist and radical feminism, accepted the historical materialist approach begun by Marx and Engels regarding the origins or causes of women's subordination (Jaggar, 1983). Though grounded in the assumptions and principles of the "sociological imagination" (Erikson, 1970; Horowitz, 1963; Wright Mills, 1976), Jaggar adopted an early Marxist feminist method of historical analysis of women's life-careers, using the seminal work of Rubin (1975) and Firestone (1971). Her key assumption, from the Marxist tradition, rejected explicitly the notion of an essential and biological determined human nature, which was the fundamental premise of patriarchal conservatism. Another assumption, adopted from Radical feminism, was her insistence that the oppression of women is fundamental to other forms of oppression associated with class, age and race within all societies (Jaggar, 1983). This has been supported in a number of ways, by both critical feminists (eg, Eisler, 1987) and concerned social historians who hold that "deeper down than we are rich or poor, black or white, we are he or she" (Roszak & Roszak, 1969, p. 94).

As her first principle of action, Jaggar emphasised that because the construction of women's careers continues to be influenced by the past collective oppression of Western society, women (and men) needed to deconstruct the past to begin to effect real change in the present (Jaggar & Rothenberg, 1984). Deconstruction also involves reflexive critical understanding of the self and subjectivity at the micro-interactive level and thus, as Jaggar claims, I reasoned that the inclusion of socio-psychological theory (Astin, 1984; Betz, Fitzgerald & Hill, 1993; Chodorow, 1978, 1984; Josselson, 1987; Newson & Newson, 1976; Martin, 1985; Roe, 1953) and critical gender theory (Noddings, 1984;

Gilligan, 1982) should be incorporated into my feminist framework for this project. This would enable me to focus more specifically on personal determinants of career (abilities, interests, values and needs) and how women define and construct "themselves in a context of human relationships ... where attachment and separation anchor the cycle of human life" (Gilligan, 1982, p. 155). Most of these theorists assumed that it was relationships within the gender regimes of family that particularly served to modify these personality factors; influence women's choice of career patterns; and their progression of relationships towards a "maturity of interdependence" (p. 155).

Jaggar, in her revised version of the Marxist theory of "alienation", made a concerted effort to inter-relate the myriad forms of women's recent oppression under the unifying concept of alienation. She explained how, under patriarchal capitalism, forms of progressive "alienation" are imposed by all the social structures that "enable men to control women's labor" (Jaggar & Rothenberg, 1984, p. 178); and are gender-mediated experiences (Jaggar, 1983, p. 308). She reasoned that all sites of social interaction (family, work, and education) have the potential to be oppressive and to position a woman as 'the other' and to be the source of her disintegration. These collusive ideologies she saw as serving to alienate women in a threefold way, namely from their own "sexuality"; from their "motherhood" and "caring" roles within the family; and from their "intellectual capacities" (p. 316) as public workers. Jaggar, as noted later by Tong (1992), provided an interpretation for women's careers under patriarchal capitalism where "each and every woman is, in special gender-specific ways, separated from all those processes she needs to achieve wholeness as a person" (p. 187).

As a second principle of action, Jaggar emphasised the importance of freeing women from present career oppression, by conscientising women to the covert ideological process in the gender regimes of family, education and work. Her plan was for women to identify forms of oppression in their present career to help them to recognise that their alienation was not only distorted by the internalised world view of women and men, but externally manifested by collectivities of men and women in the social institutions and cultural structures of society. In order to break free from this cycle, Astin (1984) went

further than Jaggar by advocating that both men and women should initially confront "gender bias in their [own] lives ... and to be examples of caring partners as models for their children at the level of practice" (p. 119).

Jaggar (1983) emphasised that the concept of "alienation" could also be used to explain how under capitalism everything (eg, work, leisure, education) and everyone (eg, family, friends, colleagues) could be a source of integration for a person (p. 383). Josselson (1987), inspired by Chodorow (1978) and Gilligan (1982), had studied from a post-positivist position the gradual modification of self within social and educational contexts, by focussing on "identity" that was "neither a structure nor a content" but a property of the ego that "organises experience" (p. 12). She chose to use a number of metaphors to signify four qualitatively different career pathways chosen by college women to attain identity.

The first group she identified were the foreclosers, who lived by the traditional domestic ideology of their mothers as "purveyors of heritage" with "little sense of self creating itself" (p. 68). The second group, the identity achievers, who were the "pavers of the way" showed a balance between "agency and communion" (p. 171). She found that they achieved identity by healthy "psychological distancing" from "mother" or domestic ideology by connecting to a "new anchor" through mentors, career involvement, friends and / or avocational interests (pp. 175-177). This career pathway, then, was best achieved in a web of relatedness (p. 179), which was undergirded by an ethic of care and concern and an openness of the women to growth and change (p. 181). The third group the moratoriums or "daughters of crisis" were full of contradictions. For example, she found these women students were "aware of choice" and often "paralysed by their awareness", yet characteristically the "most lively, interesting and engaging" women (p. 107). Consequently, this group did not possess the "positive adaptive personality traits of their male counterparts", and showed " lower self esteem and greater anxiety" than either the foreclosures or identity achievements (p. 107). They were more "insightful, self-reflective and internally sensitive" than the other groups, but most continued to be "alive to inner conflict" (p. 138). Finally, there were women who were

identity diffusers, and part of the most diverse and psychologically unhealthy group. They displayed neither crisis nor commitment to the finding of self, and Josselson (1987) concluded that their behaviour in the university setting should be taken as a "signal of an ego in distress" (p. 167).

I selected Josselson's (1987) four typologies to help me interpret from the women participants' life-career narratives: the early development of personality and vocational identity status in family, leisure and school (Josselson, 1982, August); how successfully they attained identity at the end of adolescence and had made this transition to engineering education (Josselson, 1987, 1988); and how well they were continuing to set goals and achieve their vocational identities with others in engineering contexts (see Chapter Six).

Jaggar, like other feminist theorists (eg, Alcoff, 1988; Benhabib, 1986a, 1986b ; Fraser, 1989; Greene, 1976, 1988; Heilbrun, 1979; Rose, 1994; Spender, 1980, 1981a, 1981b, 1982a & 1982b) constructed women's careers as future, as well as past and present. She advocated that women reinvent womanhood by dreaming and reading about future career possibilities involving equitable social relations and valuing different ways of knowing in society; and pro-actively begin to incorporate utopian socialist values of "equality, cooperation, sharing, political commitment, freedom from sexual stereotyping, and freedom from personal possessiveness" within their present career relations and construction of self (Jaggar, 1983, p. 337). This was part of Jaggar's third principle of action where personal awareness of oppression is combined with strategies that enhance a women's sense of personal agency to move effectively from her present oppressed positioning and to effect positive change.

Naming and Conceptualising Gender

In Jaggar's (1983) explanation of women's subordination and oppression she described her concept of alienation as a gender-mediated process promulgated by the social order of patriarchy and capitalism and the effects of hegemonic masculinity in institutions. She claimed that it is not only non-wage earning women who can be alienated, but also that wage earning women experience alienation differently than wage-earning men (Jaggar, 1983). She considered the epistemological consequences of the differences as well as the similarities among women. She reasoned that, only by working through the differences as well as the similarities, could women develop a systematic representation of reality that was not distorted in ways that promoted the interests of men above those of women (Jaggar, 1983, p. 386). Linking in with Jaggar's perspective (1983), I perceived a need to define gender to make it visible because the "names, which construct social reality as much as they express it ... are the stake par excellence of political struggle" (Bourdieu, 1989, cited in Rose, 1994, p. 239). My choice of definition emphasised the cultural process of organising life in a particular way, and where male and female sexual and social identities were built in relation to each other. It is a concept that :

> ... encompasses the notion of power relations and patterns of separation between males and females. These [gender] relationships are socially defined and constructed and are not biologically given. Hence gender is ... differentiated from sex which is based on biological determinants (Tardif & Atkinson, 1989, pp. 145-146).

My interpretation of this gender construct at the institutional level emphasised gender power over relations that I contended still influence the unhealthy construction of the 'male' and 'female' identity within social and vocational roles and is perpetuated by cyclical practice. My definition did not discount that gender "power over" relations are also the "property" of individuals, as well as institutions and "historical processes", and are fostered and/or changed by human agency (Connell, 1987; Gilbert & Low, 1994, December; Jaggar, 1983; Matthews, 1983; Walby, 1986, 1990).

For the purpose of this study, I adopted Connell's (1987) refinement of Matthews (1983) definition of the "gender order" as "structural inventory of an entire society", characterised by its "historically constructed pattern of power relations between men and women and definitions of masculinity and femininity" at a given time and place (p.99). Thus, major structures impinge on the way masculinity and femininity are formed in particular milieux (Matthews, 1983, 1984; Walby, 1986, 1990). For example, at the individual level, girls and women, as well as boys and men, are influenced from birth by stereotypical gendered expectations held by others and later by self, which ascribe status and dominance to the more valued masculine over the feminine and pervades every aspect of every person's life-career.

I also adopted Connell's (1987) refined definition of a "gender regime" as the "structural inventory" of the current "state of play in gender relations in a given institution" (p. 99), including family, education, and work contexts. I found it helpful too, to build on his interpretation of the gender structuring of "production", in the "occupational" culture of professions, like engineering, where embedded "elements of sexual character" influence the distinctive set of practices "of the moment" and subsequent practice (p. 141). From this perspective of a profession, I constructed engineering "historically as a form of masculinity" and by the way its "masculine character" was maintained by the "exclusion of women" because women were considered unfit to have its specialised "theoretical knowledge with technical expertise" (p. 181). Since "hegemonic masculinity" is always constructed in relation to women as well as various subordinated masculinities (p. 183), the very entry of women into the profession has challenged its *status quo* in recent times. By the same token, I assumed a patriarchal social order would still influence practices in engineering and the individual woman's construction of self and identity. Notwithstanding, I anticipated some change in the gender regime would reflect different patterns of hegemony amongst and between women and men in engineering. I also anticipated some change in the gender regimes of their families and schooling in terms of past career and in women's aspirations towards an equitable future career.

Feminist Perspectives on Women in Higher Education and Professions

The feminist orientation of my study was informed by four domain assumptions which I have identified in the critical literature on women in higher education (eg, Connors & McMorrow, 1988; Kenway, 1989, Winter, 1990; Yates, 1988) and the professions (eg, Cockburn, 1991; Marshall, 1985). First, feminist s of the late eighties, whilst highlighting the limitations of higher education provision for women in Australian universities, and particularly in engineering education, have also focussed attention on the special needs of women and what ought to be done to meet their needs. Kenway (1990) concluded that gender equity policies had been interpreted by government, administrators and mainstream educators in a limited way, where gender justice was simply designing education to prepare girls for the "sorts of vocations" that would "enhance the economy" (p. 73). They failed to address the deeper issues of gender harassment and the continued subordination of women and girls in the family, education and work. What was needed, she concluded, in addition to politically driven "inside" research, was an empathic, connoisseur approach that would subject both policy and practice to "skilled, sensitive and fearless appraisal" by exploring "the complex dimensions to 'cutting edge' issues" (p. 69). Kenway (1990) inspired me to conduct such research as an "outsider" researcher, who could "influence policy and [to] bring about change not only to educational practice and the current ways in which educational policy is produced, processed and received" but also to "further shape" theory (p. 75).

Second, the late 1980's was also a time when feminists were "revisioning" career concepts and finding more effective ways to explore the career development of women and social equity in practice (eg, Gallos, 1989; Hildebrand, 1989; J. Marshall, 1989), especially the "stigmatised" professional woman in a "male sex-typed career" (C. Marshall, 1985). Narrative as the paradigm for career research was gaining credibility, especially from the feminist standpoint, in its ability to "weave" and interpret women's autobiographies and biographies for "personal knowledge" and to gain a sense of the "political" (Cottrell & Latherby, 1993; Goodson, 1995; Smith, 1993; Stivers, 1993; Traver, 1986).

Furthermore, it was the notion of the political need for presently lived "subjective" career, rather than retrospective narratives of women in engineering in different historical decades and socio-cultural contexts (eg, Carter & Kirkup, 1990; McIlwee & Robinson, 1992; Robinson & McIlwee, 1988), that I felt would better serve to inform the "organisational" career of faculty to effect change (Barley, 1989; Dale, 1972; Hughes, 1937). In this regard, Secada (1989), Kenway (1990), and more recently Cobbin & Barlow (1993) and Bowen (1994), have affirmed the general need for such qualitative research in higher education to assess how far social equity principles are "integrated at the grass roots level of institutional activity, where it was no longer peripheral or removed from the every-day work of universities" (Bowen 1994, p. 20). Cobbin and Barlow (1993) asserted that, in this way, the extent to which special needs are being met by different programs and schemes could be evaluated and compared. Like Kenway (1989), Secada (1989) recommended using "justice in practice" as a key benchmark of progress in evaluating institutional adaptability towards equity, in living up to the ideals of justice in the face of changing circumstances and evolving notions of justice. I reasoned that, if read and valued, my present lived career narratives would enable faculty members to identify conditions that needed to change, as well as bench-marking their own progress in transforming the curriculum and the cultural milieu towards gender inclusivity, and in adapting the structural organisation of departments.

My third assumption is related to the cultural valuing of the "feminine". Branson (1991), like other feminists (Alcoff, 1988; Greene, 1976, 1988; Heilbrun, 1979, 1988; Swarbrick, 1991), looked at another way to achieve gender equity and inclusivity for all, when she advocated that women should caringly and pro-actively "valorise the feminine" and "value the opposite" (male)" to change the organisational structures in education, work, and the family or wherever the 'male' aspect had become too dominant (p. 105). She continued "... the sensitivities of women must be re-discovered, acknowledged, used, respected ... to valorise the 'female' is therefore to look towards harmony, which a male dominated society can never achieve" (p. 105). This, I hoped was what Sargent (1991) had in mind, when he commented that engineering is "woman" in the next century. I saw a justification in this respect to develop questions in my study

that would serve to inform me of the women's career and personality development, help them to valorise their femininity and what they uniquely had to offer to the field of engineering, and also serve to empower them in their decision-making in a man's world. The methodological implications are detailed later in this chapter and also in Chapter Four.

My fourth and final assumption is that work is a gendered concept and closely aligned to the development of self, identity and choice of career pathways. Studies of women's subjective careers highlighted the importance of investigating the origins of the gendered "meaning of work" and the "structures of opportunity" afforded to, and taken up by, girls and women over the life-span and in life-spaces (Astin, 1984; Josselson, 1987); the way girls are positioned by boys as "strangers" in school settings (Pallotta-Chiarolli, 1990); the effects of the "politics of advantage" for men on women's career development (Eveline, 1994); and the effects of "broken truces" on older women's lives and the way women tend to negotiate another truce appropriate to the new circumstances (Collin, 1986, 1990).

In summary, this account of my perspective explains how the study of women in engineering is informed by feminist interpretations and political themes. In addition, my choice of Jaggar's feminist methodology reflected these assumptions and aimed to give women, as a minority group in engineering, a voice (Jaggar, 1983, 1989; Jaggar et al, 1978, 1984).

THE PARTICIPANTS' CONSTRUCTION OF CONTEXTUALISED CAREERS

Adapting Jaggar's Unified Systems Methodology

Some women, including Jaggar (1989), had been pro-active in challenging the masculinist construction of knowledge and research methodology, especially in their broad criticism of the dominant hegemonic view of science as culturally-independent, value-free and gender-neutral (Fox-Keller, 1987; Harding, 1986, 1987, 1991; Kock, 1990; Rose, 1994). Instead they have focussed on constructing a feminist epistemology

(Fox-Keller, 1987; Harding, 1991; Rose, 1994) using the research methodology of women scientists, like McClintock, where the extension of relation and "empathic feeling" of the researcher to organism being researched is extended towards caring and collaborative relationships with co-workers. This new feminist paradigm for research has been extended to interpretive studies of women (Belenky, Clinchy, Goldberger, & Tarule, 1986; Baxter Magolda, 1992). Feminists have explored methods of constructing knowledge from the world view of women (Okely & Callaway, 1992; Kolmos, 1991; Oakley, 1981; Opie, 1992). This influenced me, as the researcher, to become a "Bricoleur" (Denzin & Lincoln, 1994, p. 2) and to feel comfortable in recognising that my choice of method was "an [emergent] construction" (Weinstein & Weinstein, 1991, p. 161), and subject to my changing the tools, methods and techniques as a reflexive response to participants' needs (Lesley Journal, 27th July, 1996). I chose to overtly monitor my methodology through a personal-professional "Lesley Journal" to preserve the intention and goal of such feminist research (Holly, 1984; Kolmos, 1993) undergirded by its ethic of care and fidelity (eg, French, 1986; Gilligan, 1977, 1982, 1990; Noddings, 1984, 1986, 1987).

Feminist Researchers Transforming the Gender Regimes of Education

In terms of the historical dialogue of the 1990's, the overarching goal of many women researchers world-wide has been to simultaneously transform the engineering curriculum, technology curricula in schools, and the engineering workplace, towards gender inclusivity (Daniels & Kahle, 1987; Granstam & Frostfeldt, 1990; Haggerty & Holmes, 1993; Rennie & Parker, 1989; Rennie, Parker & Hildebrand, 1991). Researchers were concerned about enriching girls' and young women's lives by encouraging their active involvement in science and technology, not simply to win micro-economic battles. There was also the desire to empower females to assertively stand up to sexism, other forms of exploitation and progressively build an ethos of non-violence in education, the family and workplace (Cockburn, 1985; Department of Employment, Education & Training (DEET), 1992; Flintoff, 1993; Hacker, 1990; K. Johnston, 1990; Robertson, 1993; Siraj-Blatchford, 1993; Thomas, 1990).

Women Participants in The Present Study

I was encouraged by Jaggar's (1983, p. 386) focus on the need to capture "the kaleidoscope of truths ... for what it means to be a woman" (Tong, 1992, p. 193) by inviting as many women as possible to be part of my study. 53 women from civil, mechanical, chemical, electronic, electrical and environmental engineering volunteered in 1992 and 1993. Initially, three undergraduate women, two first years and a final year from Institution A, participated. Three women, who graduated from Institution B in 1992, also began to participate. One was a new doctoral student who reflected on her past career only, and the other two continued to feedback on their early experiences as paid workers. In 1993, the second year of the narrative inquiry in Institution A, seven first years, nine final year participants, and one doctoral student also volunteered to participate. The study was also extended to Institution B, where 21 first years women, eight final year women and one doctoral student were willing participants. In 1994, 26 of the original first years from both institutions were agreeable to constructing their present life-histories, enabling me to follow their progression and accommodation to new statuses and identities as student engineers to their first appointments. 15 of these women, including Cecilia (the case study selected from these), continued to touch-base on their work-place and post-graduate experiences, even after the formal study was completed in 1998.

Professors

Whilst I conceded that quantitative measures have been, and are, invaluable for detecting trends, and for institutional accountability (eg, Cobbin & Barlow, 1993; Cooper, 1968), they can be objectified too readily and ignored in practice. They can distance educators from real life participants and can fail to measure the development, say, of a community spirit where equitable "I-Thou" relationships between superiors and fellows are essential within an educational institution (Claxton & Murrell, 1987; Crane, 1961; Super, 1990). I contended that the voices of the women participants' professors ought to be heard to encourage organisational change in the two university sites (eg, Thomas, 1990). In 1993, I approached eight heads of department from the two faculties to be part of this study. I named them the "professors". Seven were willing for me to

interview them about their organisational career perspectives and to be audio-taped. All were male. There were no female staff in these institutions at this time.

Methods - To Tell Women's Stories in Engineering Education and Work

In our post-modern world of multiple realities, I adopted Jaggar's three principles of transformative action of past, present and future career in my methodology (Jaggar & Rothenberg, 1984, 1993). In constructing and critiquing the subjective career, I found that quantitative measures were useful performance indicators in regard to gender equity (eg, percentages of women on entry, attrition rates, and graduation numbers) from the perspectives of the "generalised other" organisational perspectives in Australia. However, I was concerned that the nuances of change towards excellence and equity of university classrooms, laboratories and the general milieu from the "concrete other" perspectives had been largely unexplored. Such concerns, I contended, required qualitative measures of a more time-consuming nature to concentrate on the "bulk of discriminatory forces" that often "lurk(ed) below the threshold of consciousness" (Branson, 1991, p. 93).

Semi-structured interviews with professors provided me, the narrator, with their "organisational" career view of the nature of the women students and professional women, the "gender regimes" of engineering, and the structure of opportunities for women. Some faculty were also willing to complete the learning style inventory that related to preferences in their management style and information processing with its implications for teaching style (Felder & Silverman, 1988; Honey & Mumford, 1982).

The women's perspective on "subjective" career and its development over their life-span were accumulated from a number of data sources during the seven-year period of the study. In relation to Jaggar's first principle on past career, I encouraged each woman to complete an autobiographical questionnaire and the learning style inventory to help her to reflect and deconstruct her own gendered life and move towards a personal reconstruction of self as a young woman. In addition to reflective journalling, I gained

feedback on my strategy by sending out "clarification of methodology" forms to women who initially chose not to participate in my study.

I implemented Jaggar's second principle, by adopting a "Touching Base" method as my strategy to help these women to reflect and act upon their subjective present career by completing a series of semi-structured telephone interviews and/or mailed "touching base" forms. My intention was to promote personal agency (Jaggar, 1989), by encouraging the women to reflect positively on their achievements, evaluate their progress in attaining a vocational identity, and discuss their resolution of any oppressive practices or critical incidents. I applied Jaggar's third principle, again by using this strategy to encourage all women to voice their aspirations and expectations about their future career each year as a challenge to "the maintenance of hegemony" (Greene, 1988, p. 133) in their university faculties and first postings. From these accumulated narratives and discussions, I framed my interpretations around "career" and "gender" to construct the "concrete other" organisational career in Chapter Five, the collective subjective career in Chapter Six and the life-history of Cecilia in Chapter Seven.

Data Analysis, Disseminating and Sharing Knowledge for Theory-building

Dialogue and sharing of realities of various women's "voices" was as vital to me as it was to Jaggar (Jaggar, 1989; Jaggar & Rothenberg, 1993), especially in regard to progress in feminist career theory-building in the 1990's. I held the vision of bringing the "voices" of women in engineering together as strong epistemological narratives to be shared, in the fullness of time, by men in engineering. Like Jaggar, I wanted to deepen and sharpen my analysis of the conditions of women's "careers". I did not confine my data analysis of the women's life-career to the end stage, rather it was an on-going process (eg, Bogdan & Biklen, 1982; Merriam, 1988) where I simultaneously collected, organised and analysed data to construct organisational and subjective career perspectives, and to assess their degree of comparability (see Figure 1.1). The construction of Cecilia's life-career history was characterised by the interplay of data-gathering and multi-level analyses of "gender regimes" in engineering in the "gender order" of Australia over seven years.

My interweaving of analysis and reanalysis of aspects of my research process with my data collection was to try to ensure greater validity, to off-set ethical dilemmas in preserving anonymity, and congruence with my feminist methodology. I distributed brief interpretive analysis of the data at regular intervals, including abstracts of conference papers, to share with the women participants and others as explained later.

FINDINGS

The Concrete Other "Organisational" Definition of Career in 1993

In relation to Research Questions 1, 2 and 3, my study revealed that, although most faculty members were aware of the need for women in engineering, the "organisational" career was still defined predominantly in traditional male terms. In particular, there appeared to be little systematic analysis of the values underlying the ideology and epistemology of the Engineering curriculum in 1993. The professors appeared to take for granted the "masculinist" gender regime (J. Marshall, 1983) of engineering education and the work-place and to lack sensitivity to the special needs, values and interests of women in forging their vocational identities as engineers. I found that innovations implemented by a few of the professors were consistent with the broader generalised other view of engineering education in Chapter Five (eg, Parr & Johnston, 1994). My findings indicated the need first, for engineering educators to acknowledge the significance of their students' (especially their female students') subjective constructs of career; second, for them to recognise ways in which the subjective and the organisational constructs of career can complement one another; and, third, for them to implement changes which facilitate such complementarity.

Collective Concrete Other "Subjective" Career of Women Students

Collective "Past Career" 1967-1992

In relation to Research Question 1, collective past subjective career narratives were influenced by a range of remote and immediate situational determinants that contributed to the women's expression of non-traditional and traditional interests, their subject choices and pursuit of work in engineering. They experienced stimulating and enriching

input and support from parents, family members and friends in the home environment. They attended schools where gender inclusive policies were being implemented in the school curricula by teachers. They were encouraged at home and school to embrace technology, and to pursue leisure activities with others in the community. In 1992-1993, they showed a range of personal characteristics, including broad academic achievements, motivation and drive to achieve, initiative, self-confidence, positive values about life, study and work, the development of interests, well-balanced learning styles, a range of coping strategies for conflict resolution, and perseverance and courage to achieve well-expressed vocational goals.

Collective "Present Career" 1993-1994

In relation to Research Question 2, the collective present career was affected by remote and immediate determinants such as the gender biased structural organisation, cultural milieux (including peers, lecturers and technicians), and curriculum. The continued support of family and friends, leisure activities for health, and obligations to others were major influences. Personal determinants such as perseverance, sense of humour, computer competencies, and development of special vocational interests continued to be vitally important in maintaining their position in engineering education.

Collective Future Career in the Work-Place, 1992-1996

In relation to Research Question 3, significant immediate situational determinants confronting the women included gender bias in job interviews and having to "prove themselves" in the work-place. Support of family and special boyfriends helped them to persist. Women involved in doctoral studies were lonely and one lacked early mentoring from her supervisor. Personality determinants, similar to the above, continued to be strengthened. Overall, the subjective career patterns of the women indicated that most were "pavers of the way" (Josselson, 1989), yet were characterised by continual reappraisal of their identity and position in the gender-mediated regime of engineering education and first postings (see Chapter Six).

Quest for Identity - Cecilia's Present Life-History 1992-1999

Cecilia's life-career story mirrored the themes and trends emerging from the collective subjective career. Despite radical changes in policy for gender inclusivity in engineering education and the work-place, Cecilia experienced little adaptive change in the structural organisation and cultural milieux to accommodate her intellectual and social needs. Although, the "structures of opportunity" for other women participants in their work-place contexts, and mentoring for masters and doctoral students in academe, had improved over the years, Cecilia's life-history highlighted the contrary. Her relationships with both "superiors and fellows" were extremely important in her construction of each life-career stage. Her life-history revealed how personal determinants had influenced her increasing sophistication in making sense of engineering education, the engineering profession, and creating career pathways in and on her own terms (Kock, 1992). She achieved vocational identity as a "paver of the way" (Josselson, 1987), with shaky episodes of a "daughter in crisis" when oppressive conditions mitigated against her in particular education and work-place settings over the years (Josselson, 1987).

The Robustness of My Jaggar/Super Convergence Models

In relation to the Methodological Question, the substantive study revealed the effectiveness of the use of my convergence Jaggar/Super models in constructing and critiquing the women's narratives for theory building, and for identifying changed conditions and those in need of change. I used my combined archway/spider web model (Super, 1990; Watts et al, 1981) in building theory segments (Figure 2. 2) and connecting different segments to better represent career in interactive contexts (Figure 2. 3). Constructing and connecting the contextualised past, present and future nature of career was facilitated by using the life-stages and life-roles in my elaborated life-career rainbow model (Figure 2. 4). I used the life-career rainbow concept in the creation of my computer data base; for my on-going data analysis; and for summarising women participants' life-histories. My convergence ladder model (Super, 1990) represented organisational career statuses and associated developmental tasks associated with the formation and attainment of identity (Figure 2. 6). For example, my combined

archway model represented Cecilia's career and personality development in action with "key figures" (both superiors and fellows) in different contexts. Cecilia's life-story was linked to the gender order and gender regimes of Australia, through my elaborated "life-career" rainbow model to the "on-going historical dialog" (Jaggar & Rothenberg, 1984) as she grew up through the 1970's, 1980's and 1990's. The ladder model represented her quest for identity and subjective career progress. It also represented the organisational career from the perspectives of herself and her professor. Discussion of the usefulness of my elaborated models is synthesised and represented by my Jaggar/Super Convergence Archway Model (see Figure 8. 1) in Chapter Eight.

SIGNIFICANCE OF THIS STUDY

This study was significant for a number of reasons, both methodologically and substantively:

- Methodologically, this study modelled a critical socialist feminist narrative construction and process of women's "subjective" career life-history, after Jaggar (Jaggar & Rothenberg, 1984, 1993; Jaggar, 1983, 1989), using gender as the key construct of analysis. Substantively, this interpretive research provided an example of socialist feminist research in action in following the process of vocational identity and choices of career pathways through the past reflections, and present and future perspectives of women in engineering, where the "past shapes the present and the present is the basis of the future" (Super, 1990,p. 192).

- Methodologically, the implementation of a socialist feminist standpoint was strengthened by the use of a personal journal and a professional reflective file notes to share with my supervisor, throughout the research. The process was carefully monitored in practice to check for more effective "reflexivity" of the narrator (Kolmos, 1990), and my quotations were utilised within the context of the thesis.

- Substantively, in light of directives for change at the institutional level of higher education and in the non-traditional work-place for professional women, my study

when it began in 1992, was both justified and timely. It showed that the quality of narrative s is improved when "organisational" career and "subjective career" are adopted and counterpoised, by provided a deeper understanding of the gender regimes in which the women's present careers were initially embedded in 1992-3. Methodologically, the construction of the professors' "organisational" careers in 1993 enabled me to build on Thomas's (1990) premise for effecting real change in higher education, through deliberately involving Super's "key figures", namely the professors, as well as the women.

- Substantively, the voices of these women provided valid indicators of the degree of "adaptive style" (Hesketh, 1985) of the "organisational" career in the gender regimes of the faculty and first postings. This gave their professors an opportunity to change alienating conditions for women to achieve their potential, in relation to access, participation and outcomes in Engineering education.

- Substantively, narratives evolving from these women's stories, and the conditions for change that are illuminated, are important in the continuing dialogue at the *macro-level*, since it is evident that some mainstream academics in engineering in Australia are beginning to enter the 'gender' discourse through articles in conference proceedings (eg, Lawrance, Hullett and Goodell, 1997).

- Substantively, the longitudinal study provided a parallel elaboration of Super's (1980, 1990, 1994) models of career development to represent and to facilitate the feminist construction and interpretation of "subjective" life-career histories.

- My substantive study demonstrated a convergence of my feminist standpoint with Super's segmental theory on career and personality development to "remedy apparent defects in earlier accounts" of women's career (Jaggar & Rothenberg, 1984), by creating a more gender inclusive theory of the contextualised life-career as life-span and life-space.

- My study enabled me, as narrator, to become an advocate for women in engineering, whom I saw as vulnerable by their very lack of numbers in a man's world. This provided me with an opportunity to help them challenge any forms of alienation experienced and to incorporate utopian socialist feminist values into their every day lives (Jaggar, 1983, p. 337).

LIMITATIONS

The limitations of this narrative inquiry can be clustered in three categories. These were the scope of the investigation, adaptation of data-collection methods and confidentiality, as discussed below.

Scope.

Partly for logistical reasons, my investigation involved only women students. Because I have not done a similar study for men, I could not distinguish what was uniquely women's experience rather than the experience of Engineering students in general, or even some male engineering students. It was beyond the scope of this research. Further, because of the dual purpose of the thesis and its final length, I chose only one full life-history, to represent the woman engineer of her time and place. Ideally, I would have preferred to compare and contrast the life-histories of two women born in 1974, from each institution.

Adaptation of Data Collection Methods

Implementing the underlying precepts of socialist feminist methodology was easier for me to fulfil in theory than in practice. This was because of the value placed on fully participatory research and the treatment of people as participants, rather than static objects. In particular, I had to accept each woman's particular type of self-selection, and her preparedness or not to be further involved in the narrative career study over a period of years. I also had to learn to be flexible in adapting my methods of data collection to build individual women's career development profiles, with the least inconvenience and intrusiveness in their life-space. This at times took an act of will,

and required careful journalling of my feelings and my resulting professional development in effecting feminist methodology in practice.

Confidentiality

Because of the need to protect the anonymity of these women until they had all graduated, it was essential that there was no immediate or direct feedback to their professors. A compromise was the dissemination of findings on their anonymous or amalgamated life-careers through conferences and journal articles. It was equally important to preserve the anonymity of all the professors by not equating their organisational career with a particular department in the body of the thesis. However, the use of pseudonyms enabled me to report back, in private consultation, the precise degree of complementarity between the organisational and subjective career standpoints and the conditions in departments requiring adaptations to meet the special needs of women.

SUMMARY STRUCTURE OF THE THESIS

Following this introductory chapter, I discuss in Chapter Two the melding of my feminist perspective with Super's theoretical standpoint and methodology and his original models. I present my elaborated models, in the light of my preliminary feminist of his standpoint and methodology, and from the literature on concurrent career development standpoints. In Chapter Three, I draw out further "theory building" aspects of my elaborated Jaggar/Super convergence models, by monitoring the robustness and efficacy of these models through their application in constructing the subjective generalised other from a review of the literature on career pathways of non-traditional girls, women in engineering, and those in related educational and occupational settings. Chapter Four, I devote to a fuller rationale for my critical socialist feminist methodology and methods adopted for constructing the generalised other/concrete other organisational career perspectives, the "concrete other" collective subjective career, and life-career history of one woman in engineering. Methodologically, I provide a rationale for ways of monitoring the effectiveness of my own implementation and critical analysis of their

life-histories, and the application of graphic heuristic devices (Super, 1990) in aiding narrative construction and for theory-building.

Moving to the data analysis and interpretation in Chapter Five, I construct and compare the "generalised other" organisational career of engineering in Australia from conference papers in 1994 with the "concrete other" organisational career, which I constructed from the analysis of my interviews with the women participants' professors in 1993. I look for indicators of paradigm shifts in both organisational career constructs towards gender inclusivity for women. In Chapter Six, I construct and interpret the collective "concrete other" subjective past, present and probable future life-career narratives of the women participants to establish the degree of complementarity with the concrete other "organisational" career of their professors and the other career perspectives. In the light of these empirical findings, I also draw out further "theory building" aspects of my elaborated Jaggar/Super models and the value of adopting a nomothetic approach to understand the community of experience of the participants. The general themes evolving from their collective subjective life-career provide a focus in Chapter Seven, where I tell Cecilia's individual concrete other life-career story, as a student and professional engineer between 1992-1999. I draw out the similarities, intricacies and nuances of differences of her life-history with Professor D's organisational career and the other career perspectives. Methodologically, I comment on the value of adopting this idiographic approach to draw out further theory building aspects of my Jaggar/Super elaborated models. In Chapter Eight, I summarise my findings on the life-careers of women in engineering. I synthesise my evaluation of the power of my Jaggar/Super's convergence theory of career and associated models for my feminist construction and of women's life-career histories and to identify Jaggar's conditions. I establish degrees of complementarity between each career perspective and make recommendations for change in engineering education and the profession to meet the special needs, interests and values of women for the 21st century.

CHAPTER TWO

JAGGAR/SUPER "UNIFIED SYSTEMS" APPROACH - A SOCIALIST FEMINIST CRITIQUE OF WOMEN IN ENGINEERING

PURPOSE AND OUTLINE OF THIS CHAPTER

In Chapter One, I indicated that Super's conceptions of life-career, his theoretical standpoint and methodology on career development were commensurate with my adapted version of Jaggar's "unified systems" theory of social relations based on socialist feminist ideology and conditions for change (Jaggar, 1983, 1989, Jaggar et al, 1978, 1984, 1993; Tong, 1992). I, like Jaggar (1983), recognised the need to reconstruct reality from the standpoint of women to effect a "more total transformation of our society and of ourselves than is dreamt of by a masculinist philosophy" (p. 389). I had strengthened my critical feminist approach by adopting both subjective and organisational career perspectives (Barley, 1989; Dale, 1972, Hughes, 1937) and socio-psychological theory of identity attainment (Astin, 1984; Betz, Fitzgerald & Hill, 1993; Chodorow, 1978, 1984; Gilligan, 1982; Josselson, 1982, 1987, 1988, 1992; Newman & Newman, 1978; Martin, 1985; Roe, 1953). Further melding, I reasoned, with Super's theory, models and methodology would progress towards a more comprehensive theory of career and personality development, where gender differences (and similarities) in individuals' career patterns in a particular gender order and gender regimes could be better explained and represented. My major purpose, in this chapter, is to describe and explain my development of a socio-cultural model of career development through the convergence of my elaborated Jaggar theory with Super's theory of career and personality development.

In this regard, I conduct an in-depth of Super's theoretical perspectives and his propositions on career and personality development to reveal the extent to which he had taken into account women's special needs, interests, values and role relationships, and also his views on investigating the dual concepts of career as subjective and organisational (Barley, 1989; Dale, 1972; Hughes; 1937). I elaborate on his segmental

perspectives where required, in the light of others' theoretical standpoints regarding my four domain assumptions about women in engineering. I use the essence of Super's (1990) fourteen (14) propositions to generate three substantive questions to construct career perspectives related to women in engineering.

An inter-related purpose was to describe in detail the Super's life-career model I chose to adopt and adapt, namely his "Archway of career determinants" (Super, 1990, 1994; Watts et al., 1981). As my aim was to move towards a Jaggar/Super convergence model of career, I accepted Super's (1994) premise that his other models were "needed to tell the complex story of career development" (p. 72). I formulated a methodological question to test out the potential of my convergent Jaggar/ Super theory of life-career and personality development and the power of related models to represent career, to help in theory-building and in counselling. I believed that I had Super's posthumous blessing in attempting to do this, since his major commitment over his own 25-year "natural history of a study of lives and of vocations" was to build a theory of career patterns, by improving "the theoretical framework within which one was working" (Super, 1969a, p. 19). He accomplished this by developing "needed methods and instruments", by following "subjects wherever they may go and to collect whatever data are needed", by analysing "masses of material", and by writing "them up so that others may know what they show" through life-stories (p. 19).

JAGGAR'S AND SUPER'S THEORIES OF CAREER AND IDENTITY

The Case for Studying Careers in Socio-Cultural Context of the 1990's

> As I think more about feminism, I remember what struck me most about Jaggar's theory in the late seventies (Jaggar & Struhl, 1978, p. 83) was her frankness regarding what people are like - each aspect of personality - is largely a function of the form of, and [their] position in, their society. It was also the onus she put on people as the creators of organisations and simultaneously the construction of self and creating their own nature (Lesley Journal, December, 30th, 1992).

Super's (1980) aim, like Jaggar, in his quest to understand the construction of self and identity through work in its broadest sense, and through developing meaningful relationships with significant others, has been to "describe what careers are and how they develop" rather than simply "[dealing] with occupational choice" (p. 282). Herr

and Cramer (1992) defined career development theory as that "... body of speculation and research" that focuses on understanding "the factors underlying an individual's "free and informed choice" of occupation, the evolution of "personal identity in relation to work", and his/her "transition, induction and adjustment to work" (p. 156). The life history approach advocated and practised by Super (Super, 1953, 1954, 1957, 1969a, 1969b, 1977, 1980, 1983, 1990; Super & Bohn, 1971; Watts et al, 1981) also probed into the evolving personality or general characteristic behaviour of an individual as he/she grappled with the tensions associated with satisfying the need to belong and to be valued. His ground-breaking developmental approach to this inter-twined study of contextualised career and personality development has gained credence with other mainstream researchers in recent years (Blustein, 1994; Herr & Cramer, 1992; Osipow, 1983; Savickas & Lent, 1994; Vondracek, Lerner, & Schulenberg, 1986; Vondracek, 1990; R. A. Young, 1984; R. A. Young & Collin, 1992).

Existing theories and models of career have been under scrutiny by feminists since the early 1980's (eg, Fitzgerald & Crites, 1980; Gilligan, 1982). Fitzgerald and Crites (1980) argued then that these theories had "much to offer ... unless [one] assumes that males and females are somehow fundamentally different in their needs and aspirations" and that it is "reasonable to assume that all individuals regardless of sex, share the basic need for self-fulfilment through meaningful work" (p. 46). Gilligan (1982) was concerned that few of these models had included "women's accounts of the progression of relationships towards a maturity of interdependence" and had ignored the way women defined "themselves in a context of human relationships ... where attachment and separation anchor the cycle of human life" (p.155). This concern was also supported from a mainstream perspective that explanations and concepts had not been devised to deal with the special problems of the career development of women (Herr & Cramer, 1992; Osipow, 1983; Savickas & Lent, 1994). Career development theories that took account of the socio-cultural context were considered by feminist researchers to be better models in explaining women's careers (Betz & Fitzgerald, 1987; Betz, Fitzgerald & Hill, 1993; Fitzgerald & Betz, 1994; Hackett, 1985). Researchers, such as Josselson (1982, 1987, 1988, 1992), Northcutt (1991) and Tovell and Madill (1993) have justified

the concern of others and have built on existing developmental theories of career development. This lent support for melding my critical feminist perspective (Jaggar, 1983, 1989; Josselson, 1982, 1987, 1988, 1992), with Super's (1990) "life-span, life-space" career theory, which I was confident had the capability of integrating existing knowledge, guiding future research, and improving vocational counselling.

Super and Jaggar on Women and Work - Special Needs and Opportunity

Domain Assumptions about Women of Ability in Engineering

As I consider the convergence of Jaggar/Super theories of social relations, I bore in mind my four domain assumptions about women in engineering (introduced in Chapter One) namely that:

- higher education is limited in meeting women engineering students' special intellectual and personal needs;
- these women are "stigmatised" professional woman in a "male sex-typed career" (Marshall, 1985);
- transformations in institutions' valuing of the feminine as well as the masculine will begin when women themselves valorise their femininity in what they uniquely have to offer to engineering, which will also empower them in their decision-making in a man's world; and,
- work is a gendered concept and closely aligned to the women's development of self, identity, personality, and choice of career pathways and ultimately affects the nature of engineering.

Identity and the Issue of Gender Dimorphism for Women and Girls

Like Jaggar (Jaggar, 1983, 1989; Jaggar et al, 1978, 1984, 1993), Super developed and refined his segmental theory of "career patterns" over decades (eg, Super, 1953, 1954, 1969a, 1969b, 1977, 1980, 1983, 1990, 1994; Super & Bohn, 1971). I found evidence of Super's (1954) early involvement with the *historical dialog* of the times in his concern for the effect of social class on an individual's personal construction of career, and the need for studies of the patterns of vocational development which characterised the "American culture" of the time (p. 17).

In regard to the salience of work and women's quest for identity in a variety of roles over the life-span, a bone of contention with critical feminists (Spender 1982b; Rose, 1994) and women career developmentalists (eg, Astin, 1984; Branson, 1991; Gottfredson, 1981; Towns, 1985) was the narrow meaning given to work, as adult paid work in the public sector. In my review of Super's papers, I found he had an expanded conception of the "meanings of work" in a career (Super, 1976). He had also identified a range of career patterns and the diversity of career paths taken by women (Super & Bohn, 1971), where he concluded that women are " ... a special group ... need[ing] special consideration" (p. 188). His resolution for women, was that at "an earlier age" women ought to have "develop[ed] less stereotyped and personally realistic ideas about their possible roles in the occupational world" (p. 189).

Super's research with Kidd (Watts et al, 1981) on the opportunity structure in Britain provided him, in my opinion, with a more balanced focus on the way both external and internal forces impinged on the individual in determining his/her chosen career patterns, in practice as well as in theory. By 1990, Super (1990) was increasingly concerned about the "need for current data" because "the careers of males and females differ in some important respects" (p. 234). He asserted that his "career pattern theory ... appears to be essentially applicable to both sexes, if modified to take child bearing into account..." (p. 234). He also noted from "scientific studies", that homemaking "plays an important part in the careers of college men, although less noticeably in other men" (p. 234). Super's concern for the gender agenda was accompanied by his key question for the 1990's: "Is life-stage theory - the concept of developmental tasks - as valid for males as for females?" (p. 235). This provided a kernel of a question for me in testing the power of his career development theory with respect to its validity for women's past career and present career in university engineering education and work in the 1990's.

Convergence of Meanings of Work as a Gendered Construct

Super (1976) theorised about the meanings of work, from the simple accomplishments of concept of developmental tasks to the choice of occupation and the ultimate pursuit of a personal vocation. This concept linked well with Astin's (1984) definition of work as

the "effort to produce and accomplish something" at all stages of life (p. 117). Super (1990), like Astin (1984), emphasised the intimacy of career development and personality development, where work was the organising principle in the individual's construction and attainment of identity. This was evidenced in his most recent definition of "life-career":

> the life course of a person encountering a series of developmental tasks and attempting to handle them in such a way as to become the kind of person he or she wants to become, with a changing self and changing situations, the matching process is never really completed ... (Super, 1990, pp. 225-226).

He defined work most basically as "developmental tasks" to be accomplished through the investment of self at each life-stage. This definition was under-girded by Erikson's and Havighurst's qualitative stage theories of personality development and identity attainment (Super, 1984) and self construct theory (eg, G. A. Kelly, 1955). Super, like Astin (1984), viewed the individual as the constructor of his/her own career through work, simultaneously constructing self, a characteristic life-style (or personality) and ultimately attaining an identity through a chosen vocation to satisfy needs, interests and abilities (Super, 1983, 1990; Super & Neville, 1984). The integrating nature of Super's career and work constructs was evident to me in the way he was trying to capture the temporal involvement, and the emotional and intellectual commitment of a person to a number of life roles and related developmental task in different life-stages (eg, Super, 1983). Josselson's (1987) research on women's pathways and identity achievement in adolescence, discussed in Chapter One, adds to this segment of Super's theory.

Super's Career, Work and Sub-constructs of Work to Vocation and Identity

Super (1980) also clarified his broad concept of "life-career", not only by contrasting it with work *per se*, but with a number of its sub-constructs (Super, 1976). His distinctions provided me with a sense of qualitative progression in a person's subjective construction of career through work and emotional self investment; and the way the social order, institutional organisations and day to day interactions with others could also influence its construction.

A [developmental] "task" then, was perceived by him as the simplest notion of a work-related construct, where an individual undertook a "specific ... operation ... at work or play" (Super, 1976, p. 20). This was the only intimation I found of the medium of play being important to him in achieving early developmental work tasks, although the role of "leisurite" was highlighted as important for later healthy career development (Super, 1980). My concern was that even though Super acknowledged parents as "key figures" (Super, 1990; Super & Bohn, 1971) he was not aware, like others (eg, Astin, 1984; Gottfredson, 1981; Josselson, 1987; Newson & Newson, 1976), of the pervasiveness of gender. Specifically, he demonstrated no awareness of parents' tendency to perpetuate gender dimorphism in the earliest constructions of girls' work schemes, interests, work expectations, and their lack of aspiration towards the suitability of occupations with ascribed prestige and status. I considered that a convergent theory would highlight early "structures of opportunity" (Astin, 1984) and the type of gender regimes parents and teachers create from their interpretations of prevailing social values, attitudes, aspirations and expectations that in turn affect girls' career constructions and self-schemes.

Super (1976) did recognise the "organisational" career construct (or opportunity structure) through the existence of positions and associated developmental tasks, that were "work" challenges common for all in a society, yet not necessarily experienced in the same way by each person in each life-stage. Thus, he conceived a "position" as a "group of tasks to be performed by one person", but qualified that it was "not person-oriented", but "exist[ed] independently of its occupant", that "it may be filled or vacant"; and that positions were in essence "task- and product-[oriented]" (Super, 1976, p. 20).

This represented a kernel of the notion of the complementarity of subjective and organisational aspects of career, considered so important by Astin (1984), Barley (1989), Dale (1972) and Hughes (1937). To further distinguish organisational from subjective conceptions of "career", Super clarified his work construct of a "job" as a "group of similar paid positions requiring similar attributes in a single organisation",

which he conceived as "... task-, outcome-, and organisation-oriented" (Super, 1983, p. 7). He then linked his organisational "job" construct to that of "occupation", which he defined as a "group of similar jobs found in various organisations" (p. 7). He saw "occupations" then, not only, as "task-, outcome, and organisationally-oriented, but also as "importantly society-oriented" (p. 7). His "occupational position" was limited to adult "work-related roles" that included "student, employee, and pensioner or annuitant" roles (Super, 1976, cited in Super, 1983, p. 7). Super's view of occupation was commensurate with Branson's (1991) construct of women's "adult work" as "all activities pursued to contribute to subsistence and a life-style" (p. 95). For Super (1976) and Branson (1991) work was "public or private, paid or unpaid", and she distinguished it from "leisure" which "involve[d] the expenditure of funds and energy on life-style" (p. 95). It was not surprising to me that in 1976, his definition of career was linked very much to the investment of self in work in a number of roles and positions chosen by the individual from adolescence over a life-time:

> The course of life events which constitute a life; the sequence of occupations and other life roles which combine to express one's commitment to work in his or her total pattern of development, the series of renumerated & non-numerated positions occupied by a person from adolescence through retirement of which occupation is one (Super, 1976, p. 4).

This bore resemblance to multi-role personality development, where social roles are played out, by interpreting their prescriptions and expectations within cultural milieux, which Super (1980) named "theaters". He noted from his longitudinal study of career patterns of male adolescents that "the more adequately, in self-perception and in that of others, the adolescent plays pre-occupational roles, especially student and part-time worker, the more likely are success and satisfaction in occupational roles" (Super, 1980, p. 286). This was the parallel psychological issue that Gilligan (1982) identified for young women, which Josselson (1987) later investigated. However, he seemed to fail to see the "making of occupations" (Roe, 1956) in regard to the status and prestige attached

to them that could promote their exclusivity to men (Gottfredson, 1981), and so limit the occupational aspirations of, and structure of opportunity for, women (Astin, 1984). Super (1976), under the umbrella of his construct of "life-career", included the ultimate development of a "vocation", as that construct which he precisely defined as an "occupation to which a person has a commitment" (p. 7). Super (1976) thus distinguished "vocation" from "occupation" by the psychological meaning it had for the individual rather than its economic meaning to society. "Vocations are person-centred" (Super (1976), cited in Super, 1983, p. 7) and he made it clear that the focus was on the developing person in search of and pursuing a vocation, rather than on the static or (technologically) changing occupation. He highlighted that the theory undergirding vocational development "combined the differential approach of occupational psychology, in the strict sense of that term, with the "developmental psychology of careers" (Super, 1983, pp. 7-8). Within his conceptual discrimination between "career and vocation" and "occupation", there was further evidence of his appreciation of two distinctive, yet juxta-posed, constructs of the world of work: namely, the unique individual (subjective) life-career that the person was constructing with commitment, and society's (organisational) definitions of "occupations" and related "jobs", "positions" and tasks that were not "person-oriented" (Super, 1976).

Super's (1976) focus on "vocations" was becoming a reality for women in the 1970's and 1980's (Astin, 1984), where their adult work expectations, their economic need for work, and their changing personal desire for a vocation were influenced by the social order, as well as the "changing structure of opportunity in the world of work, that is propelled by major historical events and by scientific advances" (p.122). There was an important sense here of the way these treatises on work and career (Astin, 1984; Branson, 1991; Super, 1976, 1980, 1990) bore similarities to Hughes' (1937) Chicago school of sociology regarding careers, identities and institutions and the complementarity between "organisational" and "subjective" career where social action and the social structure intertwine in the personal construction of work by an individual (eg, Barley, 1989; Dale's 1972; Hughes, 1937).

Super's Study of Individual's Career and Personality Development

In principle, Jaggar's energy was more ideologically focussed on monitoring and effecting changes in the gender order and the transformation of gender regimes (Jaggar, 1983, 1989), whereas Super (1954) was focussed on the individual's discovery of self by investing in work and in social relationships with others in interactive life-spaces. This resulted in Super's concern to study the healthy development of personality in his career development research.

Definition of personality

Super (1990) combined two segments of personality theory to define personality, taking Allport's (1961) frame of reference of the individual person as a unique unitary being, and Drever's (1952) view of its construction in relationship with significant others, in a socio-cultural context:

> the integrated and dynamic organisation of the *physical, mental, moral, and social* qualities of the individual that manifests itself to other people in the *give and take of social life* the impulses and habits, interests, and complexes, the sentiments and ideals, the opinions and beliefs, as manifested in his/*her* social milieu (Super, 1990, p. 202, *my italics).*

I found Super's definition somewhat unwieldy in actually pinpointing these qualities with his "personal determinants" of career (Super, 1990). Super (1990) identified the motivational hub of personality as "values, interests and needs" for the construction of career and work identity, in which he was most interested. I considered it was extremely important to monitor the origin and progressive growth of all affective facets of personality to better understand the career development of women. For example, in Super's (1980) "theaters" or social milieux of family, education and work:

- the woman's satisfaction of social interest and need for affiliation to be loved and valued (Adler, 1930; 1970; Josselson, 1987);
- the significance in women's life-career construction of aspirations and expectations for future choices (Astin, 1984; Gottfredson, 1981; Heilbrun, 1979; Savickas, 1990a,1990b);

- feelings of confidence and competence in present and past career that might affect women's self-efficacy (Bandura, 1977, 1982a; Betz & Hackett, 1981; K. R. Kelly, 1993); how self efficacy mediates specific career decisions (Mezydlo & Taylor, 1994), and their courage to be and become (Adler, 1930) as "pavers of the way" (Josselson, 1987); and
- the healthy maintenance of a "playful" attitude to work (Bordin, 1994).

Super (1954), like Allport (1937), sought to achieve an holistic psychology of individuality and argued for an idiographic approach to study personality and life-career development, yet incorporated aspects of the nomothetic model where an individual might also be described in terms of traits common to all people. Super applied trait theory and used an "actuarial" method of vocational guidance through his inventories to ascertain the "needs, values and interests" of self as object (eg, Super, 1970) and cognitive style (Super, 1994). As well, he made an intensive study of the individual case, to understand self as subject (Super, 1954, p. 13) and how a personality profile develops, from the predisposition of temperament and genetically endowed aptitudes. His advance on other theorists was his use of a present-career life-history method and the integrating models he used as heuristic devices.

SUPER'S SEGMENTAL THEORY OF CAREER DEVELOPMENT

Super's Range of Explanatory Theories

I was appreciative of the fact that Super's segmental theory was as much an individual theory of personality (Adler, 1930, 1964; Allport, 1937) and self concept theory (Osipow, 1983), as it was of career development. Super (1990) based his explanations of career development primarily on Allport's (1937), Adler's (1930, 1964) and G. A. Kelly's (1959) precepts of individual psychology of personality, supported by the qualitative developmental tasks stage theories of Buehler (1933), Erikson (1968, 1970), and Havighurst (1953); role theory of personality development (eg, Brown, 1965); the needs-based motivational theory of self actualisation of Maslow (1968) and Roe (1953, 1956); and also incorporated social and interactive learning theories (Bandura, 1977, 1982a; Bandura & Walters, 1963; Lewin, 1935, 1954 ; Rotter, 1954, 1966, 1971). Super

extended his range of theoretical perspectives to strengthen the explanatory power of his theory of career development, by including segments of sociological and economic theory (eg, Roberts, 1981; Watts et al., 1981). He had reasoned earlier (Super, 1969b) that "... it is only as we make use of all these fields ... that we will eventually construct a theory of vocational development which deals adequately with the complex processes by which people progress through the sequence of positions that constitute a career" (p. 9). Super (1990) defined his segmental stage theory of life-span, life-space career development as :

> ... a loosely unified set of theories dealing with specific aspects of career development taken from developmental, differential, social, and phenomenological psychology and held together by self-concept and learning theory (p.199).

In essence, it appeared that both Jaggar (Jaggar & Struhl, 1978) and Super (1954) had adopted a post-positivist standpoint since each had drawn on a variety of schools of thought to take into account the "psychological and sociological factors" which others "suggest may be significant" to arrive at the 'truth' about life-careers (p. 17). Like Jaggar, Super theory involved a highly sophisticated systems approach (Osipow, 1983). Super's strengths were his:

- on-going empirical support for his theory-building that evolved from his longitudinal "Career Pattern Study" in America (Super, 1954, 1969a, 1969b, 1976; 1977; 1980, 1983; Super & Hall, 1978; Super & Kidd, 1979; Super & Nevill, 1984);
- sociological research on career development in Britain (Watt et al, 1981);
- current cross-cultural "Work Importance Study" on life roles, values and careers (Super, Sverko & Super, 1995);
- conceptualisation of several models as heuristic ideas that aimed not only to represent but to integrate all the theory "segments" of an individual's life-career; and
- continuing to healthily move towards a convergence of career development theories as a "planful explorer" (Savickas, 1994b; Savickas & Lent, 1994).

Adopting Super's Segmental Model of Career Determinants

Jaggar lacked visual models to represent the dialectical construction and development of women's careers. In contrast, Super (1980) had constructed a number of models, where each was required to tell the story of career development in different ways. His models appealed to me as a metaphors of dynamic career construction by the individual within a social order and/or institutional regimes. I adopted Super's (1990) "Archway of career determinants" as my main conceptualisation of career because it reflected the segmental nature of Super's theory (p. 212) and melded it with the "spider web model" (Super, 1994; Watts et al, 1981) which represented the person-environment interaction (p. 232). I also used Super's (1990) "The Life Career Rainbow" of career (p. 200) and his "Ladder model of life-career stages, developmental tasks and behaviours" (p. 216) for additional explanatory value. My aim, like his, was to build and use models to test out propositions through my research questions to yield a more integrated theory of career (Super, 1990, p. 199). He referred to both situational and personal factors affecting the construction of career as "determinants" in his models (see Figure 2.4), arguing that calling a characteristic or influence a "determinant", does not necessarily make the argument deterministic (Super, 1980, p. 295). I felt comfortable in using this 'Superish' lexicon in these models, because he emphasised their interplay in the process of personal choice and decision-making.

<u>Theory Segments of Super's Archway Model of Career Determinants</u>

Super (1980) initially adapted and refined his plane model of the "worker" (p. 295), by raising it up into a "Norman" archway, with a life-space between the pillars (Super, 1990). The career model reproduced below as Figure 2.1, was probably influenced by his avocational interest in architecture (Savickas, 1994b) and represented "the segmental nature" of his theory and associated theorists (Super, 1994, p. 67).

Each of the "segments" was integrated into his "archway model of career determinants", with self as decision-maker in the keystone segment (Super, 1990, p. 203). He used stones to represent segments of theory and the cement was interactive learning in constructing self, personality, life-career and finding one's identity, through social relations and in "encounters with objects, facts and ideas" (Super, 1990, p. 204). Each

stone in the two composite columns depicted a "determinant" with those that were more basic at the base of the structure (Super, 1994, p. 67). His aim was to better represent "the nature, sequence, and determinants" of the individual's choices (Super, 1990, p. 205). Super (1990) conceptualised the gap between the pillars (one representing personal determinants and the other situational determinants) as the individual's "life-space" or psychological environment, where there was an interactive tension between the columns, "that is why buttresses were invented" (Super, 1990, p. 203). According to Super (1990), the "outcomes" of the determinants formed "the arch that rests on the pillars" depicting the "life-career" (p. 203). On either side of the "self" were associated role-self concepts, which were salient in particular developmental stages and denoted positions an individual plays in moving through development stages (Super, 1990, p. 203). The earlier developmental stages of childhood and adolescence are at the left end of the arch, and "at the right, young adulthood and maturity", where each stage "confronts the individual with developmental tasks arising from chronological age and social expectations" (p. 203).

The left hand column of "career determinants" in the archway depicted "the qualities of personality that constitute a person", with the "biological base" of traits and predispositions, the "needs" that develop from it through interaction with the environment (right-hand column), the "values" (including ideological values) that progressively evolve from the satisfaction of "needs", and the evolution of "interests" from "activities". Parallel to the personality traits are the "aptitudes" and "special aptitudes" that are derived from intelligence (as adaptive behaviour). Both result in characteristic "personality" or life-style, and "achievements" (the left-hand capital) that evolve from the "use, misuse or disuse of personal resources" (Super, 1990, p. 202).

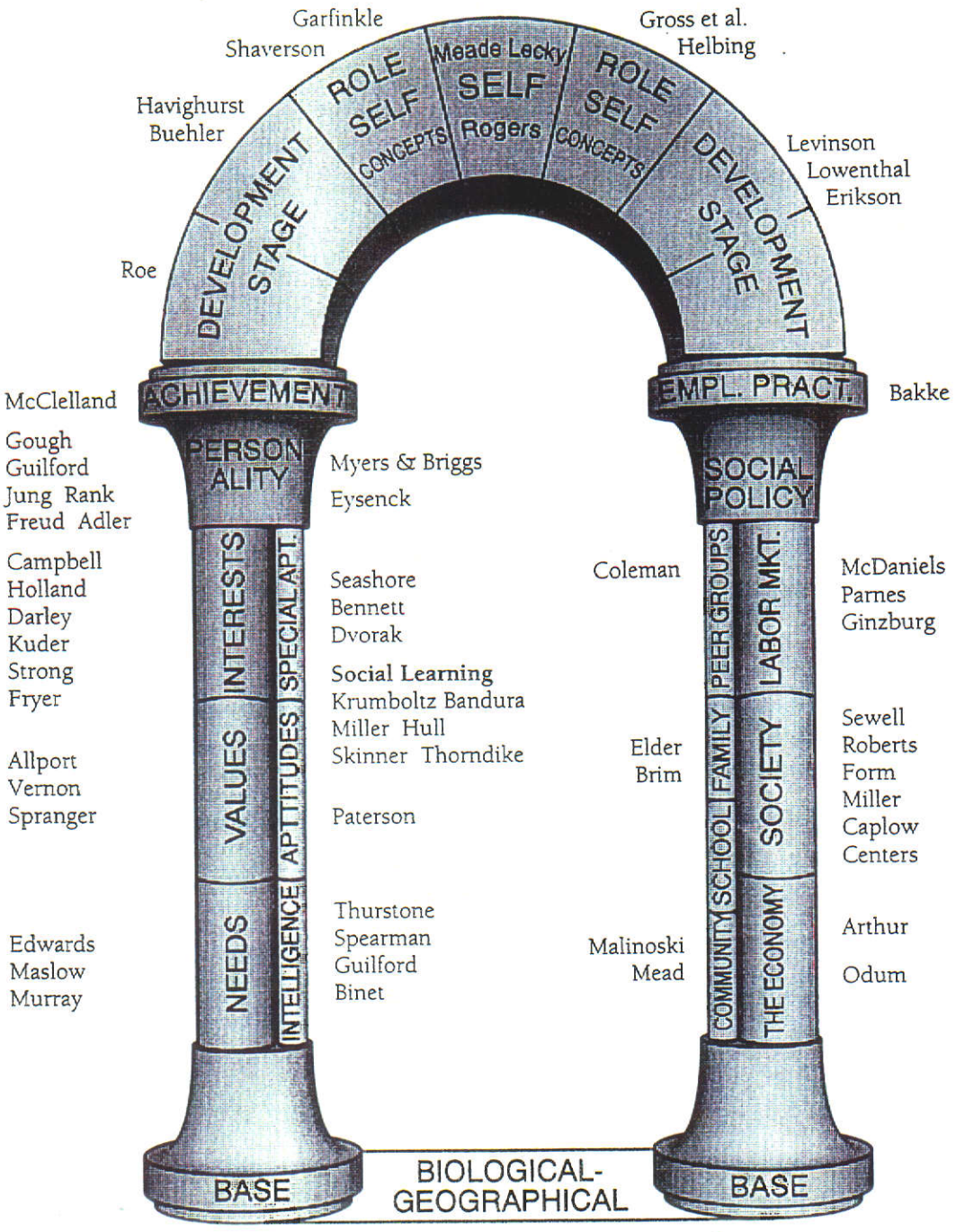


Figure 2.1: Super's (1990) Archway of Career Determinants

The right hand column (see Figure 2.1) with its "geographical" base depicted the "remote determinants" of the economy, society and the labour market. The right hand capital, "social policy" and "employment practices" of a particular society, was the culmination of Super (1990) sociogenic and econogenic segments.
On the inner side of the column are the "immediate" ideological agents with whom the individual interacts, in the community, school, family and peer groups. At the threshold of the archway, Super (1990) created a "biographical-geographical" doorstep as the entrance to one of these life-spaces. I found this model (Figure 2.1) a most helpful device in teasing out his segmental theory, because he had written key theorists alongside a particular focus "segment", and names of those who were interactionists within the arch "life-space". It provided me with a device to display recent theorists' perspectives in order to refine segments and to build a more gender inclusive theory of career development.

Explanatory Power of Segments of Super's Life-Span Life-Space Career

In the personality and self concept theory segments, Super had undergirded his standpoint with the assumptions, principles and methodology of Allport (1937), G. A. Kelly (1955), and Adler (1930, 1964). Super's (1990) central assumption was that an individual is the "socialized organizer of his/her experience" (p. 221) Foundational to Super's construct of career (Super, 1980, 1983, 1990) as past, present and future, was Allport's concept of the human being as the "self-conscious, rational [hu]man [being], who creates his [her] style and his [her] future with forward-looking motivations", rather than as an "empty organism pushed from the past against present resistances into an unknown future" (adapted from Oeser, 1961, p. 450). Super did not see heredity, traits and environment as determining personality, rather these were used as building materials by which the individual created his/her own unique personality and self-hood based on his/her own reality of what s/he "thinks and feels reality is" (p. 773). He adopted an assumption from G. A. Kelly's (1955) personal construct theory of self development, prompted by Kidd (1982, cited in Super, 1984, p. 208), that it was the interpretations an individual made of internal and external events which were organised and internalised as personal constructs. These personal constructs helped to bring order

to the individual's universe in his/her ability to adapt more effectively to the environment, and internally to construct knowledge about self, others, and the objective world.

In the light of the effects of gender power relations on women's careers, I considered that it was important to adopt Super's (1990) assumption that inter-personal dynamics involved in an individual's creation of life-career influenced the construction of intra-personal determinants (both positive and negative). Adlerian psychology (Adler, 1930, 1964, 1974) which focussed on the effects of power over relations provided a sound basis for investigating gender power over relations in the family, education and work. To converge with Super's stress on goal-oriented motivation, the perspectives of feminists on "dreaming the future" were important to include (Heilbrun, 1979; Jaggar, 1983, 1989; Rose, 1994; Spender, 1980). I considered it was important to include a segment on aspirations on the outer side of the personal determinant column for women's healthy construction of personality and present career, as well as creating hope (Gottfredson, 1982; Harmon, 1994; Rotter, 1954, 1971; Savickas, 1994).

In the "role self concepts" segments, Super (1980) conceived that personality was progressively constructed through the roles an individual played in socially interactive contexts or "life-space" (p. 283), where role-taking carried certain prescriptions of and expectations for behaviour. In this segment, Super (1970) saw these roles as "positions and processes" where and how needs were met, interests were formed and fostered, and values expressed as attitudes. He noted how values, as "qualities a person desires", were fundamental in goal setting and guided the way an individual sought out these qualities in activities (interests) he/she engaged in, in situations in which they lived, and in objects they made or acquired" (p. 4). These qualities he assumed were essential in moving an occupation towards a vocation. He also focussed on the saliency of an individual's professional and personal choices of major life roles (child, student, leisurite, citizen, worker, home-maker), and his/her ability to deal effectively with the "timing of the entry into and exit from social and work roles, and resolving identity crises in these roles, in a particular life-stage". (Super, 1994, p. 64).

I considered that this segment of his theory would be enhanced by Josselson's theory (1987), that was built on identity attainment theory (Chodorow, 1978; Marcia, 1975, 1980; Marcia & Freidman, 1970), concerning the key role of parents to help adolescent girls to "separate and individuate" in healthy ways, by finding self and a vocational identity, via personally satisfying career pathways. Personal memories of the impact of public and private relationships with other "key" figures (Watts et al, 1981); and perceptions of present-career "key figures" would be vital in monitoring "structures of opportunity" (Astin, 1984), and what I have coined associated "circles of affirmation", including "chance encounters" (Bandura, 1982b; Herr & Cramer, 1992) in Super's "theaters" or institutions of social interaction (ie, family, peer group, leisure, community, school, university and work). There are omissions in critical segments in the right-hand inner column, for example *leisure* (McDaniels & Gysberg, 1992) and *peer groups* (Super, 1990; Davies, 1989a, 1989b). Considering the move towards life-long learning, I have re-labelled the school segment as *education*. Considering the value placed on *affiliation* in responsibility oriented morality (Gilligan, 1982; Josselson, 1987), I have included this as an achievement outcome within the capital on left-side column.

Super's (1990) labour market theory segment reflecting "differential vocational" psychology focussed on "work and occupations" (p. 197) and his search for "psychological meaning of vocationally relevant acts ... and of work itself in the human experience" (Borow, 1961 cited in Herr & Cramer, 1992, p. 154). As discussed earlier, he assumed that salience of work and the worker role were central to the individual's successful construction of life career (Super, 1990, p. 248). Thus, the construction of a work identity was for Super paramount in the over all attainment of identity, although he conceded that work was a function of a variety of roles, within the social context (Super, 1980). He considered that the primary contribution of differential psychologists was in the development and use of tests, related to aptitudes and vocational interests (p. 198) and values (Super, 1970). He (Super, 1983) valued the bridge building of other key theorists in career development (Roe, 1956; White, 1956; Elder, 1968), who had studied people at work to refine and apply personality theory and cognitive development theory,

and was indignant at the dismissal of the "import" of this linkage by "developmentalists, personality theorists, or social psychological theorists" for theory-building in their own fields (p. 26).

From this theoretical segment standpoint, I considered that traits of women of ability were important to ascertain. There was room for theory building in the following "personal determinants" segments:

- "aptitudes" and "special aptitudes" recent research on multiple intelligences should be included (Gardner, 1993);
- "intelligence" defined by Piaget and Inhelder (1969) as adaptive behaviour that involves the use of both emotional and cognitive intelligence is a sound basis for constructivist conceptions of knowledge building;
- "personality" and Super's inclusion of cognitive style (eg Myers Briggs). These was in accord with Super's nomethetic approach to the study of career. I considered that preferences in information processing styles (Felder & Silverman, 1988) and learning and management styles (Honey & Mumford, 1982) would lead into his idiographic approach, where I could continue to listen to the women's voices to ascertain possible gender differences in being, knowing, learning and reasoning (Baxter Magolda, 1992; Belenky et al, 1986; Foster, 1989; Jaggar 1989; Luttrell 1989) and be alert to differences in modes and ways of knowing amongst the women (Gardner, 1993).

Super's (1990) standpoint in the "developmental stage" segments was concerned with qualitative changes and adaptation of an individual over the "life span" (p. 197). His interest in how a personality profile develops was facilitated by his present-lived career longitudinal approach (Super, 1983, p.198) which enabled him to interpret an individual's (or a group of individuals) life career, especially qualitative changes regarding his/her level of career maturity or success and career adaptability in future-oriented decision-making. In conjunction with this segment was Super's (1990) emphasis on vocational guidance to help a person accomplish particular developmental tasks at different stages, to plan for the future, and to help a person correct faulty life-styles (Super, 1990, p. 220).

He attributed his bridge between differential vocational psychology and developmental vocational psychology to Roe's (1956) "landmark book on the abilities, interests, and personalities of men and women in various occupational fields", and to her paper on "the early determinants of vocational choice", which drew heavily on Maslow's hierarchy of needs and general child development theory; and then her research on the origins of interests (Super, 1983, pp. 15-16). I was enthused by Super's (1990) incorporation of, what I labelled as, Roe's *feminine consciousness* to explain the process of "vocationalisation" or "occupational socialisation" of male scientists. From this theoretical segment, I replicated this process for women in engineering, but focused on Super's present and future oriented career methods (Super, 1954, 1984) rather than her retrospective account (Roe, 1953).

Super's developmental stage segment also theorised about the qualitative construction of a "career model of developmental vocational counselling". His interest in "life as career" began with the "identification of five familiar life stages", modelled on Buehler's (1933) career stages, to help him to identify "the problems, activities and interests of various ages" (Super, 1969b, p. 4). In addition to his incorporation of Buehler's (1933) *feminine consciousness* of life-career stages, he used Erikson's neo-Freudian (1950, 1959, 1968, 1970), and Havighurst's (1953) stage theories to explain the development of ego identity through the successful completion of developmental tasks and resolutions of conflict. Super (1969, 1983) was also impressed by the insights of Ginsberg, Ginsburg, Axelrod and Herma (1951), who had drawn from Freudian and Piagetian theory to explain the affective and intellectual construction of knowledge of career. This enabled me to use Piaget's notion of "adaptive behaviour" in the "intelligence segment" to justify Super's encouragement of future oriented decision-making, and to monitor the qualitative construction of schemes related to work, occupations and vocation over three life-stages (Super, 1983, p. 23).

Super's five stages of life-career, began with the "growth" stage and the identification of the baby's initial "personal determinants". Super, like Erikson and Havighurst, accepted the biological heritage of temperament, as the pre-disposition of personality to behave in

certain ways; and the genetic endowment of "general and specific aptitudes" as the bases for the child's active construction of knowledge about the world and self-schemes through the process of adaptation to the environment (Super & Bohn 1971). Super (1990) accepted the child's invariant progress through the completion of stage-specific developmental tasks and role-taking in the growth stage of early and mid child-hood. These tasks included becoming concerned about the future, increasing personal control over life, developing a need for achievement, and acquiring competent work habits and attitudes (between birth and thirteen years). Though he valued the work of Roe (1953) on the origins of interest, values and the importance of needs satisfaction, he did not focus on the early growth stage, rather on later mid-childhood, for the "dawning" of career maturity (Super, 1954).

With entry to the early "exploration" stage of adolescence, he found that transitions and mini-cycles of adjustment occurred. The later exploration stage was characterised by cycling and recycling of developmental tasks towards identity attainment and crystallising, specifying, and implementing an occupational choice (Super, 1990). Here, he emphasised the psycho-social impetus for a person to attain vocational identity and commitment. In this regard, he invented the construct of "career maturity" to help him to monitor an individual's success in coping with the demands of the environment (ages fourteen to twenty-four).

In the "establishment" stage of adulthood (twenty-five to mid-forties), Super (1990) was concerned with men's and women's future oriented decision-making choices, and created the construct of "career adaptability", regarding juggling their expanded roles and tasks of early adulthood. His stage of "maintenance" in mid-life, was again concerned with resolving identity crises and making commitments, with fresh choices about roles and life-satisfactions; and finally, he identified the stage of "decline" or disengagement, that begins with retirement from public life, and later from key leadership even in private life decision-making (p. 216).

I contended that this segment of his theory (Super, 1954) would be strengthened by integrating the socio-psychological theory of Astin (1984) and making the starting point

of the individual's life-history in the pre-school days of the growth stage of career. It is in this stage that concepts of work, gendered self schemes, needs, interests, values, vocational aspirations and work expectations are first being constructed. Abilities are also beginning to develop into capabilities, through accomplishment of developmental tasks by the girl child, especially through play and identification with parents (Astin, 1984; Gottfredson, 1981; Newson & Newson, 1976; Roe, 1953). Similarly in his exploration stage, the inclusion of Josselson's (1987) theory of qualitatively different career pathways adopted by women would provide a stronger theoretical basis to study links to the need for affiliation and the establishment of individual identity. The inclusion of her theory gave me the explanatory basis to the formation and attainment of work identity of women in engineering education to their "establishment in an occupation" (Super, 1954) in a gendered world. This segment of his theory is represented by Super (1990) as the "Life-career Rainbow" model (p. 200) and as the "Ladder model of life-career stages, developmental tasks and behaviours" (p. 206). I discuss, in a later section, how I adapted both models to summarise this complex theoretical segment on life-span, life-space development.

As the "interactive" theorist, Super (1990) was aware of the "life-space" between the pillars of the "give and take" of social life and the role of "superiors" in the construction of knowledge, self, and identity (p. 202). In attempting to explain the congruency of career and self development, Super (1990) incorporated Lewin's (1935, 1951,1954), field theory, Rotter's (1954, 1966, 1971) theory of "locus of control" and Bandura's (Bandura, 1989; Bandura & Walters, 1963) powerful social learning theory (p. 212). Super's standpoint was reminiscent of the Lewinian position on field theory, personality and social behaviour, in that the "life-space" or the total field of forces, contained the "total configuration of psychological reality" for that person and whose "behaviour is a function of the life-space" (Sarason, 1972, p. 111). Super included Rotter's (1954) theory because he was interested in the effect of a person's internal and external locus of control on career decision-making in life space (Watts et al, 1981). Super (1990), like Rotter, encompassed both field theory and social learning theory to enrich his understanding of career development and career maturity and adaptability, and again

placed special emphasis on a person's anticipations and expectations about occurrences of specific types of future events (p. 233). Super's strength was his representation of the process in his spider web model (Watt et al, 1981).

Super also acknowledged the importance of assessing the diverse qualities of self, including "self-esteem, self-efficacy, and occupational translations of self-perceived traits" in career development counselling. This construct was first propounded by Bandura (1977, 1982a, 1989) as a cognitive mediator of behaviour, which he defined as "an individual's belief in his/her ability to perform a behaviour in a given situation" (Starko & Schack, 1989, p. 118). K.R Kelly (1993) aligned self-efficacy to "the strength of one's expectation that one can prepare for and enter particular careers successfully" (1993, p. 59).

From a "neo-Adlerian" perspective, Super (1980) was conscious of the effects of worker role relationships "lifting him up", or "pressing him down", in a man's endeavours to find a niche in the life-space of a chosen occupation (p. 296). I was particularly concerned with a woman's struggle for freedom to develop intellectual capabilities and maintain her courage in formal mixed gender learning environments where power relations were being worked out (Jaggar, 1983). Herr and Cramer (1992) affirmed for me that "although Adler did not make work a central concern of his theory ... his concepts of personality" did describe "work motivation and the work setting" as a place to implement "social interest, unique life-styles and superiority" (p. 193). I built on Super's life-space interactive learning segment (Bandura & Walters, 1963; Piaget & Inhelder, 1969; Super, 1980, 1990) by including researchers concerned with quality of work and gender equality of relations (Carter & Kirkup, 1990a, 1990b; Cockburn, 1983, 1985, 1991, Hacker, 1981, 1983, 1989, 1990). Super emphasised the importance of the role of "superiors and fellows" (Super, 1990; Watts et al, 1981). Research has moved towards equipping and enabling an individual to find a niche in education, family and work (Eveline, 1994; Mitchell & Kromboltz, 1984; Pallotta Chiarolli, 1990; Robinson & McIlwee, 1989; Vondracek, 1990; Young, 1984; Young, Valach & Collin, 1993).

In regard to the inter-connected "self segment", Super (1990) was deeply interested in the need for individuals to construct a strong and healthy self-concept, where he asserted that "those who lack self-esteem are less likely to make good matches between self-concept and occupational concept, and those who feel unlikely to succeed avoid risky choices" (p. 249). Although Super (1983) highlighted the importance of the research of Betz and Hackett in 1981, he did not focus specifically on the origins of gendered self schemes, nor the possible effects that low feelings of self-efficacy had on lack of confidence and competence in females. In relation to this segment, I considered it necessary to monitor the self-efficacy of women in interactive non-traditional work and educational life-spaces for healthy career development (eg, Betz & Hackett, 1981; K. R. Kelly, 1993; Reis, 1987a). I also intended to monitor their level of self-agency (eg, Gilligan, 1982; Josselson, 1987; Kvande, 1987; Wolffensperger, 1993) in resolving any incongruence in lack of person-environment fit (Spokane, 1994).

In the outer segments composing the right hand pillar and the doorstep of the archway model (Figure 2.2), Super was a fore-runner in emphasising the need to take a critical sociological perspective (Roberts, 1981; Super, 1954, 1957, 1990; Watts et al, 1981) that dealt with the social, economic and political "external remote" determinants of careers, as well as a sociological interactionist focussing on the "external immediate" determinants in the family, education and work-place over the life-span, in particular historical times. He applauded the work of other "aspiring integrators", like "Blau and others (1956)" and their research on choice "where choices of individuals encounter choices of employers and are somehow reconciled through compromise or synthesis" (Super, 1990, p. 240). By 1990, Super was even more aware of the interweaving effect of key social constructs, such as socio-economic status, race/ethnicity, culture, and more recently gender. This was evidenced by his focus on "the functional relationship between time, social structures, and personal attributes" (Herr & Cramer, 1992, p. 151).

This segment of theory was much in line with Jaggar's (1983) concern for *historical dialog* and the construction of careers, which provided a theoretical basis for helping me to grasp the impact of "refractions of the truth of the social order" on the way people

(Super's "key figures") interact in families, education and work and the effects on girls and women's career development, as well as their impact on others. In a broader sense, my focus was on the "opportunity" structure of the family and school as the crucibles of personality, group affiliations and development of interests (Astin, 1984; Hesketh, Elmslie & Kaldor, 1990; Newson & Newson, 1976), and the opportunity structure for women in non-traditional vocations and higher education, with associated "status" and "prestige" (Gottfredson, 1981), and their preparedness to be "adaptive" as institutions (Hesketh, 1985). I amended Super's (1990) archway "doorstep" to place an individual's life-stage into an *historical*-biographical-geographical context to make clear the dialectical construction of self in particular historical times (eg, Erikson, 1968, 1970; Greene, 1988; Heilbrun, 1979; Roe, 1953, 1956; Super, 1954; Josselson, 1987). This prompted me to make links to changes in social and moral values (Gilligan, 1982; Jaggar, 1983, 1989); the impact of technological change on women's lives (Astin, 1984; Rose, 1994); changes in predictability of work (Phillips, 1994); and changing career needs, aspirations and life-plans of women (Herr & Cramer, 1992, pp. 243-244).

Finally, in accommodating to the post-modern world, Super (1983) incorporated segments of political scientists, economists and organisational development theories, to further contextualise life-career within a social order. These segments were evident in the outer stones of the right hand pillar of his archway model. Such perspectives highlighted the impact of the "development and allocation of human resources in national and global economies" and "the interactive effects of persons and environments as new forms of work organisation emerge in service and information-based economies" (Herr & Cramer, 1992, p. 152). This theory segment linked well with the concerns of Astin (1984), Gottfredson (1981), Jaggar (1983, 1989) and Rose (1994) for women's careers and advances in technology in realising their gifts and in making wise choices. It also provided a springboard for me to consider how research on women's careers ought to impact on reviews of social policies and practice (Gottfredson, 1982; Harmon, 1994), particularly in the way change is affecting women's choices of and preparedness for a vocation (eg, Phillips, 1994), and even how chance affects career decision-making (Bandura, 1982b; Herr & Cramer, 1992).

CONVERGING JAGGAR'S FEMINIST PERSPECTIVE WITH SUPER'S THEORY OF CAREER

Super's career theory was adaptive, judging by the integration of a range of theories from psychology, sociology and economics. Jaggar's theory emphasised unity in the sense of interrelating all aspects of women's lives and describing, explaining and predicting how a particular social order and institutional regimes helps or hinders a person's integration towards wholeness as a person and fulfilment of life-work. Most importantly to me, Jaggar made a powerful attempt to achieve a synthesis between Marxist and Radical feminist perspectives and as part of the "on going historical dialog" was open to new feminist positions that could contribute in constructing "a more fully adequate feminist framework .... and ultimately a more adequate world" (Jaggar et al 1984, p. xvii).

Given the openness of both theorists to healthy convergence, I reasoned that melding my unified systems feminist theory with Super's segmental theory would, with these elaborations, progress towards a more comprehensive career theory to better explain and represent gender differences (and similarities) in women's quest for vocational identity. Such convergence of theoretical perspectives prompted me to display these adaptations in his Super's archway model. Such an interactionist, developmentalist and constructivist approach to the study of career (Super, 1954, 1969a, 1969b) affirmed my selection of a feminist methodology that was commensurate with an ethic of care in studying the career pathways of non-traditional women.

Versions of Jaggar/Super Archway of Career Determinants Model

A Theoretical Version of the Archway Model

I synthesised my amended theoretical segments, with researchers included, to produce a modified version of Super's (1990) archway model to take account of changing theoretical perspectives on women's career development for the 1990's. This is shown in Figure 2.2 below, with my additions to the original shown in bold italics:

Figure 2.2 A Segmental Archway Model of Women's Career Development

(adapted from Super 1994)

Figure 2.2 A Segmental Archway Model of Women's Career Development

(adapted from Super 1994)

A Dynamic Archway Model of Career with the "Spider Web" Model

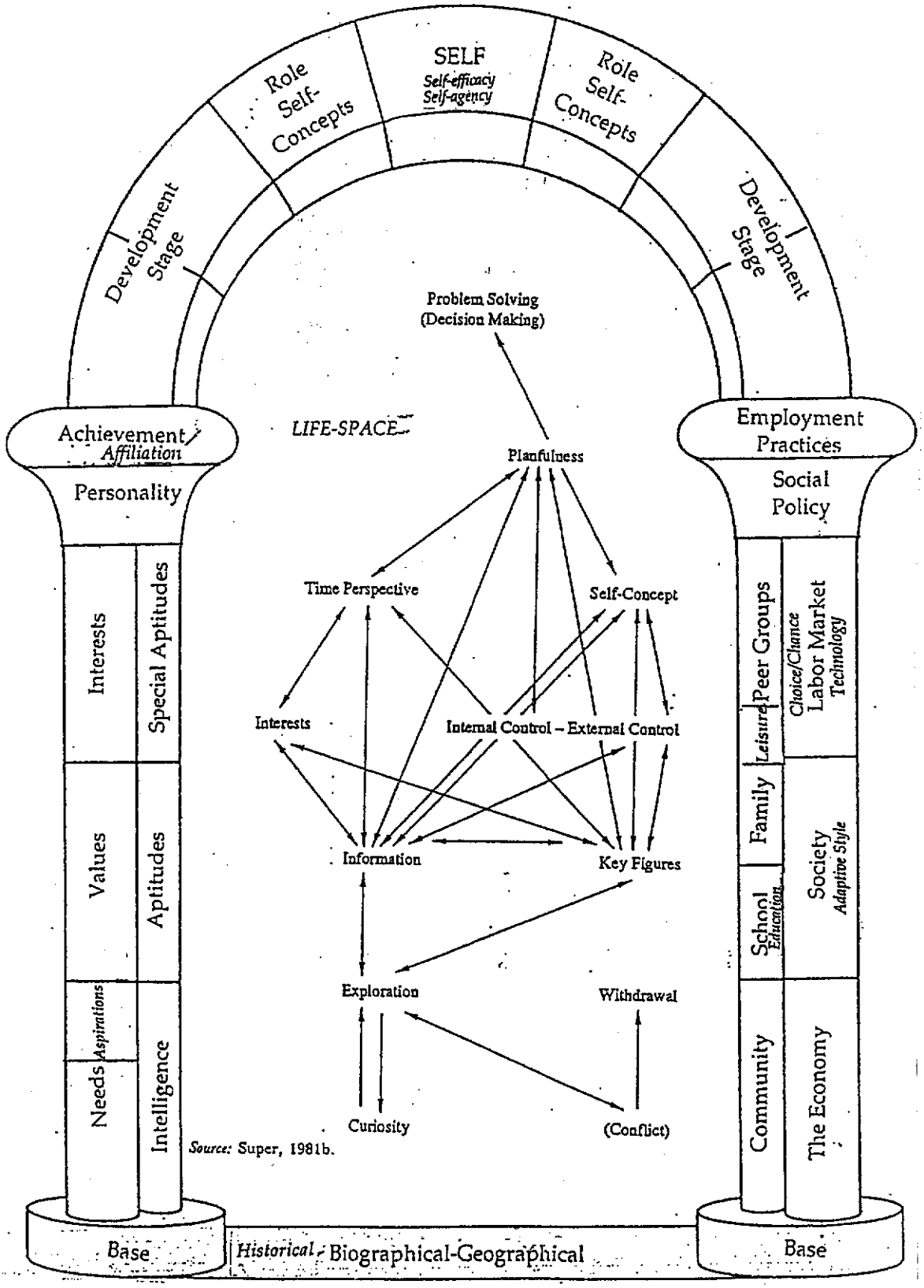
As I interrogated the theory in the interactive life-space segment, it became increasingly clear to me that I could trace the process of career maturity and identity attainment (Josselson, 1987) with women in engineering, through the incorporation of Super's spider web model (Watts et al, 1981) in the modified archway life-space.

Super (1980) had been prompted to create the archway model to emphasise the dynamic "synthetic, synthesising nature" of career development in life-spaces that the rigidity of the arc of the life-career rainbow was unable to represent (Super, 1980, p. 283). In 1981, Super (Watts et al, 1981) created the "spider web" model. His intent was to use it to create a better theory, by monitoring how it served to empower primary school children to take responsibility for their lives in "developing the attitudes and skills of career readiness", with the "help of good role models" or "key figures" as a basis for promoting later career maturity or success (Super, 1990, p. 233).

In his creation of the "spider web" model (see Figure 2.3 p. 61), he applied the theory segment of Berlyne (1960) and Jordaan (1963), who had found that if "curiosity" and "exploration" were rewarded either intrinsically or by others, these, in turn, would influence the development of "career and occupational information" encourage "further exploration" and "the development of interests", in addition to the discovery of "key figures" or good role models (Super, 1990, p. 233). Super reasoned that goal satisfaction influenced a balanced feeling of "internal control" (eg, Rotter, 1954) and the "constructive use of external control" using "key figures" or superiors. Super linked such self control balance to the development of positive "self-esteem", the creation of a healthy "time-perspective" by linking past, present and future career, an attitude of "planfulness", and the progressive ability to "solve problems, and make decisions" (p. 233). However, he had found that if "exploratory behaviour" was unrewarded it lead to "conflict" and "withdrawal" (p. 231). In the spider web model, he used double-headed vectors (eg, Lewin, 1951, 1954) that supported his dynamic interactional and

developmental view of the process of career development by emphasising the reciprocity of factors that resulted in the individual and the context changing inter-dependently over time (Herr & Cramer, 1992).

It was a major concern of Super's (1990) that the goal of satisfying curiosity was being hampered by institutional goals (p. 233), His view certainly linked with my four domain assumptions about women in higher education. As women in engineering, I reasoned that they too had need for the stimulation and cultivation of curiosity and satisfying exploration with the help of key figures. This convergent model, then, was a combination of my "Segmental Archway Model of Women's Career Development", based on Super's (1990) model (p. 212) and Super's "Spider Web" model (Watts et al, 1981), which I placed between the "pillars" to create a "person-environment interactive model" (Super, 1990, p. 232), as well as a career decision-making paradigm. This model is represented below in Figure 2.3 as "Woman in Engineering".



Source: Super, 1981b.

Figure 2.3: Woman in Engineering

Copyright for Segmental model cleared by Jossey Bass Publishers (31.1.98)

Methodological Research Question and Super/Jaggar Theory and Models

I formulated my methodological question at this point to capture my examination of the efficacy of the Jaggar/Super convergence theory of career development and associated elaborated models of life-career:

> **How robust is the Super/Jaggar convergence conceptualisation of life-span life-space career in representing and facilitating the construction and interpretation of women's subjective life-career in non-traditional occupations in Australia in the 1990's?**

PROPOSITIONS FOR CONSTRUCTING CONTEXTUALISED LIFE-CAREER

Using Super's Propositions to Formulate Career Research Questions

Like Super, I found it helpful to elaborate career theory in the form of propositions or structure about "persons, positions and processes" and the "study of lives and vocations" in socio-cultural context (Super, 1969a, 1969b, 1983, 1990). Initially, Super (1953) produced ten (10) explanatory propositions, that emphasised continuity in human development and the individual's choice, entry to new stages, adjustment in interactive settings, and transitions to new choices and stages over the entire life-cycle. By 1990, Super had expanded his propositions to fourteen (14) as a result of research and practical implementation in education and counselling. These additional propositions served to contextualise Super's concept of life-career within a social order (Proposition 14); and within social institutions (Propositions 11, 12 & 13, plus 6 & 9). The latter emphasised the influence of the role of "key figures" and "superiors and fellows" on the structure of opportunity and "approval" they ought to provide young people (Super, 1990, pp. 206-208). His propositions are framed below.

Super's Propositions

Proposition 1. People differ in their abilities and personalities, needs, values, interests, traits, and self-concepts.

Proposition 2. People are qualified, by virtue of these characteristics, each for a number of occupations.

Proposition 3. Each occupation requires a characteristic pattern of abilities and personality traits, with tolerances wide enough to allow both some variety of occupations for each individual and some variety of individuals in each occupation .

Proposition 4. Vocational preferences and competencies, the situations in which people live and work, and, hence, their self-concepts change with time and experience, although self-concepts, as products of social learning, are increasingly stable from late adolescence until late maturity, providing some continuity in choice and adjustment.

Proposition 5. This process of change may be summed up in a series of life stages (a "maxi-cycle") characterised as a sequence of growth, exploration, establishment, maintenance, and decline, and these stages may in turn be subdivided into (a) the fantasy, tentative, and realistic phase of the exploratory stage and (b) the trial and stable phases of the establishment stage. A small (mini) cycle takes place in transitions from one stage to the next, or each time an individual is destabilised by a reduction in force, changes in type of manpower needs, illness or injury, or other socio-economic or personal events. Such unstable or multiple trial careers involve new growth, re-exploration, and re-establishment (re-cycling).

Proposition 6. The nature of the career pattern – that is, the occupational level attained and the sequence, frequency, and duration of trial and stable jobs – is determined by the individual's parental socio-economic level, mental ability, education, skills, personality characteristics (needs, values, interests, traits, and self concepts), and career maturity and by the opportunities to which he or she is exposed.

Proposition 7. Success in coping with the demands of the environment and of the organism in that context at any given life-career stage depends on the readiness of the individual to cope with these demands (that is, on his or her career maturity). *Career maturity* is a constellation of physical, psychological, and social characteristics; psychologically, it is both cognitive and affective. It includes the degree of success in coping with the demands of earlier stages and sub-stages of career development, and especially with the most recent.

Proposition 8. Career maturity is a hypothetical construct. Its operational definition is perhaps as difficult to formulate as is that of intelligence, but its history is much briefer

and its achievements even less definitive. Contrary to the impressions created by some writers, it does not increase monotonically, and it is not a unitary trait.

Proposition 9. Development through the life stages can be guided, partly by facilitating the maturing of abilities and interests and partly by aiding in reality testing and in the development of self-concepts.

Proposition 10. The process of career development is essentially that of developing and implementing occupational self-concepts. It is a synthesising and compromising process in which the self-concept is a product of the interaction of inherited aptitudes, physical make-up, opportunity to observe and play various roles, and evaluations of the extent to which the results of role playing meet with the approval of superiors and fellows (interactive learning).

Proposition 11. The process of synthesis of or compromise between individual and social factors, between self concepts and reality, is one of role playing and of learning from feedback, whether the role is played in fantasy, in the counselling interview, or in such real life activities as classes, clubs, part-time work, and entry jobs.

Proposition 12. Work-satisfactions and life-satisfactions depend on the extent to which the individual finds adequate outlets for abilities, needs, values, interests, personality traits, and self-concepts. They depend upon establishment in a type of work, a work situation, and a way of life in which one can play the kind of role that growth and exploratory experiences have lead one to consider congenial and appropriate (p. 208).

Proposition 13. The degree of satisfaction people attain from work is proportional to the degree to which they have been able to implement self-concepts.

Proposition 14. Work and occupation provide a focus for personality organisation for most men and women, although for some persons this focus is peripheral, incidental, or even non-existent. Then other foci, such as leisure activities and homemaking, may be central. (Social traditions, such as sex role stereotyping and modelling, racial and ethnic biases, and the opportunity structure, as well as individual differences, are important determinants of preferences for such roles as worker, student, leisurite, and citizen).

I built on his ability to focus on each theoretical "segment" to produce a set of propositions by selecting those that would help me to generate three (3) research questions for my substantive research of women's careers in engineering, where "the past shapes the present and the present is the basis of the future" (Super, 1983, p. 192).

Super/Jaggar Convergence - Propositions for Past Career

Super's first proposition (1) was that "individual differences" in the development of abilities and personality traits arise**,** through the degree to which (i) self concepts are "positively constructed in a social context", (ii) needs are satisfied, and (iii) "the values and interests that are fostered" (Super, 1990, p. 206). His second proposition (2) acknowledged that people are "qualified, by virtue of development of these characteristics", each for a number of occupations (p. 206). In his third proposition (3), he considered that each occupation required a "characteristic pattern of abilities and personality traits", with "tolerance wide enough to allow both some variety of occupation for each individual and some variety of individuals within each occupation" (p. 206). Super's fourth proposition (4) highlighted the importance of the effect of the "self construct" on "vocational preferences and competencies, the situation in which people live and work", and the way "self-concepts" themselves changed with time, experience and awareness. He proposed that from late adolescence until late maturity, the self construct provides some continuity in choice and adjustment (p. 206).

His fifth to ninth propositions focussed more on the effects of interaction with "key figures". His fifth proposition (5) attended to the qualitative "process of change" in a life-career that "may be summed up as a series of life stages (a "maxi-cycle") characterised as a sequence of "growth, exploration, establishment, maintenance, and decline" (p. 206). He also focussed on how an individual progressed through these stages by experiencing "(a) fantasy, tentative and realistic phases of the exploratory stage and (b) the trial and stable phases of the establishment stage" (p. 206). In his sixth proposition (6), Super related the "nature of the career pattern" and the way "career maturity" and the "opportunities to which the individual is exposed" to the influence of parental socio-economic level, mental ability, education, skills, and personality

characteristics (p. 207). In his seventh and eighth propositions (7 & 8), Super defined his hypothetical construct of "career maturity", as a "constellation of physical, psychological and social characteristics", which he could use to gauge the degree of "success" a person had in "coping with such demands of the environment" in that context at any given life-career stage. Such success depended on the "readiness of the individual to cope with those demands", which was aided by the individual's ability to cope "with the demands of earlier stages, especially with the most recent" (p. 207). His ninth proposition (9) emphasised how "development through the life stages can be guided" by key figures, "partly by facilitating the maturing of abilities and interests" and "partly by aiding in reality testing and in the development of self-concepts" (p. 207).

Propositions (1-9) pointed me towards the exploration of the "making" of non-traditional girls as engineers and how their past career development and how their involvement might effect change in the "making" of engineering and its nature in the twenty-first century (Roe, 1953, 1956). Based on the above propositions, I formulated Research Question One (RQ1) to construct and the significant situational and personal determinants of *past* career perspective of the non-traditional girl:

> **RQ1. What are the key determinants of the individual's background and how are these events perceived as influencing her construction of personal and professional identity as an Engineering student and her career development as an Engineers? ("Past Career") [linked to Jaggar and to Super's Propositions 1-9].**

Super/Jaggar Convergence - Propositions for Present Career

In formulating Research Question Two (RQ2) about *present* career, I included elements of propositions 1 and 2 (regarding individual differences and needs, abilities, interests and personality traits that are/are not fostered in a social context), 4 (where the stable self influences choice and adjustment), 5 (regarding the qualitative process of change in the exploration and establishment stages), 6 (regarding the continuing influence and support of parents), 7 and 8 (highlighting the importance of continuing to monitor coping strategies and the development of career maturity and future oriented thinking or career adaptability), and proposition 9 (highlighting the importance of others' guidance

in facilitating maturing of abilities and interests, aiding reality testing and the nurturing of self). Proposition 3, relating the nature of the occupation to the characteristic pattern of abilities and personality traits of personnel, and the degree of tolerance towards difference, I found pertinent to engineering and its acceptance of women. Propositions 10 and 11 were important in present career since these focused on the adaptive style of the person where Super (1990), saw the process of career development in early adulthood as "essentially that of developing and implementing occupational self-concepts" where the individual is involved in a synthesising and compromising process in which his/her "self-concept is a product of the interaction of inherited aptitudes, physical make-up, opportunity to observe and play various roles", and his/her "evaluations of the extent to which results of role playing met with the approval of superiors and fellows" (p. 207). This process was also facilitated by "learning from fantasy, in counselling interview, or in such real-life activities as classes, clubs, part-time work, and entry jobs" (p. 208). Super's 10th and 11th propositions are supported by others (eg, Spokane 1994). With propositions 12, and 13, Super (1990) considered it important to know how people were enabled and what enabled them to find satisfaction and importance in work and in life, stating that "work-satisfactions and life-satisfactions depend on the extent to which the individual could find adequate outlets for abilities, needs, values, interests, personality traits, and self concepts" (p. 208). These were useful postulates for me and linked with my domain assumptions as far as women as a minority group in higher education were concerned.

Firstly, I recognised the need to monitor through their stories, the degree of adaptive style (Dawis, 1994; Hesketh, 1985) that the engineering faculties (ie. "superiors and fellows") showed in practice towards catering for individual differences. This was Adlerian in the sense that Super/Jaggar envisaged a communal spirit in the workplace, where interactions with others were fair and just and encouraged each person to be productive and valued. Secondly, Super (1994) noted that successful careers show "psychological continuity" (p. 69), so I determined to monitor the development of interests and their effect on women's progression towards a vocation as a mark of career maturity and attainment of identity in the present study.

In his 14th proposition, Super (1990) acknowledged that whilst work and occupation provide a "focus for personality organisation for most men and women, for some persons ... other foci, such as leisure activities and homemaking, may be central" for healthy self-construction (p. 208). He also was aware that "sex-role stereotyping and modeling, racial and ethnic biases, and the opportunity structure, as well as individual differences, are important determinants of preferences for such roles as worker, student, leisurite, homemaker and citizen" (p. 208). Thus, I planned to focus on all the women's roles as possible foci for personality and identity attainment. In accord with Super's propositions (1-14) I formulated the Research Question Two (RQ2) to systematically construct and the *present* career perspective:

> **RQ2. What events in the day-to-day interaction in the Engineering Degree course are critical to the development of women's personal and professional identities and competencies as engineering students? ("Present Career") [linked to Jaggar and to Super's propositions 1-14].**

Through this question, in my of the "concrete other" subjective career perspectives, I was able to explore the intra- and inter-personal challenges faced by women in engineering education in coping, adapting, and dealing with potential tensions connected with accomplishing "developmental tasks" or "work" in a variety of roles. I was able to indirectly assess through their voices how relations with men were influencing the "gendered nature" of work in a variety of private and public contexts (Walby, 1986, p. 51) and ways in which they, as women, might still be alienated for their intellectual capabilities and sexuality as students and workers (Jaggar 1983; Walby, 1986). Notwithstanding, I was hopeful of finding adaptive change in some "superiors and fellows" (Super, 1990, p. 207); and identifying successful women, who were well qualified, and had achieved identity as future engineers with a healthy balance of occupational and private roles (Super, 1980, p. 283).

Super/Jaggar Convergence - Propositions for Future Career

In formulating Research Question Three (RQ3) related to the construction and of *future* career, I was guided by elements in all Super's propositions. Super's 9th, 10th and 11th propositions suggested that, when an individual is guided and encouraged by "superiors"

to consciously connect past, present and future career, he/she makes better decisions in implementing an occupational self-concept, with forward looking motivations. I also added a feminist perspective to Super's propositions about future career, where "dreaming the future" (Heilbrun, 1979; Rose, 1994; Spender, 1980) was not simply to foster anticipatory vocational socialisation, but to bathe the present with a woman's "future imaginings" about a gender equitable society and to raise the collective gender esteem of women. My intention was also to draw out from their career perspectives the nature of, and adaptive style of, their future work-place or academe, and how well "superiors and fellows" helped them to be successful:

> **RQ3. What events in the day-to-day interaction in your Engineering work-place (final year or post-graduate studies) are critical to the development of personal and professional identities and competencies as engineers (and/or post-graduate student)? ("Future Career") [linked to Jaggar and to Super's propositions 1-14].**

Each of these questions I addressed in terms of the four cells shown in Figure 1.1 (Chapter One). As indicated earlier, however, the major focus of my study was on the intersection of the subjective career perspective and the concrete other (see Figure 1.1) as reported through the voices of the 53 women in Chapter Six and of one particular woman in Chapter Seven.

ADDITIONAL SUBSIDIARY MODELS WITH EXPLANATORY VALUE

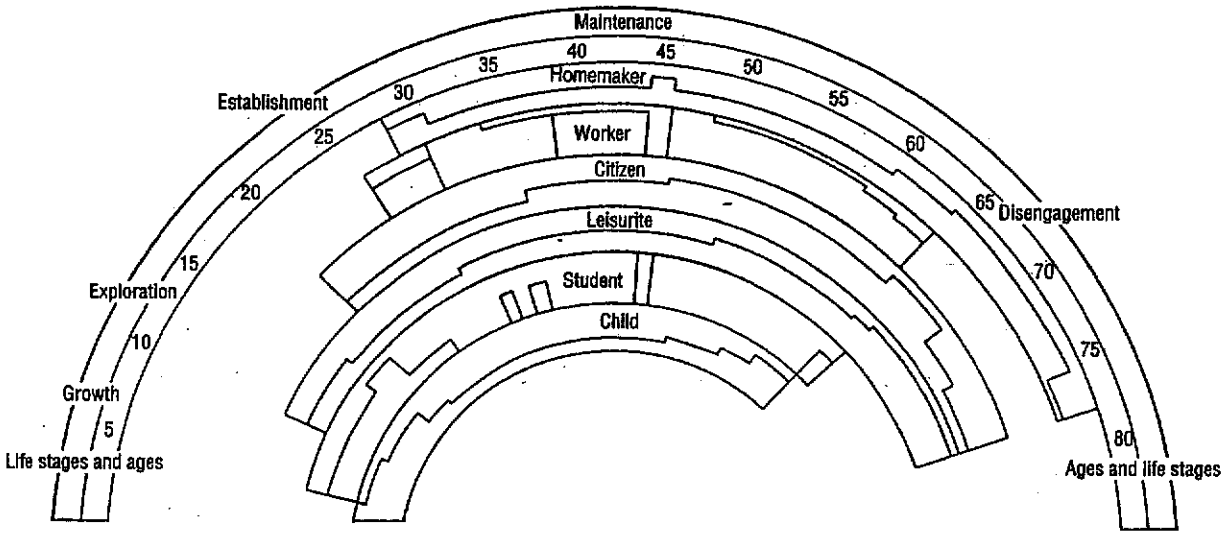
Super's Life-Career Rainbow - Description and Elaboration

To simplify the complexity of Super's developmental and personality theory segments, I utilised his "The Life Career Rainbow: Six life-roles in schematic life-space" model (Super, 1990, p. 200) because it represented the dialectical socio-autobiographical construction of self and career over a life-span. This model helped me in consolidating, and hopefully furthering, his theorising and empirical research. He had modified the model over time (Super, 1980, 1983, 1990, 1994). It represented to Super (1990) the individual "maturing and playing a changing diversity of roles" and enabled him to note and synthesise the particular "influences of biological, psychological, and socio-

economic determinants" affecting that person's career development (p. 199). See my modified rainbow model (Figure 2. 4) below.

Situational Determinants, Remote-Immediate

Social structure - *gender, race, age,* social class
Historical change - *changing career patterns and choices*
Social policy and practices
Socioeconomic organisation and conditions -*Technology and change*
Employment practices - *chance, choice and change*
School *(or Education* to *include university and life-span learning)*
Community - *change*
Family - *changing child-rearing practices, siblings and birth order*
Leisure - change
Peer Groups - Fellows' attitudes, needs, values, interests



Personal Determinants

Awareness
Attitudes - *self, others, objects*
Interests
Needs - *deficiency* and *growth*
Values
Beliefs
Achievement/*Affiliation*
General and Specific Aptitudes
Aspirations
Expectations
Feelings
Motivation - Forward looking/intrinsic
Traits - learning style, self-efficacy, coping strategies
Biological Heritage

Figure 2.4: The Life Career Rainbow: Six Life Roles in Schematic Life Space
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I further synthesised the rainbow model from Super's versions, which he validated and modified as an heuristic device through his longitudinal study of 100 men from 9th grade to adulthood (Super, 1954, 1969a, 1980, 1983, 1990). My inclusion of additional personal and external determinants was to provide an equally systemic and systematic way of representing and analysing women's careers, and further synthesise career theory towards gender inclusivity.

The first dimension depicted by the rainbow was "career maturity" or success, which was the "maxicycle" or "course of life" representing development across the "life-span" (Super. 1990, p. 213). The outer band of the rainbow showed the major qualitative life-stages of career progression, with "their normal but not invariable sequence, and ... approximate ages" (p. 213). Each person accomplished the tasks associated with each life-stage. The second dimension of the rainbow was "role salience" or importance of six life-roles, which were "latitudinal" where each "life space" represented the "constellation of positions occupied and roles played by a person" as outlets for abilities, interests and values, unique for each individual (pp. 218-9). Each colour in the rainbow represented a role and by its "shading" the emergence, and "waxing and waning" or diminution of each role with the increasing age of the individual as he/she juggled with multifarious responsibilities, and the need to accomplish developmental tasks and satisfy interests at each life-stage (Super, 1980, p. 289). He considered that a successful and satisfying career was one in which a good balance was struck between roles (Super, 1990), where faulty life-styles and relationship difficulties could be corrected by therapeutic counselling (Super, 1980, p. 288).

Super's situational determinants encircled the rainbow and represented the interactive back-drop influencing the individual's rainbow life-career construction (Super, 1980, p. 289). His "remote" situational determinants included "social structure", which in the light of current research I modified to include the social constructs of *gender, age, race*, as well as social class. I added *"changing career patterns and choice"* to Super's (1980) "historical change". Likewise, I modified the "Social policy" determinant (Super, 1990, p. 200) to *"social policy and practices"* determinant as a reminder that life-career

research on women must continue to influence policy making and current practices (Gottfredson, 1982; Harmon, 1994). To "socio-economic organisation and conditions" I added *technology and change*, which especially affect women's lives (eg, Astin, 1984; Rose, 1994). I included *chance* (Bandura 1982b; Herr & Cramer, 1992) along with *choice* and *change* (eg, Phillips, 1994) as adjuncts to "employment practices", which Super (1969a) inferred (p. 20), Bandura acknowledged as an important factor (1982b), and Herr and Cramer (1992) noted as being of increasing significance (p. 184).

I considered that the institutions or "theaters" of school (or education), community and family (Super, 1980, p. 284) were important immediate situational determinants, as potential gender regimes of interactive role behaviours. In the light of Super's (1990) recent study on "work importance" and the salience of the worker role, I balanced it with the role of *leisurite* (pp. 218-19), which was supported by others (McDaniels & Gysbers, 1992; Josselson, 1987). Finally, I included the influence of *friends and peers* in the rainbow model, to conform with Super's (1990) acknowledgement of peer groups in his archway model (p. 200).

Super (1980, 1990) undergirded his life-career rainbow with the following "personal determinants" of life-career development: awareness, attitudes, interests, needs. values, achievement, general and specific aptitudes and biological heritage. In the light of the role of motivational determinants of personality, I also included *"occupational aspirations" and "work expectations"* (Astin, 1981), and *"feelings"* and *"beliefs"* concerning self-efficacy (Betz & Hackett, 1981). I placed women's probable need for *"affiliation"* alongside the need for "achievement". I also contended that "needs" should be differentiated into *"deficiency"* needs and *"growth"* needs (Tauber, 1990), to monitor how girls and women had expended their energy in the interactive settings of the 1990's. Finally, I included *"traits"* , because Super (1990) alluded to the effect of learning styles "in the interaction of the person and environment" and the influence of "self-concepts, such as self-efficacy, self-esteem, and role self-concepts" which are "combinations of traits ascribed to oneself" (Super, 1990, p. 202). Alongside, these traits, I included

"coping strategies" because they were found to be important for women in university settings (Kvande, 1986; Wolffensperger, 1993).

Although the rainbow model "merely suggested the dynamics interaction between personal and situational determinants of career" (Super, 1990, p. 201), it was for me a useful conceptualisation of contextualised life-span career development. It also reflected the waxing and waning of roles that an individual plays in each life-stage, which will be important in my present study as the women participants mature.

Super's Ladder Model of Life-Career Stages - Description and Elaboration

Super's (1976) "Ladder model of life-career stages, typical developmental tasks and behaviours" was another way of describing the life-stages as steps in the "maxicycle" of life-career. With the ladder, Super (1990) represented the notion of upward mobility through "transitions" to the next career status (p. 214), where statuses are gained through progressive achievement of typical "developmental tasks" or "work-related constructs" towards a vocation. Yet Super (1990) also acknowledged that transitions could be "highly flexible" where there were opportunities for a person to recycle through "one or more stages" (Super, 1990, p. 215). These "minicycles" represented healthy career decision-making and Super noted how they led to new growth, through fresh exploration and establishment in a satisfying role or roles (Super, 1990, p. 215). The original ladder model is presented below as Figure 2.5.

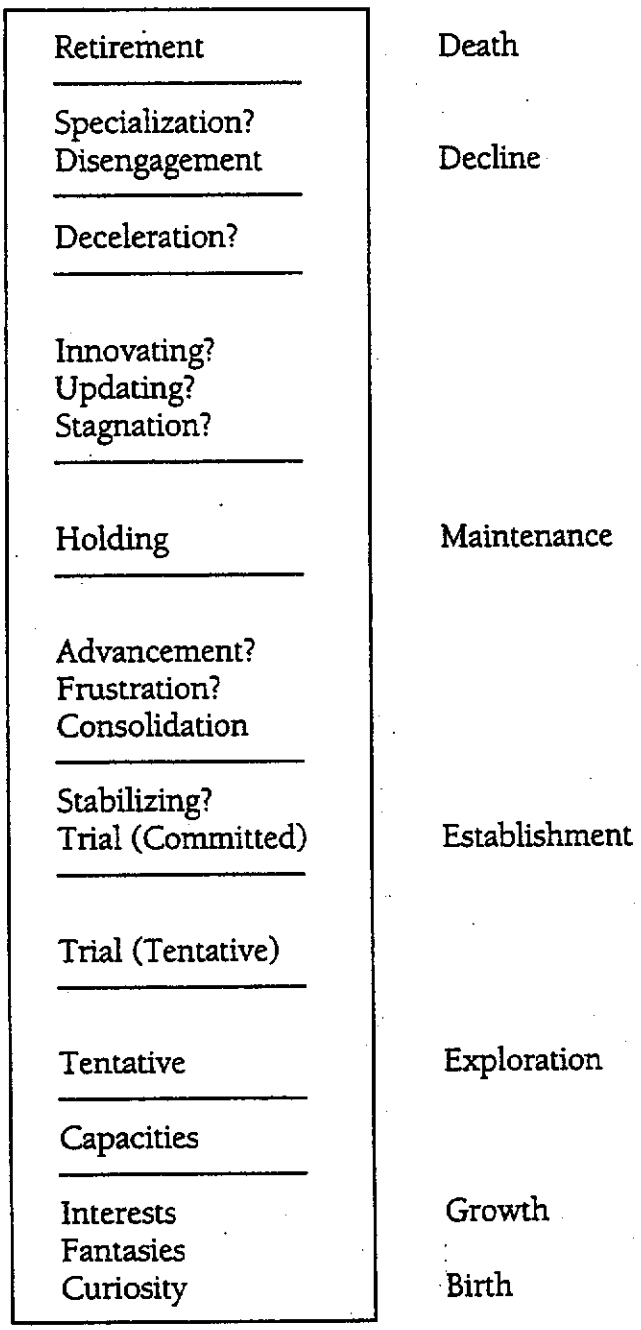

Figure 2.5: Super's (1990) Ladder Model of Life-Career Stages, Developmental Tasks and Behaviours

Convergent Ladder Model of Developmental Tasks - Work to Vocation

I equated Super's (1990) "Ladder model of life-career stages, developmental tasks and behaviours" (p. 216) primarily with Dale's (1972) and Hughes' (1937) concept of the "organisational career" and the tasks set for the individual to achieve new statuses. To add validity to the explanatory power of Super's theory segment on developmental tasks at particular stages (Super, 1994, p. 69), I adapted his basic model by inverting Newman and Newman's (1975) model (p. 24). I made a connection between Super's life-career stages (Super, 1990) and the nature of developmental tasks from the personality development theories of Havighurst (1953) and Erikson (1959,1963, 1968, 1970, 1975) and Piaget and Inhelder (1969). I assumed that the achievement of a vocation could be hindered for females by inter- and/or intra-personal determinants at each stage and included the names of feminist theorists (eg, Astin, 1984; Collin, 1986; Eveline, 1994; Gilligan, 1982; Hesketh, 1985; Josselson, 1987). I used Super's model as a theoretical reference point for the stage theory of career and personality development. In the context of this substantive study, I visualised the ladder as an "organisational career" climb with girls' and women's subjective career-climb in the spotlight. I also considered this conception required a sense of boys' and men's corresponding career-climb as a backdrop (Martin, 1985). I anticipated some adaptations in the "organisational career" in the gender regimes of home, school, engineering departments and work environments. This convergence ladder model is presented below as Figure 2.6.

PIAGET	HAVIGHURST	ERIKSON	
LIFE STAGE	DEVELOPMENTAL TASKS	PSYCHOSOCIAL CRISES	RESEARCH THEMES
8. Later adulthood (51-)	1. Redirection of energy to new role 2. Acceptance of one's life 3. Developing a point of view about death	Integrity v Despair ***Disengagement Stage Super 1990***	1. Changes in cognitive functions with aging 2. Self attitudes of the aging adult 3. Aged care & well being
7. Middle adulthood (31-50)	1. Management of the household 2. Child rearing 3. Management of a career	Generativity v Stagnation ***Maintenance Stage Super 1990***	1. Menopause 2. Australians' view of their emotional & physical health 3. Career counselling
6. Early adulthood (23-30)	1. Work 2. Marriage 3. Child bearing 4. Life style / personality	Intimacy v Isolation Sharing, self with special other ***Establishment Stage Super 1990***	1. Interaction between married couples 2. Career counselling
5. Later adolescence (18-22)	1. Autonomy from parents 2. Gender role identity 3. Internalised morality 4. Vocational choice 5. Career Education	Individual Identity Attainment v Role Diffusion - Find unique self & life-career pathways (Astin, 1984; Josselson 1987; Erikson, 1970)	1. Personality consolidation and identity 2. The university experience & 'structures of opportunity'
Early adolescence (13-17) Formal Operational Thought Stage (Piaget)	1. Physical maturation 2. Formal operations 3. Memberships in the peer group 4. Heterosexual relationships	Group Identity v Alienation - Search for Identity (Marcia 1967) ***Exploration Stage Super 1990***	1. Functions of family, peer group and school 2. Self-concept and self-esteem/efficacy
4. Middle school age (8-12) Concrete Operational Thought Stage (Piaget)	1. Social cooperation 2. Self-evaluation 3. Skill learning 4. Team play	Industry v Inferiority - Sense of Competence - Confidence (Betz & Hackett, 1981)	1. Achievement / Affiliation 2. Social expectations 3. Self-efficacy 4. Management of self and others
3. Early school age (5-7) Preoperational; Thought Stage (Piaget)	1. Sex role identification 2. Early moral development 3. Concrete operations 4. Group play	Initiative v Guilt Imagination Demands Interests (Roe, 1956) Aspirations (Astin, 1984; Gottfredson, 1981) Gender role positioning (Davies, 1989)	1. The development of Self-esteem / self efficacy 2. The quality of the young child's thought 3. Development of abilities, interests & values in home, play, and school
2. Toddlerhood (2-4)	1. Self-control 2. Language Development 3. Fantasy and play 4. Elaboration of locomotion	Autonomy v Shame and Doubt	1. The role of language in the socialisation process 2. Varied techniques of discipline for later self-management
1. Infancy (birth to 2 years) Sensorimotor Stage (Piaget)	1. Social attachment 2. Object permanence 3. Sensorimotor intelligence and primitive causality 4. Maturation of motor functions	Trust v Mistrust ***Growth Stage Super 1990***	1. Critical periods 2. The role of stimulation 3. Satisfaction of needs for belonging & love
Pre-natal experiences			

Adapted from Newman B.M., and Newman P.R., *Development Through Life*, Dorsey Press Illinios, 1975, p.24 by Lesley Newhouse-Maiden 1994. Further based on Super's Ladder Model of life-career stages, Developmental tasks and behaviours (1994, p. 68). April 1997

Figure 2.6: Convergence Ladder Model of Life-Career Stages, Developmental Tasks and Behaviours (Rungs of Organisational Status)

CONCLUSION

My elaborated versions of Super's archway models of life-career (Figures 2.2 and 2.3) were constructed as an outcome of creating a better theory of career (Krumboltz, 1994) by converging the unified systems feminist perspective of Jaggar (1983, 1989) with that of Super (1990).

My adjunct elaboration of Super's (1990) rainbow model, based on Buehler's (1933) life-span, life stage conception of career enabled me to consolidate the essence of his theory segments on personality development. Thus, I was able to better analyse and interpret career development for non-traditional girls and women, within Jaggar's post-structuralist notion of the *historical dialog* of the nineties and to identify conditions that ought to be transformed (Jaggar & Rothenberg, 1984). Likewise my extension of his ladder model (Super, 1990) helped me to summarise major stage theories (eg, Erikson, 1950, 1959, 1968, 1970, 1975; Havighurst, 1953; Marcia, 1975, 1980; Marcia & Friedman, 1980; Piaget & Inhelder, 1969) and incorporate feminist perspectives (Chodorow, 1978, 1984; Collin, 1990; Josselson, 1982, 1987, 1988); and to visualise the relationship between the subjective career ladder climb of the individual and the status rungs of the organisational "career" ladder (eg, Barley, 1989; Dale, 1972; Hughes, 1937).

In the ensuing chapters, I test the power of my convergence theory and models of career further by reviewing the literature to construct the generalised other subjective career perspective of non-traditional girls and women (Chapter Three); constructing and critiquing the concrete other and generalised other organisational career perspectives (see Chapter Five); and through the concrete other subjective career perspectives of women in engineering (see Chapters Six and Seven). I was confident that both theory-building and my feminist methodology would be improved by the use of these life-career models as heuristic devices (see Chapter Four). The question was how well and in what ways would my substantive study move theory building towards a final design synthesis to better explain women's career development (see Chapter Eight).

CHAPTER THREE

REVIEW OF THE LITERATURE ON WOMEN AND NON-TRADITIONAL CAREERS

THE PURPOSE OF THIS CHAPTER

As indicated in Chapter One, the substantive purpose of this chapter is the construction of the subjective "generalised other" (Benhabib, 1986b) life-career perspective of non-traditional women's careers (see Figure 1.1). Thus in this chapter I provide the broader socio-cultural context for the women participants' stories — the "concrete other" — in Chapters Six and Seven. The building blocks for this construction are derived from the findings of a wide range of previous research (by, for example, educators of gifted students, counsellors, feminists, sociologists, and personality and career developmentalists), in Australia and other Western societies. The scaffolding is provided by my convergence of Jaggar/Super's "united systems" theory of career in socio-cultural context, and the three research questions I generated from Super's (1990) fourteen (14) propositions (see Chapter Two).

Methodologically, my two-fold aim was to test the efficacy of my Jaggar/Super convergence models for this task of constructing the subjective "generalised other" perspective from the review of the literature:

> **How robust is the Super/Jaggar convergence conceptualisation of life-span life-space career in representing and facilitating the construction and interpretation of women's subjective life-career in non-traditional occupations in Australia in the 1990's?**

I used gender as my key construct of analysis, to identify power relations and the possible undervaluing of the feminine, compared with the masculine in women's past, present and future career (see Chapter One). I anticipated that any persistent gendered expectations of women and girls would be thrown into sharper relief when the focus was upon women's careers in engineering.

OUTLINE OF THIS CHAPTER

Firstly, guided by Research Question 1 on *past career*, I identify personal and remote/immediate situational determinants of the generalised other perspective on non-traditional girls' growth and exploration stages with the aid of the combined archway/spider model (Figure 2.3), the life-span, life-space career rainbow model (Figure 2.4), and the ladder model (Figure 2.6). Then, in terms of Research Question 2, I focus on the generalised other *present career* , using these same models to identify personal and remote/immediate situational determinants of women students in their late exploration stage in engineering education in the 1990's. I repeat the process, using Research Question 3, to gain insight into the generalised other *future career* of non-traditional women in their establishment or maintenance life-career stages. I then proceed to review the literature on gender regimes of non-traditional work-places, especially in engineering. This part of my review also provides an expectancy of *future* career for the women participants in engineering education in the 1990's. I summarise the situational and personal determinants and the gaps emerging from this career perspective.

Guided by the Methodological Question, I summarise how well the Jaggar /Super convergence theory of career, the propositions and my elaborated models served my review of the literature and construction of the generalised other subjective career perspective.

NON-TRADITIONAL GIRLS' PAST CAREER DEVELOPMENT:

RQ1. What are the key determinants of the individual's background and how are these events perceived as influencing her construction of personal and professional identity as an Engineering student and her career development as an Engineers? ("Past Career") [linked to Jaggar/Super's Propositions 1-9].

Personal Characteristics - Women Engineers as "Ambivalents" ?

In 1966 Douvan and Adelson defined "feminine ambivalents" as a newly emerging group of adolescent girls in the United States of America. These girls of ability characteristically scored "high on femininity" but choose masculine jobs in moves to improve status. When compared to other girls, the ambivalents were vocationally-oriented, rather than fantasy-oriented based on "marriage to person unknown" (Douvan & Adelson, 1966, p. 342). They displayed autonomy, assertion, and high behavioural and emotional independence. Their backgrounds showed ambitious active mothers, often with part-time jobs. On the femininity side, they were also socialised to "cultivate sensitivity, warmth and sympathy" and did expect to carry on "nurturing interpersonal activities" and to gain a vocational identity through future orientation in both professional and family roles. Many of these findings were confirmed by later researchers (Benedek, 1979; Douvan, 1970; Rothchild, 1979; Smart & Smart, 1973). This suggested to me a match between the characteristics of the "feminine ambivalents" and Josselson's (1987) "paver of the way" group and were the ones for which to look (Super's Propositions 1-4), as well as the type of interaction they experienced with "key figures" (Super, 1990) in the family, (Super's Propositions 6 & 9) and in kindergarten, formal education, part-time work and leisure (Super's Proposition 5, 7, 8, 9).

Bright Girls' and Women's Career Pathways - Possible Alienating Constraints

Overseas researchers have identified three constraints affecting the careers of gifted girls and women (Callahan, 1979, 1980; Noble, 1989; Walker, Reis & Leonard, 1992), namely the dominant socio-cultural ideology of an historical period, inter-personal relationships, and women's intra-personal traits and attributions. Each of these is explained briefly below.

Firstly, researchers found that the ideology of domesticity has served to constrain girls' and women's career development and their realisation of potential (Chodorow, 1978; Card, Steel & Abeles, 1980; K. B. Hoyenga & K. T. Hoyenga, 1979; Josselson, 1987; Reis, 1987; Rodenstein, Pfleger & Colangelo, 1977; Walker, Reis & Leonard, 1992; Weyand, 1990), especially in the male dominated domains of mathematics, science and engineering (eg, Carter, 1988; Eccles, 1985; Hubbard, 1992; Reis, 1987). Within this category was the vexed issue of the gendered nature of work and the valorising of the masculine over the feminine. Stereotyping of prestigious work and interests as masculine are internalised by young children creating a basis for career compromises. Research indicated that girls of high ability with non-traditional interests struggle with the femininity/cleverness dichotomy that is internalised by self and others (Clark, 1992; J. Newson & E. Newson, 1976; Gottfredson, 1978, 1981; Hesketh, Elmslie, & Kaldor, 1990).

Secondly, researchers identified inter-personal obstacles in educational and work situations, where sexist attitudes of peers and superiors have created psychological distress in school girls with ability (Burton, 1985; Hubbard, 1992; Kerr, 1988), in university-educated women (Byrne, 1978; Kerr, 1985; Powell & Reznikoff, 1976) and professionals (Faludi, 1992; Reis, 1987a). By not producing needed "webs of relatedness" and a "new anchor" for young women (Josselson, 1987), the ideology of domesticity and the femininity/cleverness dichotomy continues to be perpetuated.

Thirdly, researchers found that the internalisation of intra-personal obstacles into self-schemes, such as the femininity/cleverness dichotomy, often results from others' disregard of girls' and women's special needs, interests, values (Beck, 1989; Betz & Fitzgerald, 1987; Betz & Hackett, 1981, 1983; R. R. Daniels, Heath & Enns, 1985; B. A. Kerr, 1985, 1988; Reis, 1987) and aspirations (Harmon, 1971, 1989, 1994). Outcomes, often the result of achievement-related conflicts, could include the "Cinderella" complex or learned helplessness (Darling, 1981; Horner, 1972) that might not be manifested until late adolescence (Feldhusen, Van Tassel-Baska & Seeley 1989; B. A. Kerr, 1985; C.

Young, 1988); a lack of achievement motivation and underachievement (Davis & Rimm, 1994; Farmer, 1985; Hoffman, 1972; Walker et al, 1992); self-doubt and low self-efficacy (Betz & Hackett, 1981: Kelly, 1993; Reis, 1987); a compounding "fear of failure" as well as a "fear of success" and/or perfectionism (Clark, 1992; Ellis & Willinsky, 1990; Horner, 1972; Hubbard, 1992; B. A. Kerr, 1988; Kline & Short, 1991; Noble, 1987; Reis, 1987; Ryckman & Peckham, 1987); and unfulfilled occupational aspirations and lowered expectations (Eccles, 1985, 1986; Gottfredson, 1982; Hollinger & Fleming, 1988, 1992; Noble, 1987; Reis, 1987; Reis & Callahan, 1989). This suggested to me that intrapersonal conflicts can also serve to alienate women from their intellectual capabilities and gender-mediated experiences because of their being positioned as the less valued 'other'. I linked these characteristics with the Josselson (1987) "daughters of crisis" career pathway group.

These developmental trends and contradictory traits in gifted girls and women were confirmed by mainstream career researchers (eg, Fitgerald & Betz, 1994; Herr & Cramer, 1992; McDaniels & Gybers, 1992; Nevill & Schleckler, 1988; Savickas & Lent, 1994) and by feminist researchers (eg, Carter & Kirkup, 1990a, 1990b; Cockburn, 1983, 1985, 1991; Hacker, 1981, 1983, 1989, 1990; Marshall, 1985). The consensus was that because the educational and occupational experiences of women and girls of ability are different from those of men and boys, females ought to be classified as a group with special needs, values and interests. I have constructed, from a review of the literature, a generalised other subjective perspective in Australia to investigate the events that may have affected Australian women's contextualised construction of career pathways, especially in regard to who becomes an engineer (Newton, 1987).

Australian Non-Traditional Girls' Growth Stage (1968-86)

Contextualised in the Careers of Women of The Parent Generation

At the beginning of their life-career rainbow, non-traditional women of the participants' generation were born between the publication of Cooper's (1968) review on the changing roles and education of Australian women and the definitive gender equity report in Australia entitled *Girls, School and Society* (Schools Commission, 1975).

In addition, Australian feminist voices had found social breath in writing popular non-fiction on the past and present social position of women in Australia (J. Carter, 1985; Dixson, 1984; Greer, 1971; Ker Conway, 1993; Kyle, 1989; Mercer, 1977; Sawer, 1990; Spender, 1981, 1982b; Summers, 1975a, 1975b). Such literature helped Australian women to accept and value their collective past career history. Further, during the 1970's and 1980's, the social movements of Australian women against overt discrimination (Curthoys, 1987, 1992), promoted equal opportunity policies and affirmative action laws (Department of Prime Minister and Cabinet. Office of Status of Women, 1984a, 1984b, 1984c, 1985a, 1985b; Randall, 1987; Sawer, 1984, 1985). In the early 1990's, social justice for women and conditions in the work-place continued to be monitored by government bodies (Department of Prime Minister & Cabinet, 1992; House of Representatives on Legal and Constitutional Issues, 1992). Such monitoring demonstrated that in the period 1970-1991, there was an expansion of professional career opportunities for women in democratic Western societies and the adoption of new career patterns, such as "career doubler" or "career break" (Herr & Cramer, 1992; Lerner & Galambos, 1988) to accommodate to women's need to juggle time to raise a family (Bittman, 1991). The recognition of alternative career paths indicated at least some weakening of negative stereotypes towards women in work and higher education in Australia (eg, Barnes, 1989; Porter, 1987).

Non-traditional Girls' Early Socialisation in Australian Families in the 1970's

Given this climate of change, I assumed that some mothers of the participants would be in the paid workforce, which created the potential for gender equitable models of social relations in these families (eg, Hargreaves, 1982; Harper & Richards, 1979; Kiellerup, Evans, Poole & Davis, 1975). There was further evidence of such change in the overseas life-histories of women in engineering (Carter & Kirkup, 1990b; McIlwee & Robinson, 1992); gifted women (Hollinger & Fleming, 1988; Kerr, 1985; Kelly, 1988; Perino & Perino, 1981; Piechowski, 1989; Reis, 1987; Reis & Callahan, 1989; Rimm & Lowe, 1988; Smith & Butt, 1990; Walker et al, 1992); and women in "non" traditional careers (Hackett & Betz, 1981; Lemkau, 1979; Perrucci, 1984). I synthesised these findings and compared them with a local engineer's story (McPherson, 1989). Both parents were remembered as good role models, conscientious and dependable, emphasising achievement, hard work and education, conveyed by work and example that competence was appropriate for boys and girls alike. As girls, they were given ample freedom and opportunity to satisfy curiosity, explore and cultivate early interests through play, continued to develop self-reliance and initiative, cope with stress, life-long curiosity, and high personal efficacy expectations and aspirations for their schooling and future career. The past career stories of the 1960's and 1970's supported the Douvan & Adelson's (1966) research about "feminine ambivalents". These findings also supported Super's (1990) 6th and 9th propositions about the positive influence of both parents' backgrounds and personal characteristics (p. 207); and the creation of Astin's (1984) structures of opportunity in gender equitable family regimes. Some research findings (Carter & Kirkup, 1990b; Hoffman, 1991) also raised the question for me about the effects of interaction with siblings and other family members on girls' career development.

Girls and Gender Relations in Kindergarten in the 1970's

With mothers' changing career patterns, it was probable that kindergarten was a key event for girls in the late 1970's (Hitchfield, 1974; Newson & Newson, 1976). The roles of Australian mothers and pre-school teachers were under scrutiny in Australia (Poole, 1979; Poole, Davis, Kiellerup & Evans 1975). Unlike nursery schools in Europe

(Brown & France, 1986; Granstam, 1986) and America (J. Martin, 1986), Australian nursery schools had not deliberately begun to incorporate intervention programs to untie "the apron strings" of domesticity (Brown & France, 1986), to promote "non-sexist" education for young children (C. L. Martin & Haverson, 1981, 1983; Spring, 1975) or to engage girls in technology (Granstam, 1986). The key issue for young Australian girls was the persistence of the social belief in the subordinate position of women, and the importance that men's concept of masculinity attached to "being not like a girl" (Connell, Ashenden, Kessler, & Dowsett, 1982). Davies (1989a) highlighted the continuing difficulties of "undoing dualisms" in gendered self-schemes where kindergarten boys' inferior positioning of girls adversely influenced girls' construction of self and established boys' superiority. These findings aligned with Super's (1990) 10th and 11th propositions about the importance of support and positive intervention of "superiors" and approval of "fellows", even in kindergarten, if girls were to achieve early developmental tasks and develop both traditional and non-traditional interests.

Primary School Days for Australian Girls in the late 1970's and 1980's

Changes in Gender Order - Women in Science Networking in Early 1980's

As the participants' generation climbed up the organisational ladder into formal education, women were persistent in "reclaiming a conversation" on the issue of excluding girls and women from the "educational realm" at each stage (J. R. Martin, 1981, 1985, 1989). Women were beginning to network and disseminate findings to combat gender exclusive curricula in mathematics, science and technology (Raat, Harding & Mottier, 1981). Australian education policy focused on the pursuit of excellence and equity for all students, especially in terms of girls' participation, retention and achievement in these non-traditional subjects (Australia Schools Commission, 1980; Beazley, 1984; Commonwealth Schools Commission 1985a; Mossensen, 1981). Related 'Projects of National Significance' were being funded to help teachers create more gender inclusive curricula in mathematics and science (eg, Lewis & Davies, 1988). In terms of the structural organisation, there was evidence that some Australian primary schools were failing to create strong community ties and were not actively promoting

gender inclusivity (Evans, 1989). There was a dearth of female principals as much needed models and mentors for girls (Sampson, 1987a, 1987b).

Primary Curriculum 1980's - Trends and Issues in Non-Traditional Subjects

Given the age of technological change, girls' involvement in science, mathematics and technology and ways to break down the masculine stereotyping of these subjects and associated future work (Sells, 1973, 1978) was coming under closer scrutiny in Australia (Large, 1993; Leder, 1980, 1981; Parker, 1983; L. P. Newhouse, 1990; Sampson, 1982) and overseas (J. Harding, 1983, 1986; Smail, 1984; Whyte, 1985). Girls need for practical skills and competence in design and technology was an ongoing area of action research (Catton, 1982, 1985; Egan, 1992; Sherwin, 1992). Overseas research (Burton, 1986a, 1986b; V. Clarke, 1990a, 1990b), indicated that children believed that "boys and men" were the "proper users of computers" (Gribbon, 1984, cited in Burton, 1986a). Australian girls' perceived lack of competence in computer use was signalled as a new "critical filter" for entry to prestigious jobs (Spender & Sarah, 1988).

Changing trends were evident in science curriculum content and process, as evidenced in my analysis of *Science for children, an* American journal and *Investigating* (Cumulative Index, 1990), which were used by teachers in Western Australia in the 1980's. I found that these journal articles aimed at encouraging teachers to help children to construct scientific knowledge and foster curiosity through collaborative problem-solving and exploration of real-life problems. However these articles were not overtly gender inclusive, in contrast to a handbook for teachers by Barnes, Plaister and Thomas (1984). I later found an omission of women's achievements in science, mathematics and technology in resources and text-books (L. P. Newhouse, 1990) supported by (Burfitt, 1988; Spender, 1982b). In terms of Super's 1st and 9th propositions (pp. 206-207), I concluded that Australian primary teachers were in transition in developing programs to foster girls' interests, abilities, and identity in non-traditional subjects.

Cultural Milieux - Gender Regimes in Australian Primary Schools 1980's

As girls aimed in their growth stage to gain competencies with a positive sense of self, Australian sociologists concluded that girls were healthily addressing their femininity, whilst boys' failure to address masculinity was becoming increasingly problematic (Connell et al, 1982). Co-educational schools, as in Britain and America, were found to be "schools for boys" and were generally not catering for girls' intellectual and socio-emotional needs (Mahoney, 1985; Parker, 1983; Sadkar & Sadkar, 1985a, 1985b; Stanworth, 1981) and, in part, maintaining the "great divide" in Australian primary schools (Clark, 1990). The quality of classroom interaction in terms of gender inclusivity was found to be problematic for girls (Ramsay, 1983; Spender, 1982a). Western Australian teachers in a video: "Person to Person" (Butorac, 1986a, 1986b, 1986c) were deliberately making the curriculum more gender inclusive, but found that girls were more reluctant to think creatively in art than boys, a finding supported by overseas research (eg, Clark, 1992). Classroom environments were found to affect girls' motivation to achieve their potential in "critical filter" subject areas, such as mathematics, science and computing (Leder & Sampson, 1989). However, some Australian teachers were helping girls in the construction of vocational expectancies and value orientations towards career and marriage (Large, 1993; Poole & Lowe, 1985). Such pointers indicated how important anticipatory vocational development was in laying the foundation for non-traditional girls to attain identities congruent with "pavers of the way" (Josselson, 1982, 1987). These findings identified a primary school system in transition, and the importance of teachers creating equitable learning climates to help all to achieve their potential, as indicated in Super's (1990) 6th, 7th, 8th and 9th propositions (pp. 206-207).

Overseas research highlighted the importance of both parents' compensatory support of girls with ability (Askew & Ross, 1988; Martin and Halverson, 1983). As a consequence, non-traditional girls learned to be well-adjusted and single-minded, to persevere, to show initiative, to develop an internal locus of control, to foster leisure and work interests (Carter & Kirkup, 1990b; Kerr, 1985; Josselson, 1987; McIlwee & Robinson, 1992; Zinberg, 1994), and to gain "greater social knowledge or empathy and

accuracy of social judgements" than average peers in primary classrooms (Kerr, 1985 p. 105). This supported Super's 6th, 7th, 8th and 9th propositions on the importance of parents as "superiors" fostering girls' career maturity and ability to cope with the demands of that stage (pp. 206-207). How far was this true of Australian girls?

High School for Australian "Ambivalents" in Super's Exploration Stage

Identity Attainment, Mentors and Models as Josselson's "anchors"

Moving along the life-career rainbow to the exploration life-career stage in the mid-1980's to 1990's, the participants' generation of girls experienced high school education in Australia at a critical time when "any statement about equity or about the freedom of girls to pursue male activities" was evaluated from feminist perspectives within the "enormous constitutive force of the existing social order" (Davies, 1993, p. 272). The attainment of a vocational and personal identity status was their key developmental task (Coleman & Sanders, 1994; Erikson, 1968, 1970; Marcia, 1980; Hummel & Rosselli, 1983; Josselson, 1987, 1982; Kroger, 1990). By the late 1980's, Australian adolescent girls had more role models and possible mentors in "non-traditional" occupations, than at any other time in history (eg, Kingsland, 1989; McPherson, 1989; Parker, 1989). Notwithstanding, there was still an under-representation of women teachers in positions of power and authority (Sampson, 1987a, 1987b); and a lack of women teachers in science was linked to girls' underachievement (Parker & Offer, 1989).

Australian Education Policies for Equity and Excellence - Late 1980's

The National Policy for the Education of girls in Australian schools (Commonwealth Schools Commission, 1987, May) and other significant policies related to promoting gender equity and gifted girls' potential in mathematics, science and technology curricula were produced (Australian Education Council, 1993; Australian Science Teachers Association, 1987; Commonwealth Schools Commission, 1985a, 1985b, 1987; Department of Employment, Education and Training (DEET), 1991a, 1991b; Education Department of South Australia, 1989; GEMS, 1990; Ministry of Education, Western Australia, 1991). There were concerns about females in education getting *A Fair Say*

and for the promotion of gender inclusive communication and resources generally (Ministry of Education, Western Australia 1987). A report on the career development of adolescent girls from different ethnic and social backgrounds (Ministry of Education (WA), 1988) encouraged teachers to consider the interweaving of gender with other social constructs and opportunities for success. As in America (Ethington & Wolfle, 1988; Hesse-Biber, 1985; Wolfe, 1991), there was a parallel move to strengthen careers education in Australian schools (National Board of Employment, Education and Training, 1991, 1992; Furkin, Samms & Spalding, 1986). Associated professional development was provided for teachers and those in pre-service teacher education (eg, L. P. Newhouse, 1990; Newhouse & Cullen, 1994).

Women Educators Networking for Change in Gender Regimes - Late 1980's

Australian feminist educators were taking stock "after the applause" (Kenway, 1990) and questioning the seeming break-through in implementing policies for social justice in girls' education in secondary schools in Australia (Connors & McMorrow, 1988; Foster, 1989; Kenway, 1991; Porter, 1986, 1987, 1991; Suggett, 1987; Yates, 1992, 1993). Women continued to network and now disseminated findings to transform curricula towards gender inclusivity especially through GASAT (Gender and Science and Technology) conferences (Craig & Harding, 1985; Daniels & Kahle, 1987; Granstam & Frostfeldt, 1990, Lie, 1983; Ravina & Rom, 1989; Rennie, Parker & Hildebrand, 1991). *The GEN*, a national gender equity newsletter in Australia (DEET, 1990-1996) was established to air central gender issues in education, home, and work. There were also issues and concerns related to the education of talented girls in Australia (C. Young, 1988), despite the earlier development of successful extension programs in Australia (eg, Genoni, 1986; Jones & Newhouse, 1984; L. P. Newhouse & Washbourne, 1991) and the stress on the importance of mentors (Nash & Treffinger, 1986). There were renewed moves to focus on the culture of the disadvantaged (Sharp, 1980) and to create socially critical schools (Connell, 1990a; Jones, 1990; Kemmis, Cole & Suggett, 1983; McConnochie, Hollingworth, & Pettman, 1988; Short, 1992). Feminist literature reviews about the need for a caring ideology to undergird scientific research, to complement the masculine construction of prestigious knowledge (Fox Keller, 1987;

Noble, 1990), and to include women's knowledge and ways of knowing (Burfitt, 1988; Bushaw, 1991; Mares, 1989) were being addressed at the curriculum level (Beruldson, 1989; Brook, 1991; Cross, 1989; Hildebrand, 1989; Peck & Dick, 1989; Stocklmayer, 1989). In addition, the extent of the institutionalisation of boys' aggression in the high school (Askew, 1989; House of Representatives Standing Committee on Employment, Education and Training, 1994), the socialisation of boys (Askew & Ross, 1988), abuse of girls (Noble, 1987; Robertson, 1993) and conditions for change (Gewirtz, 1991; Grimsley, 1979) had become the focus of action research worldwide. A conference on "dismantling the divide" promoted a systemic life-span approach to promote equity of access, participation, retention and excellence in outcomes for non-traditional girls and women in male-dominated occupations at each life-stage (DEET, 1991, June).

Towards Gender-Inclusive Curricula in Australian High School Classrooms

The "catch-cry" was "women teaching for change" (Weiler, 1988) and a call for new directions in women's "action for equity" in non-traditional fields (Rennie, Parker & Hildebrand, 1991) with vigilance in ensuring the continuance of affirmative action and social justice (Sawer, 1985, 1990; Yates, 1988, 1992). The action research on countering the effects of intra-personal constraints on girls' achievements and femininity was prolific (DEET, 1992b, 1992c; Kenway & Willis, 1990; Lees, 1986; Linn, 1986; Linn & Hyde, 1989; Parker & Offer, 1987. 1989; Pettman, 1992; Poole & Lowe; Poole & Beswick, 1989; Willis, 1989). Research also focussed on the mismatch of girls' interests, preferred learning styles and ways of knowing which affected their participation and levels of achievement and creativity in non-traditional subject areas (Beyer, 1991; Beruldson, 1989; Doenau, 1987; Hildebrand, 1989; Issacs, 1987; Peck & Dick, 1989; Sjoberg, 1989; Staberg, 1991; Stocklmayer, 1989). Issues were raised about equity and technology (Sanders, 1989; Secada, 1989), the way computers were transforming schooling (Papert, 1993), and girls' lack of passion for "tinkering and technology" in contrast to boys (McIlwee & Robinson, 1992, p. 26). Overseas researchers were particularly concerned that computer skills tended to be taught predominantly by male teachers, often within the domain of mathematics (Burton, 1986; EOC, 1984; Evans & Hall, 1988; Walkerdine, 1989, 1990; Whyte, 1986). This

association reinforced computing as a "masculine" domain of expertise, with the potential for girls to doubt their self-efficacy in this subject (V. M. Johnston, 1988; Kelly, 1985; Rose, 1986; Turkle, 1988; Turkle & Seymour, 1990). In response, changes were introduced through girl-friendly and gender sensitive mathematics and science (Gianello, 1988; Gillbert, 1993) by promoting girls' involvement in design and technology (Egan, 1992; Groves, 1989; S. Morgan, 1988; Rogers, 1993) and dispelling myths about girls and computers by transforming computer education (Clarke, 1990a, 1990b; S. Morgan, 1988; Sherwin, 1992). This lead to a systemic and systematic approach to developing a gender inclusive curriculum (eg, Hildebrand, 1989), which was defined by Australian teachers as:

> Curriculum which in its content, language and methods gives as much value and validity to the knowledge and experiences of girls and women as it gives to boys and men (Australian Science Teachers Association, 1987, p. 19).

Such reflections resulted in a crucial change in focus from "girls' education" *per se* to the effect of cultural "gendered" expectations on the structural organisation of secondary schools; the construction of curricula and knowledge; and the cultural milieu of social relations in classrooms. In response to technology and change, and as a way of broadening women's career options in Australia (eg, D. Morgan, 1988), researchers advocated the promotion of compulsory mathematics and science for girls (Barnes, 1988, 1989; Parker & Offer, 1987, 1989) and a compulsory first year in design and technology in state high schools in Western Australia (eg, L. P. Newhouse, 1990). The need for Australian girls to acquire computer competencies was now accepted as the "latest critical filter" (Spender, Personal Communication, 1989), especially for successful problem-solving outcomes and effective participation in non-traditional occupations (Clarke, 1990b; Crawford, Groundwater-Smith & Milan, 1990; Towns, 1985). Computers were also being promoted as a vital prosthetic arm for creativity (Hattie, 1987; Hattie & Fitzgerald, 1988; Papert, 1993). Researchers were promoting gender inclusive communication and resources in science and technology (Rennie & Mottier, 1989) and extending this concern to computer software (Le Souef, 1990; Miura, 1986, April; Smith & Keep, 1986). There was also action research regarding gender fairness in science assessment (Rennie & Parker, 1992).

Cultural Milieux of Australian High School Classrooms

At the classroom level, there was concern about the behaviour of boys towards girls, and male teachers towards women and girls, in Australia (DEET, 1992b; Murphy & Murphy, 1990; Spender & Sarah, 1988). This situation was exacerbated by the deep-seated belief in Australia that "success was male" (DEET, 1991 March). There was a strong move to "conscientise" teachers to the hidden curriculum of such milieux and the effects of their own aspirations, expectations and differential valuing of girls and boys on the quality of learning, construction of identity and self esteem of girls (Gilbert & Taylor, 1991; Lewis & Davies, 1988; Kenway & Willis, 1990). Debate about the improved achievements of girls in single-sex schools (Carpenter, 1985; Kenway & Willis, 1986) and single sex science classes for girls in coeducational schools continued throughout the 1980's and 1990's (eg, J. Jones, 1990; Spender & Sarah, 1988).

Career Guidance for Adolescent Girls - Professional or a Social Model?

Career education for bright women focussed on creating options and identifying antecedents that would enhance their life-choices and life-satisfactions (Fleming & Hollinger, 1979; Hollinger & Fleming, 1988, 1992) unencumbered by gender stereotypes (Jacobs & Weisz, 1994). There was also a bid to understand the reciprocal interaction of work and non-work in vocational development (Swanson, 1992).

<u>Why Choose to be an Engineer?</u>

Overseas research indicated that key academic qualifications of girls entering university to become engineers included a love of, and ability in, mathematics and physics, a practical bent, and the capacity for creative teamwork (V. Anderson, 1992; Carter & Kirkup, 1990b; Evetts, 1993; Godfrey, 1991; Hackett, 1985; McIlwee & Robinson, 1992; Newton, 1987; Thomas, 1990). Like Astin (1984), women educators in Australia and overseas were actively connecting girls to "marketable skills" and "critical filter" subjects (eg, Spender & Sarah, 1988) needed to access education for prestigious professions. Life-histories of women in engineering confirmed that women's positive resolution of tasks in relation to academic achievements, interest development, and occupational choice was aided by "key figures", including mothers, fathers, siblings,

other family members, and friends, as well as career counsellors and teachers (Carter & Kirkup, 1990; Evetts, 1993; Godfrey, 1991; McIlwee & Robinson, 1992). Fathers of women engineers had at the very least created an "awareness" of engineering as a possible career (McIlwee & Robinson, 1992), although some fathers felt it "was not quite what they wished" for their daughters (Carter & Kirkup, 1990b, p. 40). Mothers were generally remembered as responsible and independent, and valued as good role models of competence in their chosen career-pathway, though their influence was more indirect than fathers (V. Anderson, 1992; Carter & Kirkup, 1990b; Clark, 1992; Evetts, 1993; McIlwee & Robinson, 1992). Australian researchers (Dweck & Elliott, 1983; Poole & Low 1985) had linked parental influence more specifically to girls' occupational aspirations, expectancy factors and positive attributional factors in achievement motivation.

Summary: Traits, Trends, and Gaps in Generalised Other Subjective Past Career

In terms of Research Question 1, there were positive changes in the gender order in Australia in terms of policies related to equality of opportunity and affirmative action. Australian women were finding a public voice, which was reflected in their prolific writing about their world views and the need for social justice and equity with men. Gender relations within the families of gifted and non-traditional girls were characterised by changing career patterns of mothers and equitable child rearing patterns with a focus on developing individual potential and interest areas. Kindergarten was becoming a key event in children's lives with a focus on gender equity research, where the lack of value of girls by boys was a growing concern in Australia. There were progressive trends in schools to dismantle the gender divide in terms of monitoring policies in action and for action, transforming curricula, changing the cultural milieu of classrooms and monitoring the structural organisation. In the high school context, findings from the literature on the exploration stages of non-traditional girls highlighted a number of personal determinants needed for the engineering profession. Educators were also creating opportunities for girls in high school to achieve in non-traditional subjects and make sound career decisions about pursuing prestigious occupations. There was evidence of positive change in girls' intra-personal determinants, (eg,

assertiveness, valuing the feminine, high aspirations), effected by the intervention of older women. Notwithstanding, the persistence of girls' negative intra-personal determinants to adulthood suggested that some gender regimes in education were not well-disposed to their special needs, values and interests. What was missing was a subjective concrete other perspective to tell the story of past career in another way — in other words, qualitative evidence of Australian non-traditional women's actual experiences of growing up during this historical period.

In this regard, it was apparent to me that the early personality and interest development of women in engineering in their family of origin and kindergarten with parents, siblings, teachers and peers was worthy of investigation. Similarly, with the climate of change in adapting curricula and cultural milieux in primary schools, the women's memories of teachers and favourite subjects would provide me with information in relation to identity formation as "feminine ambivalents" (Douvan & Adelson, 1966).

In investigating whether they were "pavers of the way" in their attainment of personal and vocational identity (Josselson, 1987), I sought to understand the reciprocal interaction of work and leisure and how, with whom, and where, vocational and avocational interests, values, achievements, aspirations and expectations developed over time.

With reference to successes in the high school context, I wanted to ascertain how effectively the women were prepared for engineering in terms of technical drawing, computing and industrial arts; their ability to make wise, high status subject areas choices and achieve confidently and well. As an educator, I was also interested in their involvement in the creative arts and the development of special interests in school that might relate to their vocation and for leisure.

In view of the different models of vocational guidance emerging from the literature review on high schools, I was also interested in women's experiences in relation to the structural organisation (eg, coeducational and single-sex) and the cultural milieux

created by teachers and peers in limiting or nurturing their vocational identity, occupational choice, and career transition to engineering. At the same time, I wanted to investigate how out-of-school activities with family, friends, the community, and possibly part-time work prepared them for engineering and other adult roles. Because of the variety of vocational guidance preferences, I considered that it was important to ask why women wanted to become engineers and what type of career guidance they preferred. I constructed this alternative perspective as the concrete other subjective career (see Chapter Six). The fact that professors of engineering would become future "anchors" in the women's identity attainment (Josselson, 1987), also prompted me to seek their perspective on the past career of women students, which I constructed as the concrete other organisational career (see Chapter Five).

WOMEN'S PRESENT CAREER IN ENGINEERING EDUCATION: GENDER ORDER AND REGIMES IN THE 1990'S

Climbing The Organisational Ladder Model of Life-Career in the Early 1990's

As this group of well-qualified young women progressed along the life-career rainbow (V. Anderson, 1992; Carter & Kirkup, 1990b; Evetts, 1993; Godfrey, 1991; Hackett, 1985; McIlwee & Robinson, 1992; Newton, 1987; Thomas, 1990), their life-roles expanded to include a new vocational role and professional relations in engineering education. Josselson (1987) found that early professional affiliations were critical to the "individuation" aspect of women's identity attainment in Super's (1990) "spider webs" of interaction in higher education. Guided by Research Question 2, and using my combined archway model (Figure, 2.3), I analysed the literature to construct the subjective generalised other "present career" perspective of women in engineering education:

> **RQ2. What events in the day-to-day interaction in the Engineering Degree course are critical to the development of women's personal and professional identities and competencies as engineering students? ("Present Career") [linked to Jaggar/Super's propositions 1-14].**

Remote Situational Determinants - Policies and Practices in Higher Education

Levers of change begin with legislation (Randall, 1987, p. 20)

In Australia, there have been a plethora of reports since the early 1980's focussing on social policies related to affirmative action and equal opportunity for women and ways to effect real change (Department of Prime Minister & Cabinet, Office of the Status of Women, 1984, 1985a, 1985b; Porter, 1986; Randall, 1987; Sawer, 1984). Politically and legally, women were designated as a special group in post-compulsory education (Finn, 1991; Towns, 1985), in higher education (Commonwealth of Australia, 1987; Commonwealth Tertiary Education Commission, 1986; DEET, 1990, 1991; Department of Prime Minister & Cabinet, 1992, 1993; House of Representatives Standing Committee on Legal and Constitutional Affairs, 1992), and in engineering education (Williams, 1988). There were also reports on promoting "education for excellence" in higher education (Business/Higher Education Round Table, 1992; DEET, 1990a, 1990b; Higher Education Council, 1992; Kingstin, 1990; National Board of Employment, Education and Training, 1990) and in engineering education (Caldwell, Johnson & Anderson, 1994; Institution of Engineers, Australia, 1991).

Feminist reviews focussing on higher education highlighted the lack of progress in reducing the gender gap for women (Allen, 1990, 1994; Bacchi, 1993; McNamee, 1993; Wheelahan & Knowles, 1993). As a result, women set an agenda for the decade (Byrne, 1994, 1993; Hegarty-Hazel, 1990; Jones & Davies, 1990; Porter, 1991; Summers, 1990; DEET, 1991, June) and equity initiatives were monitored (Arnot & Weiler, 1993; Cobbin & Barlow, 1993; Haggerty & Holmes 1994; Stiver Lie, Malik & Harris, 1994; Wall & Anderson, 1993).

Engineering as an Occupation for Women - Lack of "Critical Mass" 1990's

In the late 1980's and early 1990's the gender imbalance in engineering confirmed that it was still a non-traditional profession for women in Western societies (Bielski, 1989; Byrne, 1985; Carter & Kirkup, 1990; Cobbin, 1995; Donald, 1991; Ehrhart & Sandler, 1987). C. Newhouse (1989) noted that engineering courses in his institution comprised 10% women, with a higher percentage (35%) in Chemical engineering. Lewis and

Harris (1995) summarised the 1994 data for women's choice of, and participation in, the various disciplines of engineering education in Australia. Engineering, with 4.6% of women in 1983 and 13.1% in 1994, continued to have the lowest share of women of all female enrolments in higher education (p. 2). Chemical engineering, the most popular choice, rose from 22.1 per cent in 1983 to 31.9 per cent in 1994; with Civil engineering rising from 8.3 per cent to 13. 4 per cent. These figures for Civil and Chemical may have included figures for 'environmental engineering' (p. 4) which, as a relatively new departure did not yet have a separate classification. Electrical/Electronic, (with a rise from 5.9 percent to 9.1 per cent), and Mechanical engineering (with a rise from 4.2 per cent to 7.2%) showed the lowest female enrolment figures, along with Marine engineering. Percentages for women's progression in engineering education showed that those in bachelor degree courses rose from 9.2% in 1989 to 13.4% in 1994. Similarly in the same period, those women pursuing Masters degrees rose from 8.6% to 12.3% and the doctoral students rose from 9.1% to 13.2%.

These trends were also evident in other Western countries (Carter & Kirkup, 1990; McIlwee, & Robinson, 1992; Morgan, 1992; National Science Foundation, 1992; Oakes, 1990). Armstrong and Godfrey (1994) noted that the plateaux, and "in some cases decline" in the 1990's was despite a number of "well funded initiatives aimed at redressing the perceived future shortage of engineers" generally, without a loss in potential quality and for gender equity reasons (p. 59). For example, coordinators for Women in Science and Engineering (WISE) programs in Australian and New Zealand universities had been funded and established for several years. In earlier discussions, with Lewis (Personal communication, December 1994) she expressed the view that WISE coordinators' apparent lack of efficacy in achieving access and retention of women students in engineering education in Australasia was in part due to women coordinators not being members of an engineering faculty. Hence, she felt they lacked power at the margins of the masculine structural organisation to effect real changes for women students.

Women in Academe and Structural Organisation of Australian Engineering

In 1991, in Australia, the attrition rate of graduate women from the engineering profession soon after recruitment was alarming, according to the convener of the Victorian Women in Engineering branch of the Institution of Engineers (Donald, 1991). There were only about 1500 women among the estimated 95,000 practising engineers in Australia, which confirmed a huge gender gap in the profession. The percentages of female academic staff currently holding positions in Engineering/Processing in Australia was 18% for tenured staff and 27% for untenured staff, with only 3% holding positions above senior lecturer in tenured positions and 4.7% in untenured positions (Department of Employment, Education and Training, 1993, Table 7. 10). The continuing low numbers of women at each level in "organisational career" of engineering education and positions in academe and the work-place was indeed a dilemma for women and the profession. These figures affirmed the continuing male-dominated hegemonic nature of the structural organisation of engineering in academe and the professional work-place.

Personal Determinants of Non-Traditional Women Students in 1990's

With reference to earlier discussion on three personal constraints that might serve to alienate women in higher education, I predicted from past career findings that these well-qualified women entering engineering education would more likely be affected by the inhibiting ideology of "superior masculinity", in the public sphere of education and work (Carter & Kirkup, 1990a, 1990b; McIlwee & Robinson, 1989) and the internalisation of the "feminine/cleverness" dichotomy (Beck, 1989; Ellis & Willinsky, 1990; Kerr, 1988; Reis, 1987), than by negative effects of "slavish" domestic ideology (Josselson, 1987). In engineering, McIlwee & Robinson (1992) found that when no account was taken of their need to learn to become "tinkerers" like their male peers, the lack of development of technical abilities began to "let them down" (p. 49). Research by Turkle (1988), Turkle and Seymour Papert (1990) and Griffiths (1988) indicated that women have strong feelings and reticence towards the "intimate machine". In both instances, women experienced lack of confidence, insecurity, and low self-efficacy. Internalisation of similar experiences has been found to exacerbate women students'

under-achievement (K.R. Kelly, 1993; Lent & Hackett, 1987, 1994; Reis, 1995a, 1995b; Thomas, 1990).

Career development researchers have focussed on the importance of coping strategies in stressful educational and occupational contexts (eg, Folkman, Lazarus, Gruen, & DeLongis, 1986; Osipow, & Davies, 1988; Parkes, 1986; Paterson & McCubbin, 1987). Feminists too have emphasised the need to investigate women's coping strategies when facing barriers in higher education, especially in non-traditional subjects (Hegarty-Hazel, 1991; Kvande, 1987; Thomas, 1990; Wolffensperger, 1993). In understanding women's decision-making and why some able women choose to withdraw, these researchers have been able to change adverse conditions for learning.

On the positive side, Zinberg (1994) identified personality characteristics of perseverance and courage in young women students in engineering. Ellermann and Johnston (1988) found in the United States that non-traditional college women were significantly less committed to a home and family in their future aspirations than those pursuing traditional careers. There were some contradictions in women's preferred learning styles. Foster (1989) found that women favoured a constructivist approach to learning, facilitated "where possible [by] setting one's own learning agenda by negotiation"; and through "group work featuring cooperation, sharing negotiation, trust, consensus, acceptance of difference and opportunity to speak freely"; with the "sharing of information, knowledge and skills" (p. 34). Lemkau's (1979) findings, however, suggested that the preferred learning style of non-traditional women was more oriented towards ideas and things and less to the social environment than other women. Both descriptions were reminiscent of the characteristics of Douvan & Adelson's (1966) "ambivalents", I alluded to earlier in the chapter.

Judging from these research findings on the personal determinants of career for women in "non-traditional" areas of study, I concluded that they were more likely to display two of the four career pathways on Josselson's (1987) continuum, initially discussed in Chapter One. They could be "pavers of the way" or identity achievements, who showed a balance between "agency and communion" (p. 171) and achieve identity by healthily

connecting to a "new anchor" (p. 175). Alternatively, they could be "moratoriums" or "daughters of crisis", who are full of contradictions, continue to be "alive to inner conflict" (p. 139), and lack "supportive others" to help them to "consolidate an independent identity" (p. 138). Even the existence of university women's narrower range of "faulty" and healthy choices in finding self and attaining identity would support Super's standpoint that they require intense exploration, characterised by extra "mini-cycles", to effect "career maturity" or success within each life-career stage as they work through inner conflict, vulnerability, and at times confusion in chilly "life-spaces".

The Curriculum In Engineering Education and Conditions for Change

Hindrances to Women Students and their Construction of Knowledge

> Central to the social construction of the engineer is the polarity between science and sensuality, the hard and the soft, things and people ... Engineering seems to be the epitome of cool reason, the antithesis of feeling. Judy Wajcman (1991)

Women researchers world-wide have challenged the taken-for-granted tradition in universities and have monitored barriers that have affected and continue to affect women students intellectually and emotionally, especially in North America (Anderson, 1992; Hall & Sandler, 1982, 1984; National Science Foundation, 1992; Pascarella & Terenzini, 1991; Sandler & Hall, 1986; Ware & Lee, 1988). Clusters of hindrances to women's progress in traditionally male areas in university have been identified from a number of studies (Kvande, 1984, 1986,1987; Western European Education, 1982; Wilson & Boldizar, 1990; Wolffensperger, 1993; Wolfe & Betz, 1981), including several particularly compelling narrative inquiries in engineering (eg, Anderson, 1992; Carter & Kirkup, 1990b; Evetts, 1993; McIlwee & Robinson, 1992). The disabling effects on the learning process and creativity of women in higher education curricula is well documented (eg, Reis & Callahan, 1989) especially in the "hard" sciences, like physics (Perrucci, 1984; Thomas, 1990) and engineering, when conceptualised as "applied science" (Benckert & Staberg, 1993; Papa, 1991). Researchers have identified the inappropriateness of conditions for women in mixed universities (Carter & Kirkup, 1990; Godfrey, 1991; Lewis, 1993; Robinson & Reilly, 1993; Thomas, 1990; Tobias,

1990), and in America have compared these conditions unfavourably to those created in single-sex institutions (Tidball, 1989).

The Challenge of Male Academics' Resistance to Change in Universities

A number of feminist researchers found male academics' active resistance to change posed a huge problem to transforming tertiary curricula (Aiken, Anderson, Dinnerstein, Lensink, & MacCorquodale, 1987; Andersen, 1987; Benckert & Staberg, 1993; Faludi, 1992; Kyle, 1989). Benckert & Staberg (1993) had found male scientists and engineers, in general "completely unaware or worse hostile to other perspectives" (p. 875). Researchers challenged the men's taken-for-granted normative view on the nature of the construction of curricula, knowledge disciplines, and research methodologies as rational, objective and value free (Andersen, 1987, p. 254). This was especially so where research was strongly influenced by political and economic value systems. There was also a challenge to men's taken-for-granted perception of self as people, researchers and teachers (Aiken et al. 1987, p. 270). Problematic too, was their view of women in engineering, technoscience and technology as taking "supporting roles" (eg, Standish, 1982) and for academe failing to acknowledge the contributions and giftedness of women in research and industry (eg, Rose, 1994).

Professional women and researchers in engineering and science have been prepared to get in touch with their own femininity, and to interrogate the nature of masculinity and femininity in the construction of knowledge about self, knowledge and the world (Bickart, 1991; Bielski, 1989; Carter & Kirkup, 1990; Kock, 1990; McIlwee & Robinson, 1992). Australian men in the field of sport have been encouraged to look at the role of hegemonic masculinity and the taken–for–granted assumption of its normality in social relations and the conduct of one's private and professional life (Connell, 1990b, 1987; Connell, Radican & Martin, 1987), and similarly men students in teacher education (L. P. Newhouse & Cullen, 1994).

Wall and Anderson (1993) strongly advocated the education of men in the area of equity to reduce the multiplicity of biases against women in the engineering. Building on

Palmer (1987), Claxton and Murrell's (1987) argument, commensurate with my own socialist feminist stand-point, was that, in universities, the dominant epistemology and objectivism, with its emphasis on detachment and analysis, was anticommunal. Like Belenky et al (1986) and Palmer (1986), they argued the need for an alternative more intuitive, and a more subjective way of knowing. Belenky et al (1986) had found that a collaborative approach to learning had helped their women participants to gain both epistemological truth and collegiality. However, there was consensus that both separate knowing and connected knowing needed to be "honoured" in the university, where faculty should help students deal with the "creative tension when the two are used in tandem" (Claxton and Murrell, 1987, p. 75).

Feminist Challenges and Gender Inclusivity of Curriculum in Engineering

Most feminist researchers in engineering, technology and science have challenged the perception of women as deficit in regard to their aptitudes. Kenway (1990) was pessimistic about Australian policy makers' "orthodox and simplistic view of women's position in the labour market" that had failed to take account of the merits of socialist feminist theories (p. 22). She believed that masculine principles for change were based on "human capital theory" and implied that gender-segregated labour markets arose from "women's and girls' lack of credentials and their inappropriate attitudes", which could then be simplistically remedied at the level of women's and girls' "attitude change and skill formation" within formal curriculum offerings (p. 69).

Women educators have been more concerned with focussing on ways of retaining and enriching the growth and confidence of women through addressing special needs and values, then changing the *conditions* of the curriculum (eg, Anderson, 1992; Armstrong & Godfrey, 1994; American Society for Engineering Education (ASEE), 1987; Brook, 1991; Brush, 1991; Byrne, 1991; Carter, 1991; Carter & Kirkup, 1990b; Daniels, 1991; Desrochers, Henderson & McDonald, 1993; Kvande, 1987; Kolmos, 1990, 1991; Matyas, 1987; Mitchell, 1993; Rothschild, 1988; Stonyer, 1991). Creating a national and international effort by benchmarking and reporting progress has become a vital aspect of their evaluation process (Committee on Women in Science, Engineering &

Technology (Great Britain), 1994; Carter, 1994; Daniels, 1991; Frize, 1993; DEET, 1991, June) to create "policy for action" (Kenway, 1990) in transforming the curriculum and professional practice towards gender inclusivity.

A Contradiction in Values in the Construction of Engineering and Engineers

> Epistemological inequality surely has destructive effects on the students of a field. How difficult it is for any group to be seen as the equals of others, or even see themselves as such, when they are not accorded equality in knowledge itself (Martin, 1985. p. 26).

A particular focus pertinent to the present study is the feminist challenge regarding the masculine construction of science (Bleier, 1986, 1989; Fox Keller, 1987; Harding, 1986, 1991; Kelly, 1985) and the late 19th century concept of engineering as evolving from science, rather than a craft (Benckert & Staberg, 1993; Bickart, 1991; Bielski, 1989; Dunlop, 1991; Kock, 1990; Rothschild, 1988; Wajcman, 1991; Willoughby & Carter, 1993). Benckert and Staberg (1993) argued that engineering, in contrast to science, "cuts across the boundaries between physical and intellectual work while science is purely analytical and rational" (p. 876). Such a conception, driven by masculinist science's inherent reductionist methodology is seen to affect the construction of engineering knowledge, practices and ways of knowing. There is a view that the "engineer" has been similarly and erroneously built on scientific polarities related to "cool" reason in opposition to feelings (Wajcman, 1991).

In consequence, Kock (1990) concluded that the current paradigm of engineering education required a transformed ideology and value system, with the integration of the feminine ideology and 'ethic of caring' and connectedness (French, 1986; Gilligan, 1982; Noddings, 1984). Kock (1990), like Foster (1989), utilised Schuster and van Dyne's (1984, November) six stages of curriculum transformation in her review of engineering curricula (p. 28). Foster (1989) acknowledged that curricula generally in Australian universities were at Stage three, where women were recognised as a "disadvantaged group" (p. 29), though with a rise in the inclusion of women's studies at university (eg, Mares, 1989). Kock (1990), supported by benchmarks for each stage analysis, was more pessimistic about this degree of inclusiveness in engineering curricula world-wide. Siraz-Blatchford (1993) emphasised the need for both gender and race to become the

central organising constructs of tertiary curriculum to effect real transformations. Kock (1990) made an impassioned plea for men in engineering education to recognise that:

> feminist awareness is not a question of preferring women to men, but a question of listening to the feminine part of all human beings and all conceptions" not only to try to "overcome the current imbalance", but to bear in mind that "technology is powerful and must be used sensibly" for the preservation of humankind and the environment (p. 291).

Gender Inclusive Content in Engineering Education

The investigation of Engineering courses in Western countries has also revealed the lack of inclusion of women's historical contributions to science and engineering (Alic, 1986; Asimov, 1991; Burfitt, 1988; Burton, 1986; Kirkup & Keller, 1992; Spender, 1982b; Standish, 1982; Vare & Ptacek, nd). Some, like Benckert & Staberg (1993) conceded that "texts by Harding, Bleier, Fox Keller, Rothschild are read ... but we have to widen the group ... they must be spread to engineering and science students" (p 875). They argued for the inclusion of, in engineering and science courses, units on the social construction of technology and the effects on human lives and systems (Benckert & Staberg, 1993; Department of Employment, Education & Training (DEET), 1992; Keise, 1992; Jaffe, 1992; Robertson, 1993; Rose, 1994).

Gender Sensitive Curriculum and Women's Preferred Ways of Learning

More overt "immediate" situational determinants have been identified that exacerbate under-achievement and women's attitudes to self as learner, to learning and work-related tasks in the university context. Bickart (1991) highlighted faculty's apparent lack of understanding of the diversity of valuable characteristics and abilities in their students, the lack of supportive services, and failure to emphasise the creative and humanistic dimensions of engineering. Research has increasingly focussed on the perceived mismatch of teaching/management styles and women's learning styles (Anderson, 1991; Beyer, 1991; Felder & Silverman, 1988); and women's preferred ways of "connected knowing" in the construction of knowledge in tertiary education generally (Belenky et al, 1986; Baxter Magolda, 1992; Foster, 1989; Thomas, 1990); and in engineering (Anderson, 1992; Carter & Kirkup, 1990; Evetts, 1993; Hall & Sandler, 1982; Kock,

1990; Scholer, 1993). Given that I had found a contradiction regarding non-traditional women's use of both masculine learning styles (Lemkau, 1979) and feminine learning styles (Foster, (1989), I considered that getting academics and students to discover their own learning style was an important, non-threatening way to engage them in the change process especially where there was resistance to gender equity issues. This equated well with Thomas (1990) and Claxton & Murrell (1987) stance on effecting change in university settings.

Gender Inclusive Curriculum - Changing the Curriculum Organisation

Lewis & Roberts (1994) concluded that "curriculum strategies for intervening and changing this culture were urgently needed" (p. 673). In response, gender inclusive curricula have been formulated by female academics in the field (Armstrong & Godfrey, 1994; Boman & Yasukawa, 1994; Carter, 1994; Cukler, 1993; Lewis, Chapman & Arnott, 1992). Researchers were especially concerned that first year or foundation courses, based on the theory-precedes-practice model, were failing to help women (and men) to make connections with the real world of engineering, within the gender regimes of faculties (eg, Anderson, 1992; Godfrey, 1991; Kolmos, 1991; Meikle, 1989; Rothschild, 1988; Stonyer, 1991). Anderson (1992) found that if her women participants survived these early years, then practical projects of special interest, mentoring by their professors, and informal small group learning restored feelings of self-confidence.

The Cultural Milieu of Engineering Education - Feminist Research

Jaggar's Alienation Concept and Being Positioned as Stranger

> If we are serious about including women in (the) profession, then factors that make the masculine culture alien to women need to be addressed (Boman and Lewis, 1994, p. 470).

There was strong evidence from feminist research of women students being constituted as the "stranger" (Pallotta Chiarolli, 1990) in the chilly cultural climate of engineering education by both male students and by lecturers (Anderson, 1992; Brush, 1992; Carter & Kirkup, 1990b: Erhhart & Sandler, 1987; Hacker, 1981, 1983, 1989; Lewis, 1995; McIlwee & Robinson, 1992; Willoughby & Carter, 1993). In this climate, women were

seen as grappling to interpret the new social context, through, as Schutz (1964) expressed, "a continuous process of inquiry into the cultural pattern of the approached group", with the need to orient [herself] within it or remain "marginal [wo]man" (p. 37). Anderson (1992) noted what an inordinate amount of energy was being dissipated by women in engineering education in satisfying, what Tauber (1990) differentiated as, "deficiency" needs to belong and be valued by others, limiting their energy for satisfying "growth" needs in constructing knowledge about engineering and themselves as engineers. Anderson (1992) found her students' "silence" and lack of recognition that "individual problems were shared problems for which solutions may be found", prevented them from serving "as agents of change in their engineering programs" (p. 37). Suggestions and group exercises from a feminist perspective have been developed to help conscientise faculty, administrators and students to the issue and for each to redress the chilly climate for women students in engineering and science (eg, Rosser, 1995; Sandler & Hall, 1986).

There was also research evidence of more overt and deliberate sexual and gender harassment of women, which characterised the nature of the structural organisation and cultural milieu in higher education, and was exacerbated by racial and social class discrimination (Blair & Maylor, 1993; Campling, 1989; Davies, 1989b; Flintoff, 1993; McConnochie, Hollingworth & Pettman 1988; Siraj-Blatchford, 1993). Such behaviour has been shown to be particularly prevalent for women students in the non-traditional contexts of engineering and science (Anderson, 1992; Armstrong & Godfrey, 1994; Byrne, 1993, 1994; Carter & Kirkup, 1990b; DEET, 1990 November/December; Kvande, 1987; Lewis, 1995; McIlwee & Robinson, 1992; Wolffensperger, 1993); and extended to women faculty members and postgraduate students (Allen, 1990; Armstrong, 1991; Atkinson & Delamont, 1990; Delamont, 1987, 1989; Sandler & Hall, 1986; Zinberg, 1994).

As a necessary first step in investigating and combating discriminatory behaviour in Australian faculties of engineering, the concept of "gender harassment" has been named

and broadened by the Women in Science, Engineering and Technology Advisory Group, Commonwealth of Australia, (1995). Such behaviours expressed:

> ownership of the terrain and solidarity between the boys and men, who enact it" and had a "negative, exclusionary and undermining impact on the women ... who experience these interactions in the context of tertiary institutions and the work-place (p. 14).

Another strategy, from the career development perspective, was the "idea of a mentor, patron or rabbi for women" to facilitate their career decision-making and to foster vocational aspirations (Herr & Cramer, 1992, p. 247). Mentors who provided a trustworthy anchor helped younger women to achieve identity more successfully (Josselson, 1987). If mentors also capitalised on women's strengths and interests (Lambert & Lambert, 1985; Josselson, 1987), it was found that women's academic achievements and creativity were enhanced (Daniels, Heath & Ennis, 1985). Women's inter-personal and communication skills, confidence in career decision-making and life-long friendships, were fostered especially through experiential learning (Anderson, 1992; Beck, 1989; Bolton, 1980; Grau, 1985; Lambert & Lambert, 1982; Moore, 1982; Shamanoff, 1985). Hackett, Esposito and O'Halloran (1989) confirmed that these models need not necessarily be female, though Beck's (1989) research suggested female mentors provided the "additional benefits" by women also serving as successful role models. Byrne (1989) advocated, because of the current lack of women in Australian academe, that policy mechanisms be put in place to promote mentorship, rather than role-modelling, in engineering education. Cesari (1985) advocated intra-personal counselling to help young women professionals in higher education to take control of their own vocational socialisation. Emms & Kirkup (1993) set up a mentoring scheme to help first years in non-traditional areas make the transition from high school to university. Beck (1989) raised the vexed question of "cross-gender" mentoring, where "sexual attraction and rumours of romantic involvement are frequently mentioned as risks" (p. 23).

Need of Women for Leisure for Healthy Career Development

An issue for career development researchers, feminists and gifted education researchers was the role of the "leisurite" (Super, 1990) and the paucity of the pursuit of leisure in women's lives, their need for a more adequate balancing of work and leisure for

emotional health, and for the enhancement of creativity and passion in one's vocational life-work (Bordin, 1994; Ellis & Willinsky, 1992; Hesketh, Elmslie, & Kaldor, 1990; Henderson, 1990; Newson & Newson, 1976; Sears & Barbee, 1977; Maccoby & Jacklin, 1974; McDaniels & Gysbers, 1992; Reis, 1987). McDaniels and Gysbers (1992) emphasised that "a premium should be put on gender equity programs and practices that really get results" where "numerous sources provide plenty of ideas for creative efforts" to ensure optimal career development for girls and women over the life-span (p. 281).

Summary: Trends, Traits and Gaps in Generalised Other Present Career

In terms of Research Question 2, I identified personal and situational determinants from the present "generalised other" subjective career perspective presented in this chapter. There were some contradictions in personal career determinants which required further investigation. I also found inadequacies in the engineering curriculum, cultural milieux and structural organisation in catering for women's needs, interests and values. Feminists and career developmentalists have identified ways to transform and alleviate the conditions endured by women in engineering. I noted that there was a greater chance of change if both the women and their professors were prepared to adapt (Claxton & Murrell, 1987; Thomas, 1990). Building on research presented in this chapter, I made a decision to focus in depth on the issues related to their perspectives on:

Firstly, how women's learning needs, values, special interests, aspirations, "fear" and reticence with computers, and learning styles were being catered for within the formal curriculum and informally at each year level. I also looked for evidence of mentoring, effective teaching and management styles, learning practices, and career counselling at each year level to the women's transition to work.

Secondly, how the structural organisation and the lack of critical mass of women in engineering education impacted on women students' academic lives and work experience. For example, I was interested in lecturers' and male peers' awareness and appreciation of women's strengths and how they had facilitated women's transition and acceptance in engineering education. In parallel, I investigated the recruitment of

female academics, and the degree of freedom given to WISE coordinators, to accommodate the inclusion of women students in terms of their access, participation and retention.

Thirdly, the engineering curricula and the professors' awareness of feminist literature reviews of the construction of knowledge, and the values the women participants brought to, and developed in, engineering education. For example, ways that the interaction of men and women might have changed the construction of engineer and engineering, and whether there was any transformation in the undergirding values of the engineering curricula. I encouraged both professors and women to discover their learning style in a effort to engage both in "adapting" to effect change (Claxton & Murrell, 1987; Thomas, 1990).

Fourthly, the cultural milieu and the chilly climate for women with the potential for gender and sexual harassment; and ways professors and women students might have acknowledged the adverse conditions faced by women in universities by adapting and changing. I encouraged women to list their coping strategies and to monitor how effective they were in adapting to the culture of engineering and the behaviour of "superiors" and "fellows".

Finally, given the need for leisure for the construction of healthy life-careers and identities, I investigated its relevance in women students' lives at this life-career stage.

WOMEN'S FUTURE CAREER IN ENGINEERING AND SCIENCE: GENDER ORDER AND REGIMES (LATE 1960'S-1990'S)

Subjective "Future Career" in Super's Establishment and Maintenance Stages

Moving along the life-career rainbow, non-traditional women make the transition to the establishment and maintenance life-career stages (Super, 1990). C. Newhouse (1989) identified the key characteristics of women engineering graduates as logical thinkers, highly capable and interested in mathematics, physics and chemistry, creative with a practical bent, traditional male and female interests, and the ability to work with others. Their major developmental task now was to be "generative" in an extended number of

roles in private, work and leisure contexts. I therefore, surveyed a range of research to produce a subjective generalised other perspective of "future career" for non-traditional women within the socio-cultural constraints of a Western society:

> **RQ3. What events in the day-to-day interaction in the Engineering work-place (final year or post-graduate studies) are critical to the development of personal and professional identities and competencies as engineers (and/or post-graduate student)? ("Future Career") [linked to Jaggar/Super's propositions 1-14].**

I established earlier in this chapter that the profession of engineering is male-dominated in Australia (eg, Department of Employment, Education and Training, 1993b, 1994, June; Donald, 1991).

Intra-Personal Determinants of Non-Traditional Women

Women's Constructions of their Nature and Role as Professional Engineers

On the positive side, overseas research found that non-traditional women, even in the early 1980's, showed strong career-centredness and career salience (Illfelder, 1980; Marshall & Wijting, 1980; Yanico, 1981). They exhibited high self esteem needs (Betz, 1982), had a greater propensity for risk-taking adventures, and hence tended to gravitate towards male-dominated careers (Douce & Hansen, 1990; Nevill & Schlecker, 1988; Swatco, 1981). Wolfe & Betz (1981) concluded that women who chose non-traditional career fields were significantly more likely to make career choices that were congruent with their personality type than women who choose traditional career fields. Lemkau (1979), in her review of 1932-1976 studies on careers of adult non-traditional women, consistently found that they shared characteristics with male peers related to competence on the job, and having the traits of assertiveness, imagination and intelligence. They were somewhat more oriented to ideas and things and less to the social environment than other women. However, they did not demonstrate the stereotype of the "castrating" career woman who developed competence at the expense of sensitivity or expressiveness (p. 237). She concluded that although women in non-traditional careers experienced "some stress in her role", she was "generally emotionally healthy with unusual resources for coping with the difficulties she encounters." (p. 237).

Feree (1980) found that career women became more feminist in their attitudes, especially in regard to changing conditions for women and themselves. Research has increasingly studied the attributes of *successful* career women (eg, Northcott, 1991; Solomon, 1990), and more specifically the career patterns of successful women in science and engineering (McPherson, 1989; Rose, 1994; Tovell & Madill, 1993). Researchers have noted a general tendency for career women to "revision career concepts" (Marshall, 1989), such as redefining success and voicing a new set of career values (Kock, 1990; Northcott, 1991) and career aspirations (Harmon, 1989). Women were tending to continue to redefine "achievement" as accomplishments in a multiplicity of roles, especially in identifying life-satisfactions in different ages and stages of their lives (Hollinger & Fleming, 1988; Reis, 1987a; Holahan, 1981; Sears & Barbe, 1977). Research has also focused on the "ordinary courage" in the lives of young women, where taking risks has meant facing the consequences of their actions (Rogers, 1993). This career pathway linked Josselson's (1987) "paver of the way" with the "feminine ambivalent" (Douvan & Adelson, 1966).

On the down-side, psycho-social developmentalists focused on the debilitating effect of the feminine/cleverness dichotomy on professional women's academic and vocational self-concepts (Chance & Imes, 1978; Dowling, 1981; Hackett & Betz, 1981; Horner, 1972; Kerr, 1985; Reis, 1987a; Silverman, 1986, 1990) and the inevitability of distress and disease (Nelson & Quick, 1985) because they did not fit in (Newby, 1985). Hackett & Betz (1981) focussed on the non-traditional work-place and found women had fewer opportunities to demonstrate successful task accomplishments and to watch other people succeed and experience success vicariously. They found that anxiety prevented the development of "facilitative efficacy expectations" and that women were more likely to have anxiety responses, especially in situations where there was a lack of information about efficacy, from the verbal encouragement and persuasion of others. Kerr (1985) concluded that "fear of success and desire to be cared for, avoidance of academic risks, the imposter syndrome, and being too resourceful in adapting and compromising to others" all served to "distort women's views of their attributes and accomplishments and

inhibit their vocational development" (p. 24). I linked the development of these personal characteristics with Josselson's (1987) "daughters of crisis" career pathway and lack of "webs of connectedness".

In summary, this section of the literature review identified the non-traditional woman as part of a well-defined group, with a balance of masculine and feminine traits. They were well-suited for their profession, with the capability to adjust to chilly work environments, and to redefine success to meet their own needs, values and interests in a variety of roles in the establishment and maintenance life-stages. However, there was still the depressing down-side. Reis (Davis & Rimm, 1994) cautioned that many women are still "adult underachievers" and that "the realities of a changing world" mandated a "different role for women" without denigrating their role as wife and mother (p. 313).

Women's Conceptions of the Nature of Engineering and the Ethic of Care

A Continuum of Work-Place Conceptions of Engineering held by Women

Although successful women were re-defining career concepts, women's conceptions about the nature of engineering still hovered between the stereotypical perception that it is "dirty and physically demanding" and the reality with "developments in technology", that a large proportion of the work involves "designing, estimating and planning", most of which is done in "pleasant, well-ventilated offices" (Dreissen, 1993, p. 27). Whilst this indicated contradictions in women's conceptions of engineering as an occupation, it did show that women's values were changing and that they were beginning to identify their own needs and increasing the value they accord to "achievement and recognition" (p. 27). In consequence, Dreissen (1987) found that the value of "work conditions" for women in engineering was not quite as salient (p. 27). However, like Kock (1990), she found transforming the undergirding values in engineering and science practice and methodology was a burning issue.

Challenging and Changing Masculine Values in Engineering and Science

During the last three decades, there have been strong social movements in science to promote an ethic of caring for people and the environment (Benhabib, 1986a, 1986b;

Eisenstein, 1984, 1991; Eisler, 1987; Gilligan, 1977, 1982, 1987; Littleford, 1989; Noddings, 1984, 1987; Rose, 1983, 1986, 1994). Eisler (1987) identified such a "dominator" ideology, which emphasised only a rights-oriented morality of power and control over others and the environment. These women have provided a "sizeable frontal challenge" to the prevailing patriarchal system, "going straight to its ideological core" (Eisler, 1987, p. 144). Others identified how this ideology also undergirded a masculine conception of science and engineering and fostered the mis-use of techno-science that was deleterious to women and "the survival of the planet" (Carter, 1994; Cross, 1989; Kock, 1990; Rose, 1994; Staberg, 1991), and to women's career development (eg, Wajman, 1990; Walker, Reis & Leonard, 1992). As a result, researchers of women in engineering have advocated that the construction of engineering must also include responsibility-oriented morality (eg, Kock, 1990). They have analysed everyday occurrences, and pro-actively devise ways of combating present oppression and alienation of women in the gender regimes of work, family, and education (Carter & Kirkup, 1990a, 1990b; Cockburn, 1983, 1985, 1991; Hacker, 1981, 1983, 1989, 1990; Lewis, 1993; Smith, 1974, 1987). More recently, researchers have focussed on the issue of the "politics of advantage" (Eveline, 1994) afforded to men to achieve eminence through networking. This advantage is further enhanced by society's preferential valuing of men's contributions over those of women (Silverman, 1990; Spender, 1982b; Spender & Sarah, 1988).

This type of action research also motivated women to create future visions of different social structures and organisations, using a variety of genre (Eisler, 1987; Martin, 1985; Rose, 1994; Spender, 1980; Sundal-Hansen, 1984). Feminist research deliberately aimed to promote new conceptions of gender equality in women's *present* career, in anticipation of re-creating "partnership" societies (Eisler, 1987; Martin, 1985) and to "begin to create sciences which bring together love, power and knowledge" (Rose, 1994, p. xiii).

Another approach taken by feminist researchers, like Greene (1976), was to urge women towards "honourable work" and "awakening" to promote and value the feminine, to build gender esteem, and pro-actively effect positive change in their own

lives and in society in general. To promote a sense of the significant role of women in the field, women researchers have recorded the contributions of women to science and to a lesser extent engineering, and produced a *collective past* career, by (Alic, 1986; Burfitt, 1988; Burton, 1986; Department of the Prime Minister and Cabinet, 1994, January; Kirkup & Keller, 1992; Outram, 1987; Spender, 1982b; Standish, 1982; Vare & Ptacek, nd).

Women in Engineering and the Quality of Career Networks

Some claim that the continued lack of effective career networks for women in engineering was still problematic (eg, Armstrong & Godfrey, 1994). However, I would disagree in part with this pessimistic contention, in the light of the high priority given to advocacy. This is most evident in the networking created by worldwide and regional conferences related to research into the promotion of women, as well as girls, in engineering, science and technology (eg, Craig & Harding, 1985; Daniels & Kahle, 1987; Haggerty & Holmes, 1993; Rennie et al, 1991). Such research has culminated in the drive to promote gender inclusive education and professional development at all levels, with a focus on present career conditions. This has also helped to build knowledge from a feminine standpoint, with the aim of complementing the still present taken-for-granted masculine construction of science and engineering (eg, Rennie et al, 1991). Ideologically, then there has been a move in the 1990's by women researchers and scholars towards creating a "partnership" society (Eisler, 1987) perhaps more in theory than in practice, yet creating a "gender shock" (Eisenstein, 1991) on a number of continents.

Inter-Personal Obstacles to Access, Participation, and Promotion

Challenging Non Traditional Women's Positioning as Strangers

Research on inter-personal and structural organisational determinants has found that women employed in male-dominated professions experience particular marginalisation stemming from gender-role stereotyping and occupational discrimination as a minority group (Carter & Kirkup, 1990a, 1990b; Cockburn, 1983, 1985, 1991; Greenglass, 1982;

Hacker, 1983, 1990; Robinson & McIlwee, 1989; McIlwee & Robinson, 1992). Yet there was, in Australia, the curious paradox of "demanding skill" of women (Pocock, 1988), while at the same time actively constraining their achievements. The inter-personal constraints on women's achievements are complex, ranging from the domination of men and technological change, the so-called masculine know-how or mathematisation in engineering and technological areas, men's active resistance to gender equity and the setting of limits on women in the engineering work-place (Cockburn, 1983, 1985, 1991; Hacker, 1981, 1983, 1990), and alleged failure to recognise and appreciate women's value system (Kock, 1990).

At a deeper level, Cross (1989), Jordanova (1980) and Rose (1994) in their reviews of the literature highlighted the vulnerability of women in scientific and technological fields. The conception of science and technology as the tamer of nature and of women has continued to affect today's zeitgeist through the "promulgation of myths of femininity", which are paradoxical and inconsistent and serve to reify and harden the stereotypes of men and women and adversely affect social behaviour (Jordanova, 1980, p. 65). Rose (1994) perceived a link between extreme masculine and feminine relationships and the legitimacy of violence in society, in the home context and within powerful occupations, especially science, engineering and technology (Rose, 1994, p. 45). Rose (1994) also connected the "undervaluation of unpaid labour" with the "undervaluation of women's paid employment" (p. 37). The positioning of women and their vulnerability in the vector spaces of the laboratory in science and technology have been affirmed by others (Cross, 1989; Gold, 1990; Outram, 1987; Reis, 1987a; Ruddick & Daniels, 1977; Spender, 1982b; Spender & Sarah, 1988; Standish, 1982), where women fare worse in academe, than the work-place (Rose, 1994). Zinberg (1994) observed that older women in engineering were disenchanted and embittered in the maintenance stage of career development, as a result of their constant accommodation to the chilly climate of engineering, research contexts and academe.

Women's Transitions in Non-Traditional Careers - Challenging Tokenism

Okely and Callaway (1992) found that the minority of females, especially in traditionally masculine dominated professions, were designated with the prefix 'women' to their profession. This was interpreted as "lesser" and hence was seen as demeaningly discriminatory and tokenistic. As women make transitions up the organisational ladder into the establishment and maintenance life-stages, women's career patterns have been shown to be more complex than those of men (Betz & Fitgerald, 1987; Betz, 1982; Stockton Berry, Shepson, & Utz, 1980). Research into "tokenistic" behaviour in "non-traditional" career settings has confirmed that women are treated differently to men and do suffer more from discriminatory practices (Jolly, Grimm & Wozniak, 1990; Zimmer, 1988).

Researchers have identified biases in hiring and interviewing procedures (eg, Frize, 1993; Graves and Powell, 1988; Glick, Zion & Nelson, 1988; Heilman & Martell 1986; Heilman, Martell & Simons, 1988). However, the impact of female sexuality could be countered in selection, if clear evidence of women's ability and competence was provided (Heilman et al, 1988). Research on the promotion of professional women has revealed that they are often handicapped by unfair organisational practices in academe and the work-place, making gender equity an unrealistic short term goal in Australia (Allen, 1990, 1994; Bacchi, 1993; Bradley, 1993; Cass, Dawson, Temple, Wills, & Winkler, 1982; Cullen & Luna, 1993; Heward, 1994; Morrison & Von Glinow, 1990) and overseas (Carter, 1994; Daniels, 1991; Tripp-Knowles, 1993) in the 1990's. This has been variously coined by these researchers as the "brick wall", "glass ceiling", "gender gap", and implies, according to Herr & Cramer (1992), an "invisible barrier put up by white males to deter the upward mobility of women beyond middle management" (p. 251). Compounding issues are "discontinuities" (Herr & Cramer, 1992) in married women's careers, when juggling time with families, which hinders their promotion (Wall & Anderson, 1993), especially in Australia (Bittman, 1991; Burton, 1985).

The lack of effective mentoring (Beck, 1989; Herr & Cramer, 1992) of women in engineering and academe may be a contributing to the attrition of women discussed earlier in this chapter (eg, Donald, 1991). Researchers (Alcoff, 1988; Anderson, 1991;

Bittman, 1991; Burton, 1985; Greene, 1979, 1988; Jaggar & Rothenberg, 1984, 1993; Martin, 1985, 1989, 1994; Rose, 1994) have concluded that both women's self-agency and men's responsibility in the home are required to change society's limited conceptualisation of women's role in work, and to overcome their exclusion and intellectual alienation in the educational realm. These findings supported Super's life-career premise regarding women's curbed structures of opportunity for success, and the compounding effects of marriage, fertility and motherhood on role choices.

Summary: Trends, Traits and Gaps in Generalised Other Future Career

In terms of Research Question 3, my review of the literature on "future" career revealed strong intra-personal determinants and changes in women's construct of what success in engineering meant. There was still evidence of intra-personal conflict exacerbated by immediate situational determinants. These included the structural organisation of work; the general tenor of inter-personal relationships with "superiors and fellows"; possible discriminatory practices; issue of the token woman; biased interviews and transitions; glass-ceilings that curtailed their structures of opportunity; and juggling other life-roles in the establishment/maintenance stages of career.

In terms of the attrition of women from engineering, discussed earlier in this chapter, I wanted to establish whether there was a changing zeitgeist towards valuing and affirming women in Australian engineering firms and in academe in the 1990's. My search from organisational and subjective perspectives was for historical change and a willingness to adapt; a feminine edge to engineering to promote less gendered work undergirded by an ethic of care (eg, Kock, 1990); where women's sexuality was less of a hindrance to hiring and promotion; and for glimpses of new conceptions of being a competent engineer (eg, C. Newhouse, 1989) where both men and women valued the feminine as the well as the masculine in public and private life.

CONCLUSIONS

Generalised Other Subjective Career of Women Engineers (1968-1994)

The period 1975-1990 was, historically, a time for girls and women in all life-career stages to become "heroes of their own stories" (Noble, 1989). From my review of the literature, I constructed the generalised other subjective career of non-traditional women of ability in the historico-social and geographic context of Australia. By organising my review in terms of early (1968-1981) middle (1974-1981) and late past career (1981-91), I was able to identify nuances of historical change in the gender order and gender regimes when the women participants' generation where growing up. In the same way, I constructed and analysed present and future career in engineering education and the workplace. Where there were "gaps" in past career, present career and future career expectancies of this group, I drew on research from other Western Countries with a similar type of gender order and concerns about the effect of gender regimes and social interaction in home, school, higher education and the non-traditional workplace.

In relation to Research Questions 1 and 2, my understanding of gaps in Australian women's development of career pathways (Josselson, 1987), in terms of personal and situational determinants, required further research from the past and present lived subjective concrete other perspective and from the generalised other and concrete other organisational perspectives.

In relation to Research Questions 2 and 3, my premise, drawn from Jaggar (1983, 1984, 1989) in Chapter One (p. 11), about alienation of non-traditional women from their intellectual abilities and their sexuality was supported from the generalised other subjective career perspective. My domain assumptions about women in higher education and the gendered construct of work (pp. 15-18) were vindicated from this standpoint, but required further research from the present lived subjective concrete other perspective and generalised other and concrete other organisational perspectives. I concluded that the construction of concrete other perspectives required a collaborative feminist methodology that valued the participants (both women and professors), their contributions, and promoted adaptive change, as described in the following chapter.

Theory Building: Jaggar/Super's Propositions, Models And Women's Careers

In terms of the methodological question, Super's (1990) propositions (1-9) that I linked to Research Question 1 (RQ1) was supported by my "generalised other" construction of past subjective career. However, findings related to the "alienation" (Jaggar, 1983) that girls experienced by the lack of approval of "fellows" or male peers in kindergarten, primary school and high school, supported my inclusion of Super's (1990) 10th and 11th propositions (p. 208).

I applied all Super's propositions (1-14) to construct present (RQ2) and future career (RQ3). For example, I identified intra-personal and inter-personal determinants in personality development and adjustment of non-traditional women (1st, 2nd, 4th, 7th, 8th, 10th & 11th, 12th & 13th); the nature of engineering education and engineering as an occupation for women and its lack of adaptive style (3rd, 6th, 9th, 10th and 11th, 12th & 13th); and the need to identify leisure activities (or homemaking) as other foci for these women's personality organisation (14th).

My theoretical career archway (Figure 2.2) was helpful in relating the range of explanatory career theory segments to the current research on non-traditional women's career construction in interactive contexts in Australia. For example, research suggested that gender power relations contributed to girls' and women's alienation in interactive spaces (Figure 2.3) which supported my naming and conceptualising gender (Cornell, 1989, Matthew, 1983 and Walby, 1990) and hence, the inclusion of these theorists in this part of the model. My Jaggar/Super Life-career rainbow (Figure 2.4) represented, and aided my dialectical construction and analysis of the generalised other subjective career perspective. It was useful in conceptualising career as a series of life-span stages and roles in life-space. "Historical change" and "gender", in relation to each situational determinant (including social policies and practices, technology, peer groups, and leisure) listed above my life career rainbow, were valid inclusions for "non-traditional" girls' and women's careers between 1968 and 1991. Like-wise, my extended personal determinants (eg, aspirations, expectations, need for affiliation, growth and deficiency needs, traits, interests, and values) were helpful in identifying "gaps" in career research

on women. My convergence ladder model (Figure 2.6) provided me with a sense of the organisational career to be climbed and tasks and statuses to be achieved in becoming "feminine ambivalents" and "pavers of the way".

CHAPTER FOUR

A SOCIALIST FEMINIST METHODOLOGY AND ANALYSIS OF THE LIFE-CAREERS OF WOMEN IN ENGINEERING

PREFACE

> I didn't know I was a "Bricoleur" (Denzin & Lincoln, 1994, p. 2) but I am. That is "a jack of all trades or a kind of professional do-it -yourself person" (Levi-Strauss, 1966, p. 17). The outcome of my methodology "a pieced together, close-knit set of practices that provide solutions to the problem in a concrete situation" (Denzin & Lincoln, 1994, p. 2). In cultural studies the solution or "bricolage", is "the result of the bricoleur's method" and is "an [emergent} construction" (Weinstein & Weinstein, 1991, p. 161), that "changes and takes form as different tools, methods and techniques are added to the puzzle" (Denzin & Lincoln, 1994, p. 2) (Lesley Journal, 27 July, 1996).

As indicated by the above excerpt from my journal, my methodology developed as a creative, responsive process and not one of linear order. For example, methods, models and instruments from my past research were considered and adapted to my new methodology using a guiding question from a mentor "What do I choose to take on board that sits comfortably with me?" (Stocklmayer, Personal Communication, 25. 6. 93). This process is evident too in the way I have written this chapter, since I found it spurious to follow the classical sequence of data collection and analysis, when in reality aspects of the research process were interwoven and subjected to my constant analysis and reanalysis to try to ensure greater validity and congruence with my standpoint.

DETAIL OF RESEARCH QUESTIONS

In Chapter Two, I identified Super's (1990) fourteen (14) propositions for a person's successful and healthy construction of life-career and personality, which focussed on the interplay of personal and situational determinants in identity development, and I used these to formulate the three research questions listed below:

Research Question 1 (RQ1). What are the key determinants of the individual's background and how are these events perceived as influencing her construction of her personal and professional identity as an Engineering student and her career development as an Engineer? (The "Past Career") [linked to Jaggar and to Super's propositions 1, 2, 4, 5, 6, 7, 8, 9 and (3, 10 and 11)].

Research Question 2 (RQ2). What events in the day-to-day interaction in the Engineering Degree course are critical to the development of the woman's personal and professional identity and competence as an engineering student? (The "Present Career") [linked to Jaggar and to Super's propositions 1-14].

Research Question 3 (RQ3). What events in the day-to-day interaction in the woman's Engineering work-place (final year or post-graduate studies) are critical to her development of personal and professional identity and competence as an engineer (and/or doctoral student)? (The "Future Career") [linked to Jaggar and to Super's propositions 1-14].

I used each of these questions to construct the four career perspectives described and discussed in Chapter One (see Figure 1.1) namely, the "generalised other" subjective career of non-traditional women constructed from my review of the literature (see Chapter Three); the women participants' "concrete other" subjective collective and individual career (see Chapters Six and Seven); the concrete other organisational career perspectives of their professors, and the "generalised other" organisational career of engineering in Australia constructed from my review of the proceedings of a conference on engineering education (Parr & Johnston, 1994) (see Chapter Five).

PURPOSE AND OUTLINE OF THIS CHAPTER

The major purpose of this chapter is to describe the research methods I used to answer my three (3) research questions related to the past, present and future aspects of my construction and of the "concrete other" subjective career perspective and the "concrete other" organisational career perspective. Adopting a systemic evaluation (Shufflebeam & Shinkfield, 1985), I used the same set of questions to construct and the broader perspectives of the "generalised other" organisational career of engineering in Australia and the "generalised other" subjective perspective of non-traditional women's careers.

Substantively, I begin with reasons for the adoption of "Narrative" as my research paradigm (Cochran, 1990; Connolly & Clandinin, 1990; Heilbrun, 1988) explaining that this choice was made in the light of my integrated standpoint based on my socialist feminist "unified systems" standpoint (Jaggar, 1983, 1989; Jaggar & Rothenberg, 1984) and the life-history approach of Super (Super, 1954, 1969a, 1969b; Super & Bohn, 1971; Watts et al, 1981). I then show how this standpoint framed my analysis of women's past and present life-career stages of "growth", "exploration" and "establishment" (Super, 1990). In particular, I explain how I developed and utilised methods that reflect a "caring", subjectivity conscious and reflexive standpoint (Baxter Magolda, 1992; Kolmos, 1993), which not only matched my socialist feminist beliefs but also reflected the persistent fidelity in Super's approach in understanding an individual's construction of self and career patterns in the historical dialog of Australia in the 1990's.

Methodologically, I discuss why I adopted a personal introspective narrative style for myself as researcher, in this case manifested in my keeping of a personal professional journal over the course of this life-history study (Abbs, 1974; Heilbrun, 1988; Holly, 1989). I also used the ideas of mainstream qualitative researchers (Bogdan & Biklan, 1982; Glesne & Peskin, 1992; Lincoln, 1993, January; Lincoln & Guba, 1985; Merriam, 1988; Patton, 1990; Peskin, 1988; Punch, 1986, 1994; Schratz, 1993; Young & Borgen, 1990) to monitor my implementation of methods and instruments, and to check the conduct of my analysis and interpretation of women's lives in ways which aimed to be ethical, valid and reliable.

In the next section, I discuss the procedures I used to construct the women's life-histories. These ranged from the setting up of the research process, my early choice of dealing with and analysing the data, to a description of the two research sites, the women participants, the professors, and the major phases of the research.
I then link the three research questions to my choice of instruments (all of which are described later in this chapter). Each instrument reflected segments from my converged Super/Jaggar Archway model (Super, 1990) and elements of his interactive "Spider

Web" model (Watts et al, 1981) (see Figures 2.2 & 2.3). I discuss how the following instruments helped me to construct the participants' subjective life-career narratives, namely:

- an autobiographical questionnaire to discover personal and situational determinants in the participants' identity formation and attainment in past career and relates to Research Question 1 (see Appendix A);
- a composite learning style inventory, which provided me with a profile of each participant's preferred ways of information processing and her preferences regarding management and learning style as a probable theme of enablement in present career and relates to Research Question 1 (see Appendix B);
- a "touching base" evaluation form, where my aim was to capture the essence of present career as a dynamic interactive process of vocational identity attainment and linked to Research Questions 2 and 3. Its simple and built-in "reflexive" nature was intentional for it enabled me to respond to the special needs of the participants as undergraduates or doctoral students of engineering, and/or as professional workers in first postings. Such reflexivity also legitimised the adoption of a variety of modes of data collection (see Appendix F).

I explain that, to monitor the validity and fidelity of my socialist feminist methodology, I created:

- a "clarification of methodology" form to gain feedback from some of the women students in engineering who did not accept my invitation to participate (see Appendix E);

I discuss how and why I openly contextualised the women's subjective careers within their professors' "concrete other" (Benhabib, 1986b) organisational career standpoints on engineering education by producing:

- an interview schedule for (male) professors to enable me to listen to their stories face to face as colleagues and to encourage them to complete a preferred learning style inventory (see Appendix C).

I also explain that, to facilitate the construction of the "generalised other" (Benahabib, 1986b) organisational career from the conference proceedings of Australian educators and professionals engineers (Parr & Johnston, 1994), I used:

- EXCEL to categorise the authorship of papers according to particular university engineering faculties and professional institutions.

I proceed to discuss the inherent ethical dilemmas facing the researcher in conducting a longitudinal study. I then expand on how I gathered, organised, clustered and managed my data on computer in the process of constructing the participants' life-careers. I follow with a description of the levels of analysis I undertook in my interpretation or 'narrative criticism' that helped me to draw out themes and key determinants of career from the collective voices of 52 women, and the in-depth case study of one woman. Ultimately, I stress the importance of disseminating findings appropriately to all the stakeholders, with the aim of theory-building and improving practice.

NARRATIVE AS A PARADIGM FOR FEMINIST CAREER RESEARCH

Feminist Methodology

> From my reading of women's stories (eg Campling, 1989; Luttrell. 1989), I see more clearly how narrative, as a feminist methodology within patriarchy (ref Harding, 1986,1991; Lather, 1992), has been used to untangle both the ideologies and objective conditions in these women's lives. Their work and knowledge were made visible, and hopefully empowered. One thing's for sure, as narrator, I need to behave ethically from start to finish (Lesley, Journal, 17 March, 1993)

My unified systems socialist feminist critical theory standpoint provided me with a language for the building of a theory of career which "empowers" women in engineering (Opie, 1992) and serves to effect social change (Gaskell, 1990; Jaggar, 1989; Olesen, 1994). Like Allard (1994) did in teacher education, I was intent on constructing a new radical andragogy (ie. adult pedagogy) because I believed that it was not enough to reconstruct the modern tradition on the level of theory without this goal (Nicholson, 1989; Marshall, 1983, 1994; Middleton, 1983, 1984; Weiler, 1988, 1993). Central to my deliberation on methodology and epistemology were the political issues of gender, class and race domination and the recognition that women in engineering were different from rather than deficit to men (Eichler, 1993; Gaskell, 1990). In adopting this paradigm, I

aimed to be empathic and caring (eg, Noddings, 1987; Rose, 1983, 1986; Smith & Noble-Spruel, 1986), where "fidelity" to my participants was my "proper guide to educational reform" (Noddings, 1986, November). I also recognised that, in the construction of knowledge, both emotion and the declaration of values were an integral part of the ethics of my feminist methodological process (Jaggar, 1989, 1994; Lather, 1986; Weiner, 1990) and qualitative research (Punch, 1986, 1994).

As a scientist, I was intrigued by the way feminist scholars had challenged the masculinist construction of knowledge and scientific methods as culturally-independent, value-free and gender-neutral (Harding, 1986, 1987, 1991; Keller, 1982 Spring, 1983a, 1983b, 1985; Rose, 1994; Rossiter, 1982; Widnall, 1988). The associated research methodology, according to Rossiter (1982), was a "tough, vigorous, rational, impersonal, masculine, competitive and unemotional" endeavour (p. xv). Such a masculine paradigm is not only considered to be an inappropriate research methodology by feminist scientists, but also by feminist sociologists and anthropologists (Okely & Callaway, 1992; Hacker, 1983, 1989, 1990; Middleton, 1984; Oakley, 1981), by feminist researchers (Gilligan, 1977, 1982; Gilbert & Taylor, 1991; Lather, 1992, 1994; Luttrell, 1989, 1990; Nash, 1994; Opie, 1992; Rogers, 1993; Sutherland, 1986); and by some mainstream qualitative researchers (Denzin & Lincoln, 1994; Giroux, 1984, 1986; Lincoln, 1993; Marchant, 1986; Peskin, 1988; Schratz, 1993).

Methodologically, feminist inquiry equated with some of my own past forms of inquiry, including a collaborative biographical study of self and social change using the sociological imagination (Williamson, 1973). It also equated with my use of Parlett and Hamilton's (1972) notion of "illumination" in evaluating an innovatory gifted curriculum (eg, Jones & Newhouse, 1984), where I recognised the importance of feedback to participants, especially in longitudinal studies (Sears, 1977; Sears & Barbe, 1977; Terman & Oden, 1935). Notwithstanding, feminist methodology served to challenge my traditional research habits:

> Feminist Methodology, I am learning to 'walk the talk', as a former traditional scientist trained in the 'agricultural method' mode of test, retest, sample, control variables. This research must be collaborative, where all stakeholders' perceptions of women in engineering are noted, valued, and carefully recorded (Lesley Journal, 21 February, 1994).

In essence, the methodology I adopted was an amalgamation of a "client-centred" study (Stake, 1973, 1988) and a "connoisseur-based" study (Eisner, 1976; Madeus, Scriven & Stufflebeam 1983). My aim in using the client-centred approach was to help the people (both the women and their professors) involved in the program to tell me their story of what they were doing with a view to changing conditions for women (Cotterill & Letherby, 1993, February; Gaskell, 1990; Jaggar, 1989; Razack, 1993). The connoisseur-based approach (Madeus et al, 1983) assumed that I, as the narrator, had "particular expertise" and had "developed finely defined insights", by "devoting much time and effort to the precise area of study" to provide a unique perspective because of my "particular insights, past experiences and refined insights" (p. 35).

Narrative as a Paradigm of Career

My adoption of narrative as a paradigm for career research (Blair & Maylor, 1993; Cochran, 1990; Connelly & Clandinin, 1990; Heilbrun, 1988; Super, 1954, 1969a, 1969b), was because of its power to provide a vehicle for women's "voices" to be heard (Jaggar, 1989; Rudduck, 1993) and the freedom to use gender (with the inter-twining of social class, age and race) as the key social construct of analysis (Gaskell, 1990). Hacker's (1981, 1989) method of research of women's subjective careers, provided me with "a model of how to create a feminist sociology" and was an inspiration to me of feminist action (Wacjman, 1991, p. 480). It was heartening that Hacker included both quantitative and qualitative research, ranging from participant observation, "just hanging out with people", "hearing the way they felt", counting, in-depth interviews, and just "listening to women's stories" (p. 480). I had found Opie's (1992) insights helpful in accepting the validity of contradictions as well as commonalities in strengthening the telling of women's life-stories. Further, I was fascinated by Oakley's (1981, 1984) method of interviewing, so divorced from masculinist protocol, in its ability to draw out deep felt beliefs and emotions, and richness of data in constructing her participants' stories:

> ... I value the Buber-type 'I-Thou' relationship [Crane, 1961], that this type of collaborative research engenders and so the work of Oakley (1984) provides me with a template for the confidentiality and depth of relationship that can develop, as a consequence of personal disclosure, both women and professors alike (Lesley Journal, 28 February, 1993).

Like others (Baxter Magolda, 1992; Belenky et al 1986), my qualitative inquiry aimed to allow the women's marginalised voices to be heard, and to serve to empower them in higher education. I became more conscious of the compounding effects on women of class, ethnicity/race (Campling, 1989; Siraz-Blatchford, 1993), and with high ability (Kerr, 1988; Reis, 1987; Walker et al, 1992). I became the participants' advocate, for I did not want them to be denied the right to contribute or simply be "not heard" in these two educational institutions.

Listening to Voices

I used Rudduck's (1993) definition of "voice", differentiating it as "something different" from the word "dialogue" (p. 8). Dialogue is "part of a social convention where rules underwrite the possibility of speaking and being heard" because turn-taking "offers some possibility of equality". Voices, in contrast are "more emotive, more disembodied, more disturbing" because "they speak to our conscience" reminding us of "the individuality that lies beneath the surface of institutionalised structures" (p. 8). The women's voices had to be listened to, and because of their vulnerability, I needed to tell their stories in such a way that they "nudge[d] at the routines" that maintained the status quo " (p. 8) in engineering. Their voices, past and present, would tell me of on-going external conditions that needed to be changed (Jaggar, 1989; Razack, 1993). I became more aware of the importance of telling the story of women's development of vocational identity and growth of personal agency, in a passionate way. I wanted to help those in power to "respond to difference" and to check on the "institution's story of itself", by accepting important differences of perspective and experiences of the women (Jaggar, 1989 p. 8).

The professors, as the powerful key figures, were also given a voice in my study to provide the concrete other organisational career perspective. Their voices, from positions of leadership, enabled me to discover the degree of complementarity between

the organisational career and subjective career. I believed that their involvement at the beginning of the study would provide an opportunity to effect transformations in engineering education (eg, Claxton & Murrell, 1987; Stake, 1988) in meeting the women's special needs, interests, values, aspirations (Super, 1990) and preferred ways of knowing (Baxter Magolda, 1992; Belenky et al, 1986).

Narrator Know Thyself

For me, the major disadvantage of such an approach was its openness to my bias and subjectivity as the researcher-narrator, and the sustaining of my fidelity towards, and maintaining my credibility with the women participants. As a feminist researcher, I needed to be reflexive and to monitor my own subjectivity and standpoint for biased appropriations (Baxter Magolda, 1992; Kolmos, 1993; Weiner, 1990). Such a role required a deep interrogation of self, particularly in regard to *past* career in historical and geographic context at the beginning of the study and carefully monitor changes in my own construction of self and knowledge over time, and my own application of feminist methodology throughout the study. This became a major purpose, in addition to others, in establishing and maintaining a "Lesley-journal" and a "Lesley-Lesley" dialogue with my supervisor, as mentor. Accordingly, two separate files were established and maintained on the computer (See Appendix J).

Narrator's Need for Immersion in Present-Lived Careers

Like Hacker (1981, 1983, 1989, 1990), I immersed myself in *pre-research* insights from actual Australian women graduate engineers to provide a vital backdrop for my embedded career narrative construction, which my broad review of the literature alone could not. Ideologically, it gave these non-traditional professionals an opportunity to reflect on their career progression, as a springboard for personal change. In this way, I also gained a reflective cameo of their structures of opportunity (Astin, 1984). For example, I was able to ascertain from their *past* and *present* career the themes of "glass ceilings and glass brick walls" (eg, Bacchi, 1993) and their need for "coping strategies" (eg, Kvande, 1987) as "female strangers" (Pallotta-Chiarolli, 1990). Similarly, I immersed myself in constructing a "generalised other" organisational career perspective

of engineering from papers presented at an Australian conference (Parr & Johnston, 1994). This was timely because it helped me gauge where the professors were positioned on the change continuum regarding the engineering curriculum, structural organisation, and the cultural milieu, in comparison to other Australian educators and professionals in 1993.

PROCEDURE - CONSTRUCTING WOMEN'S LIFE-HISTORIES

Introduction

My aim, guided by Merriam's (1988) insights, was to understand the "phenomenon" of women's experiences in the two engineering education programs in a "holistic manner" (p. 153). In my description of procedure, I have tried to encapsulate the essence of qualitative research in social situations, so that the reader can catch glimpses of real participants, create images of these sites and compare these with their own experiences of different, though similar sites. I also wanted the reader to appreciate the diversions of energy required of the qualitative researcher to simultaneously collect, order and analyse data as an on-going process to construct both organisational and subjective career, and assess their degree of complementarity. Early in my research, I recorded an example in my journal:

> Rang Mandy, [a final year] doing Chemical engineering [at Institution A] - My first full respondent [since the pilot study]. Interesting how contact with [her professor] develops a sense of the next step (It was like the Chinese spinning plate trick concept of Research to me ... keeping the dialogue swinging over (I'm reminded now of Noddings' 1986 paper on fidelity in ed. research). [Mandy] talked of changing perceptions of the Engineering curriculum (I am thinking perhaps a 'letter to graduates' will help as a framework. I must keep Glass ceilings and glass brick walls in mind 'to the key most'). [Mandy] talked of the expectations of the first years and their sense of 'being cheated / misinformed / misconceived view of Chemical Engineering (linked to her liking for chemistry). How has Mandy 'weathered the years, ups and downs highs /lows pressures? (Lesley Journal, 18 September, 1993).

Setting up the Research Process – Three Phases

The research was situated in Institution A, a tertiary institution, with a technological foundation, and Institution B the oldest, most traditional university in Western Australia. Permission was granted by the deans of the two engineering faculties on 20 February, 1992, provided that I worked collaboratively with their respective Coordinators of the

Women in Science and Engineering (WISE) programs. The research was effected in three main phases, with a number of levels of investigation involved at each phase.*

Phase One (Began early 1992) The initial study of three "subjective careers" in Institution A, which grew into the study of more women (early 1993). I also interviewed professors in Institutions A and B to create an immediate "concrete other" organisational career (November 1992).
Phase Two (Began later part of 1993) Extended the study to women participants in Institution B.
Phase Three (1994-1998) Creating present life-histories. Contextualising in a remote "generalised other" organisational career (December, 1994).
The Life-History (1975-1999) Cecilia - One Woman in Engineering.

As the narrator, I was fully immersed in gaining insights into people's perceptions of the fields of engineering and engineering knowledge, the nature of engineers and their culture.

Early Choice of Dealing with the Data

At the outset of this research, it had been my intention to use the computer based programme, NUD●IST (Richards & Richards, 1991a, 1991b), to "handle my qualitative data" (Lesley-Lesley file, 14. 12. 1991, Appendix I). I had attended a work-shop and had used it as a means of analysis in a small research project. However, I was not comfortable with the adequacy of its use in this study. I wrote in my Lesley journal at the time on this very issue of how to analyse and by what means. My thoughts ranged from my feminist methodology, my growing affinity with Super's models as heuristics for analysis, substantive issues related to simplistic reasons given for drop-outs and whether the NUD●IST programme could deal with it:

> I've had some ... disquieting notions from J C "I too have a sense of limitation". I perceive this package (in my concurrent research with children's perceptions in a multicultural classroom) as a

* See Appendix G for detailed records of methods of data collection used during the phases of this study. Broad outlines of which are framed above.

> systematic reductionist means of analysing data, like a half brain form of building generalisations (Lesley Journal, 2 April, 1994).

The NUD●IST technique appeared to me to work in a reductionist, left brain way of the human mind, without the intuitive, mind-meadowing and infinite connections of the right brain. The very act of reflective journalling, as new evidence emerged, was my preferred way to go with my women's perceptions of the engineering culture. I did wonder whether, perhaps:

> ... profs and the male interviews transcripts, may be lodged in this way? Maybe not. Am I guilty of prescribing one type of analysis to male perceptions and another to the female perceptions?!* (Lesley Journal, 2 April 1994).

Within my account of the 'procedure', I describe how my data were collected (See Appendix G), organised and managed, and analysed as part of an inter-weaving and on-going process of constructing meaning about women's life-histories in engineering. This process was an example of narrative criticism (Cochran, 1990).

Phase One - Institution A Site of Interaction, Early 1992

Phase One began at Institution A and consisted of two levels of investigation in the faculty. In February 1992, to encourage first and fourth year women students to volunteer to participate in this study, the WISE coordinator in Institution A created an opportunity for me to talk 'face to face' in an informal lunch-time setting about the nature of my life-history research and about writing women's lives. From this meeting, a pilot study of three undergraduate women, all willing participants, was completed in that first year. Cecilia* in Electrical engineering and Carolyn in Chemical engineering, were from the group of eight first year women. Zumei, an overseas Chinese Malay student in information and electronic engineering student, was one of nine final year women. Each woman initially completed the autobiographical questionnaire (see Appendix A) and the composite learning style inventory (see Appendix B). These data on past career and preferred learning styles were filed on computer (See Appendix G).

Through sheer serendipity, I was able to encourage three other women, who graduated from Institution B in December 1991, and were about to enter the establishment stage of

*All women's names are pseudonyms

first postings, to participate. Two other women engineers in the maintenance stage of life-career, one in academe and one in management in the public sector of engineering, also agreed to tell their stories which I filed on computer, thus adding to my immersion in the real-life culture of engineering. I recorded in my journal:

> Merriam (1988, p. 154) considers that nearsightedness plagues much research... Ask the question 'What does this remind me of?' The professional women's stories have helped to expand my "analytical horizons". I must try to "raise concrete relations and happenings observed in all their particular engineering settings, as well as my participants to a higher level of abstraction" (Lesley Journal, 30 September, 1993).

Continuing in Phase One, the three original undergraduate women were prepared to 'touch base' with me at regular intervals to provide in-depth feedback on their experiences. I encouraged them all to keep a reflective journal, since both first years already maintained this practice, as a coping mechanism. The 1992 graduates from Institution B also continued to feedback on their early experiences as paid workers. Thus, even in this initial phase of the research, the participants were providing "distinctive qualities of this group of women's discourse", and their willingness to participate suggested a need to "strive for a certain social significance, a social breath" (Bakhtin (1981, p. 333), cited in M. Schratz, 1993, p. 63).

By November 1992, I had written to five professors at Institution A requesting interviews. In the following spring, all but one were agreeable to meet 'face to face' to help me to construct their organisational career perspectives. Each professor was sent a set of six broad questions prior to the interview (see Appendix C). I had extended these interviews to Institution B and the four professors who headed various departments. Data were collected from the professors[*] on women and educational issues, and broader issues related to equal opportunity, affirmative action and their perceptions of the achievement of women in the field of engineering and engineering education. All interviews were taped and transcribed.

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[*] Professors were designated letters A-J

I found my analysis of the interview question responses provided "explanations about the social processes" and learning opportunities the professors provided within engineering, as well as "the rationale for intervention" (Marchant, 1986, p. 14). With increased fidelity towards the women and their professors, I felt comfortable that this was an appropriate way to effect changes in conditions in the social system of engineering education and work.

I also, through chance meetings and networking, collected more reflective narratives of women in engineering, engineering management, and engineering education outside the two university settings. These women provided narratives related to first postings and their move into the establishment stage (Super, 1990) of their vocation as engineers. Their stories, too, related to their different roles in variety of situations and were collected, written up, interpreted, verified and compared with my own participants' stories. A brief interpretive analysis of the data so far, using gender as the major construct of analysis, was completed and shared with the 'Women in Science and Engineering' coordinator at Institution A.

Analysis of Process and Emergent Themes - "Phase One - Level One"

Collectively, the narratives in Phase One provided support for viewing women's career development as complex, with differences in the conceptions of career and educational opportunities in engineering, and career progression. This was dependent on the different age and experience of the three students; the age and personal experiences of the professors; and the age and experiences of women in the engineering workplace. Each person was, in effect at a different stage (Super, 1990) of her career development.

I believed that it was beneficial to gain information about each professor's preferred learning styles (Felder & Silverman, 1987; Honey & Mumford, 1982) to ascertain what sort of profile a master engineer and educator would have. The women participants' learning profiles could then be judged from both a female perspective and as the "novice" engineer. In line with the ideals for feminist methodology and the fullest partnership participation with the women, I reviewed the efficacy of the order of data

collection, the methods used, and instruments of data collection. I modified these, where
appropriate, before moving into the next level of Phase One. I was also affirmed in my decision to monitor change in myself, as the researcher, as a vital aspect of this type of research. I later recognised this phase in my narrative inquiry as my own mini-cycle of re-exploration, that Super (1990) had identified in his model.

"Phase One - Level Two" - Mid Year 1993

In the second year of the narrative inquiry, the invitation to participate was extended to all first year (31) and fourth year women (28) in Institution A. These numbers represented 11.6% of all new undergraduates and 13.7% of all final years. Six or 20% of the first year women volunteered to participate, including four from Chemical, two from Civil and one from Mechanical, with Cecilia from Electrical engineering and one extra Civil engineering student transferring from Institution B in 1994. Ten women (approximately one-third) of final year participants, included six Chemical, one Construction and three Electronic engineering students (including Zumei). Astrid, a doctoral student in Civil engineering also volunteered to participate. This constituted the second level of Phase One in the engineering faculty in Institution A. Adding to the validity of their 'voices', some of the women in Institution A had men friends, who were also studying engineering and they provided a refreshing perspective to this narrative inquiry (eg, Mandy's friend). Mothers too, quite inadvertently with this new mode of narrative inquiry, entered into incidental chats with me over the phone. This too provided valuable corroborating information about daughter's progress intellectually and emotionally, from the perspective of the care-giver in the family.

Phase Two - Institution B Site of Interaction - Later in 1993

The choice of a different university setting, Institution B, constituted Phase Two of the research project. The research was again primarily a qualitative narrative inquiry for the reasons expressed for Phase One and Two of the study in Institution A. The focus here was on the similarities and the differences, that evolved in the analysis and interpretations of the narratives of participants, from the key groups identified in Phase

One. Twenty-one of the sixty-seven first year women and eight of the thirty-three final year women were willing to be participants. The total number of women in engineering represented 15% of the first year cohort and 13% of the fourth year cohort. These women were from various branches of engineering (see Table B). Seven final years were studying bachelor of engineering degrees, three in mechanical, and one in each of electrical, electronic, civil and environmental. One final year, Penny, already had a science degree and was studying environmental engineering. Of the 21 first year participants, nine were pursuing the four year bachelor of engineering degree. From these nine, two wanted to study environmental, five civil, one was ambivalent between mechanical and civil, and one was undecided. The other 12 first year participants were pursuing integrated studies. Seven of these 12 women were studying science/engineering (representing about a third of the women enrolled in this double degree). Five of these 12 women were studying commerce/engineering (representing forty-two per cent of the women enrolled in this double degree). Sandie, a doctoral student in civil engineering, consented to participate. Maggie, an older woman in civil engineering, and Sara, Beth and Hettie, recent graduates in electronic engineering, had also agreed to contribute their life-stories (See Appendix G).

The 'Silent' Voices

I sent the "Clarification of Methodology" (see Appendix E) with a stamped addressed envelope via the two WISE coordinators, to all the non-respondents in first and final year engineering. 16 women from Institution A and 28 women from Institution B responded and their reasons were illuminating. My analysis of their responses revealed that my method of data collection was viewed by some as "dip in dip out" research, that was characteristically the antithesis of feminist methodology. This was a salutary lesson for me for the next phase on the study. With some, there was a lack of awareness of the 'gender agenda' and even active resistance to gender issues. Other themes emerged related to their busyness, overwork and shortness of time, forgetfulness, hurt, and disinterest. The frequency of 'busyness' as a response also cautioned me to be more flexible in collecting data in the longitudinal phase of the study. A positive outcome

was that three final years and twelve first years willing to participate in the study (See Appendix G).

On-Going Analysis of Participant Involvement

I noted that the response of Institution B's women towards my research and to me, they were generally very helpful and cooperative, and over the years their notes to me have been a source of great encouragement. I conjectured that this was due in part to my adoption of a more collaborative approach initially and partly because they were at an institution more attuned to a research culture.

Jaggar/Super Models - Progressive Evaluation

By 26 January 1994, I was able to affirm the usefulness of using my combined archway model of individual life-career as my major interactive heuristic device, as well as the value of Super's rainbow and ladder models that represented stage developmental models of career (Super, 1990). The women were detailing their career progress through newly constructed 'touching base' forms, which I based on themes emerging from the Phase 1 findings (see Appendix F). I was able to organise and manage their data by using determinants from my combined version of Super's (1990) Archway of career determinants and his spider web model (Watts et al, 1981). Again, I placed the data on computer files.

Drop-Outs 1993 - Failures or Effective Career Decision-Makers?

The issue of why women drop out of engineering education arose, when three women from Institution B (eg, Katelyn, Colleen and Vivienne) chose to withdraw. I asked these 'drop-outs' to comment on the reasons for their decisions. I was able to reanalyse previous data on 'drop-outs' from the same institution and ascertained that low interest, lack of people-oriented study, coercion (both unconscious and conscious, initially), lack of practical application to real-life in the course, and lack of opportunity for creativity and design were raised as contributing variables. Both the re-analysed data and the comments by the 'dropouts' of the 1993 cohort suggested that, rather than assuming the

women were deficient, the focus of research should be on the nature of curriculum and the cultural milieu of the faculty.

Phase Three - Creation of Present Career Life-Histories (1994-1998)

What did emerge most strongly from Phase Two, was my decision to seek the consent of the 26 former first years at both institutions to follow them through their university course and into first postings. The women's narratives were again gathered from versions of the touching base concept, either as a letter or a form, and appropriate for second, third, fourth/fifth year experiences. Similarly, I was able to extend my research to include the final year women's experiences in their first postings (eg, Billie and Sarah) and postgraduate studies (eg, Sandie and Astrid). These career narratives were interpreted and analysed, again using gender as the construct of analysis (eg, Sara). I continued to monitor the emotional health in all participants partly by assessing, as key factors, the level of support of family and friends, and the women's leisure activities.

Cecilia - The Life-History of One Woman in Engineering (1975-1999)

I selected several voices for special study to provide a level of detailed narrative not possible from the group as a whole. Of these, the voice of Cecilia is the one presented in this thesis. Her life-story was contextualised in the "concrete other" organisational career of her professors and the community of experience of the women participants "concrete other" subjective career from both institutions. The three research questions, and four themes evolving from the collective voices of the other participants' subjective career, guided the telling of Cecilia's story and my analysis of her quest for self and vocational identity between 1974 and 1999 (See Appendices G & I).

On-Going Construction and Analysis of Organisational Career

In December 1994, I used the three research questions, matched with the professors' interview schedule, to analyse conference papers to construct the then current generalised other organisational career perspective (Parr & Johnston, 1994). This enabled me later, to compare and contrast remote and immediate situational determinants of organisational career, especially with non-traditional women students

and professional engineers in mind. I was later able to establish whether there were positive refractions of the truth of the gender order, as evidenced in the "generalised other" subjective career perspective constructed from the literature review on families of gifted and non-traditional girls in Chapter Three.

Jaggar/Super Convergence Models - Further Evaluation

By 1996, my theory building had become as important as the substantive study. In 1997, through the substantive analysis of women's life-careers in engineering, I found the archway model and the rainbow model were adaptable in representing the multiple-role careers of women in a social order, in building a more gender-inclusive segmental theory of career life-stages, and their utility in my vocational counselling with participants over the telephone.

METHODS, INSTRUMENTS AND SUPER'S HEURISTIC DEVICES

> Looking back again critically at the methods I used they are in essence, as Gaskell (1990) suggests, "lens" that influenced what I found, as well as what I asked (p. 230). Ontologically, I took my stand as an advocate for women; by using their "vantage" point to formulate questions to serve their purposes and change their conditions of learning and work (Lesley Journal, 29 January 1999).

(A) THE WOMEN AND THE CONCRETE OTHER SUBJECTIVE CAREER PERSPECTIVE

Instruments

As indicated earlier, a number of strategies, planned and created to accommodate to the busy life of the women, were used to help me to construct their subjective life-career narratives and to find the "embedded or contextual" nature of their ego identities (Blustein, 1994, p. 150). At this juncture, I describe the instruments per se. Details of the administration of the instruments follow in the next section.

Autobiographical Questionnaire

> Women must be in charge of their autobiography, because before they can act to change a situation, they must know how it has arisen and evolved [Jaggar], so they have the ability to move forward. They need to understand, from their own experiences, the way "we are all caught up in the ideological processes of our every day lives" [Gilbert and Taylor (1989, pp 133 -134] (Lesley Journal, 9 March, 1993).

Super's instruments were too clinical for my use (Super, 1970; Super & Crites, 1962; Super & Forrest, 1972). My autobiographical questionnaire was a compromise, for it served to inform me of key *past* career determinants (see Appendix A) and was also intended to be a reflective exercise or "conscientisation" process for the women (Freire, 1972, 1974; Gilbert & Taylor, 1991; Giroux, 1981, 1986; Jaggar, 1983, 1989) of the construction of the gendered self. In accord with my third domain assumption about women's career (see Chapter One), it was to help them to valorise their femininity (Alcoff, 1988; Branson,1991; Greene, 1976, 1988; Heilbrun, 1979, 1988; Swarbrick, 1991) and what they uniquely brought to engineering.

The autobiographical questionnaire evolved from one I had used with my student teachers since 1984. Like Gilbert and Taylor (1991), I had found that this exercise created a cultural consciousness of the ideology on which my students' personalities were based. Subsequent workshops served to enhance reciprocal gender esteem amongst these students, and to effect real changes in gender social relations in the college, and their own high school classroom practices, judging from their stories (Newhouse-Maiden & Cullen, 1993).

The present autobiographical questionnaire (see Appendix A) was re-constructed primarily with my elaborated Super's ladder model of life-stages in mind, with specific developmental life-tasks and transitions in particular "life-spaces" (Super, 1990). I incorporated new items in the questionnaire to discover the more precise intricacies of these stages of life-career development for "feminine ambivalents" (Douvan & Adelson, 1966), as reviewed in Chapter Three.

The clusters of autobiographical items (1-8, 9-12, 13, 14-15, 16, 17-18, 20-21, 22) were linked to Research Question 1 and Super's (1990) propositions (pp. 206-208) and derived from the literature review in Chapter Three. Items (1-8, 14-15, & 21), linked with Super's (1990) 1st and 6th propositions, related to the demographic details of the women participants' lives, as well as social relationships and values, within their particular cultural and family context in Australia between 1968 and 1997. The cluster of items (9-12) was linked to Super's (1990) 1st and 4th propositions, which related to the participants' development of vocational/avocational interests (Swanson, 1992) since early childhood. Responses to these items were also used to evaluate progress in "dismantling the divide" in Australian families. The next extended item (16), relating to Super's (1990) 1st, 4th, 5th, 7th and 8th propositions on the qualitative process of development of abilities, vocational interests, positive self concepts and vocational identity focussed on the women's formal education from kindergarten (item 16a), through primary (item 16b), to year twelve in high school (item 16c)i-vi). Item (16c)(vi) was an extended item, pertaining to the participants' previous experience, expertise and confidence in the use of computers, and deemed to be a critical competency for students in engineering education and professional engineers. The influence of teachers as "key figures" in the participants' career and personality development, linked items 16b)iii) & 18e)i)ii) with Super's (1990) 9th, 10th and 11th propositions. Responses to these items also link back to my concern for the effect of remote situational determinants, such as historical, technological and educational policy changes, on the participants' life-career in Australian high schools.

Item (18a), related to Super's (1990) 2nd proposition, asked for in-depth reasons why the women had chosen engineering as an occupation. Associated items, which were related to Super's 6th and 9th propositions, focussed on who, and how deeply, had influenced their choices. The following items on informal career guidance, linked to the relative influence of both parents (18bi)ii)iii) & (21)), the potential influence of siblings (17 & 18c), and how influential adolescent peers and friends had been in the participants' choice of career path and in terms of interests, dress, and gender role stereotyping (13 & 18d). Responses were used to ascertain such metaphors as "structures of opportunity"

(Astin, 1984) and my notion of "circles of affirmation" in the family of origin. Items (18e)i)ii)iii); 18fi); 18fii) focussed on the women's estimations of more formal career guidance by teachers and career guidance officers and were linked to Super's 9th, 10th and 11th propositions related to implementing occupational self concepts and gaining the approval of "superiors" (p. 208).

Finally, a number of items (19, 20 & 21) were included as possible themes of enablement for the women participants in view of the research that highlighted the external barriers to women's success and identity attainment in tertiary education (eg, Bacchi, 1993). Item 19, linked to Super's (1990) 8th, 9th and 10th propositions, related to the women's adaptive style and identification of coping strategies when faced with "the demands of the environment" (p. 207). Item 20, linked with Super's associated construct of "career adaptability", focussed on their aspirations and expectations of their role(s) in engineering and life in general, as an enabling projection to their future career (Jaggar 1989; Super, 1990). Item 21 was devised to encourage participants to make a judgement on the degree to which their past career pathways (Josselson, 1987) and occupational choice of engineering had been enabled or hindered by family upbringing, schooling, leisure and gender.

Administration of Autobiographical Questionnaire

The autobiographical questionnaire was mailed out to all first and final year students by the WISE coordinator at both Institution A and Institution B. Nineteen women from Institution A and thirty-four women from Institution B responded.

I organised and managed on computer the wealth of data obtained from this questionnaire, by entering each woman's response (using a pseudonym) beneath each relevant cluster of determinants of past career. At the top of each subheading I tended to add relevant notes as part of my on-going analysis (Bogdan & Biklen, 1982; Merriam, 1988), regarding emergent themes, special determinants, and importantly about the efficacy of Super's models as heuristic devices in this task.

Learning Style Inventory

> Back to my thesis ... Methodology ... with learning styles, I wanted no tight compartments of the "Myer-Briggs" variety ... I had a need for instruments that allowed the individual to consider changes to preferred ways of doing things and were simple enough for both of us to mark and interpret together (Lesley Journal, 17 August 1996).

The second instrument was a composite learning style inventory (Appendix B), based on the inventories of Felder and Silverman (1988) and Honey and Mumford (1986). I developed my instrument, in response to gaps in knowledge I had identified in Chapter Three, in relation to learning and management style preferences from the "concrete other" subjective career perspective. I wanted to find out, firstly:

- whether non-traditional career women conformed to women's ways of knowing and learning (Belenky et al, 1986; Baxter Magolda, 1990; Foster, 1989; Schuster & van Dyne, 1984), or whether they might have a more androgenous learning style that also encompassed the traditional 'masculine' logical/analytical modes in information processing (Lemkau, 1979).

- how women related to objects and people in learning and management situations; as well as the traditional feminine affinities for the more holistic, intuitive, and cooperative social learning modalities.

Secondly, building on the premise of other researchers (Claxton and Murrell, 1987; Palmer, 1987; Thomas, 1990), I was confident that completion of these learning style inventories, by the women and their professors, would:

- provide a basis for the improvement of teaching and learning practices in higher education, and help faculty and administrators to think about their roles and associated responsibilities as teachers, managers and curriculum developers.

- be a way of breaking down barriers of resistance and finding out how professors' learning styles differed or showed similarity to the women's.

Thirdly, I wanted to construct the women's preferred learning style profiles at the beginning of the course in engineering:

- as a form of standpoint check, in view of their influence on each participant's evaluation of the relative worth of curricular offerings, especially their interpretation of what is good teaching and management in engineering (and/or science and/or commerce) in the university context.

Ideally, at the end of the course or in first postings, I wanted to ascertain with a few volunteers, like Cecilia:

- whether learning style profiles had changed over time and as an inference that the course and interactions on work experiences had made a difference.

Finally, as the narrator, I too needed a knowledge of my own preferred learning style:

> to make me more conscious of any biases in my interpretations of the learning environments and the culture of engineering education, as told by the women and their professors (Lesley Journal, 2 July, 1995).

Face Validity of the Composite Learning Style Instrument

The six-page instrument that was sent out to 53 women, comprised Part A and Part B (see Appendix B). The brief introduction was aimed at engendering curiosity and exploration, and was deliberately personalised with an emphasis on helping "you to pinpoint your learning preferences" and to "select learning situations that suit your style". In Part A, I interpreted learning styles as preferred ways of information-processing, adopting these aspects from the format used by Felder and Silverman (1987) to assess their engineering students in America. There were five questions related to five dimensions of this learning style construct, expressly:

- What type of information do you preferentially perceive?
- Through what sensory channel do you get your external information?
- How do you like your information organised?
- How do you prefer to process information? and,
- How do you progress toward understanding of knowledge?

Each question presented two alternatives, with brief descriptors, specifically:

- Sensory (concrete) information versus Intuitive (abstract) information;
- Visual (Demonstrations, pictures) versus Auditory (learn by explaining things to others) sensory channel;
- Information organised - Inductively versus Deductively;
- Processing information - Actively (experimentalist) versus Reflectively (theoretician); and
- Progress to understanding - Sequentially (Convergent) versus Globally (Divergent thinking) (see Appendix D).

I found the advantage of Part A of this instrument was its user friendliness, with a focussing statement and simple "either/or" choice questions that encouraged its completion, sometimes with clarifying comments and served to inform the participants about 'self as a learner', immediately. The format enabled me to collate the responses

with ease and to link with similar dimensions in Part B, for increased validity of responses.

Part B comprised the learning style questionnaire, that was produced in booklet form by Honey and Mumford (1982). The authors were happy for others to use their learning questionnaire and encouraged feedback to them to build a data base. The instrument had been well validated with business groups of both genders. Its intent was not to place people in boxes, but rather to encourage individuals to use their "learning styles" (pp. 3-10) to construct a two-dimensional profile, of Activist-Theorist and Pragmatist-Reflector. These profiles then provided visual springboards to facilitate positive growth where there was an imbalance in the profile. There were 80 items, which simply required a tick or a cross, as a "gut level" reaction.

My method was to attach the simple scoring sheet and a general description of the four dimensions for Part B to the questionnaire, so that the participants were the major players in the evaluation. This was intended to prevent the inventory being misinterpreted as 'dip in dip out' data collection, at the start of this research venture (see Appendix B). When the completed inventories were returned, my major role was to monitor accuracy and to record Part A responses on the scoring sheet; and with Part B to score the item clusters and their relative strengths, and produce a profile for each woman. This was an easy task. I then returned a photocopy of the completed scoring sheet, with Part A and Part B profiles, as soon as I could. I asked the participants if they agreed with the strength of the activist, reflector, theorist and pragmatist and which parts of the descriptors they agreed with on the reverse side of the scoring sheet. This is what I wrote about its potential in July, 1995, as I thought critically about career "theory-building" and the need for personal exploration of learning style for women's empowerment:

> A drawing in of interest for participants is essential, with feedback and ... comment about accuracy. It also has (according to Honey & Mumford, 1982) the potential for ... the individual person to develop aspects of his/her preferred learning style profile, as better learners and as future managers. In their jobs ... they will be able to determine what strengths are needed on a

> team of problem-solvers that will assist them as future mentors and managers (Lesley Journal, 2 July 1995).

To facilitate my analysis, I summarised each participants' learning style profile (along with those of their professors) on a spreadsheet 'Personal Determinants of Present Life-Career' for Institution A and Institution B (see Appendix H, Table E & Table F).

Reflexive Instruments for Subjective Career Narrative Construction

'Clarification of Methodology' Form

> I am intrigued about the lack of response of some women students to participate in the study. Is it busyness, apathy, lack of interest, the instruments I am using, I feel that I want to give silent voices of this kind a "social significance", a "social breath" [Bahktin's expression, in Schratz, 1993] (Lesley Journal, 21 February, 1994).

In May 1993, I prepared the 'clarification of methodology' form as a monitor of my feminist methodology in action (see Appendix E). My purpose was three-fold:

- to ascertain why some women preferred not to be involved, and/or reasons why they had been unable to complete the autobiographical questionnaire and the learning style inventory.
- to gain feedback on the efficacy of the research instruments and the timing of their distribution (Merriam, 1988).
- to encourage more women to participate and provide a "voice", however transitory, for this study. I anticipated receiving some unsolicited and illuminating comments, which might produce more holistic notions of the phenomenon of women in engineering education (Merriam, 1988; Parlett & Hamilton, 1972).

This form was sent out to all non-respondents as described in *The 'Silent' Voices* of the 'Procedure' section (See Appendix G).

"Touching Base" Strategies and the Development of a Flexible Form

> Following GASAT in New Zealand and mindful of Boman & Lewis, 1994, I want to increase my understanding of the "different skills and experiences that women bring to their work" and to bring its value in line with men to encourage equity (Lesley Journal, 9 July 1996).

My original 'touching base' form was derived from my review of the literature in Chapter Three and informal interviews with final year Institution A students (eg, Billie and Mandy). This led to the production of an additional item (19) for final year participants in the Institution B version of the Autobiographical Questionnaire. As Jaggar (1983, 1989) advocated in her second principle of action to counter women's "alienation" and promote personal agency in women, I rationalised that as they were about to enter the new "mini-cycle" of the establishment stage of their career (Super, 1990), it would be efficacious for them to monitor their "own pulse" (Boyd, 1993) regarding strengths and weaknesses in their knowledge base in mathematics, arts and science; attainment of requisite skills for engineering (including drawing, practical, modelling, and computing); their personality disposition for engineering; proficiency in social and work skills; and the level of support they were receiving from family, friends, peers, faculty members, administration, and the value of the role of the WISE Coordinator of women in engineering and science.

This provided a highly adaptable instrument that increased the probability of my conducting a more systematic, and in depth understanding of the tensions between the immediate situational determinants and personal determinants of present career in establishing their vocational identity as engineers. To visualise these tensions, I used the "spider web" vector space as the engineering site within Super's Archway model (Figure 2.3).

Because of the busy life of these women, my "touching base" feedback could be described as "gossiping", but not in the destructive European use of the word, but in the casual chattiness of family support. Such an approach to "interviewing" was supported by Oakley (1981). To accommodate to the lack of time factor and preferred styles of communication, I progressed from personal interviews, to twice yearly posting out a simple two-page form, with a stamped return-addressed envelope enclosed and/or

backing this up through telephone links. A combination of both forms of communication began to evolve into a feminist counselling model in action (Chaplin, 1988; Wodlinger, 1990, June), enabling some of them to use me as a sounding board or "anchor" point (Josselson, 1987) in their career decision-making. This occurred in two ways. The first way was the degree of anonymity fostered a professional distancing and provided those, who were being harassed, with a counsellor's ear (eg, Helen, 1993). Secondly, it gave other students the courage to ask for help with references for a gender issue assignment (eg, Haylia, 1993); or even to inquire about changing her pseudonym, "I wonder if I could change my Dorothy name to Kate? Please don't worry, if this will create huge problems" (Kate, Institution B, Touching Base, 1996). This evaluative "touching base" strategy enabled me to interpret what was happening in the engineering course over the years and to tell 'herstory', without encroaching on precious time or erroneously creating the stereotypical woman student.

The "Touching Base" forms included 21 items which were linked to Research Question 2, Super's (1990) 14 propositions and determinants I had derived from the "generalised other" subjective career perspective in Chapter Three. These items assisted me in my construction of the "concrete other" present subjective career perspective of the undergraduate women. These items were adapted for graduates in work-place and/or postgraduate studies, and linked to Research Question 3 and Super's 14 propositions (see Appendix D). The varieties of 'touching base' form for first, second, third, fourth and sometimes fifth year participants and touching base forms for those participants progressing in the work-place are presented in Appendix F.

<u>On-going Analysis of "Touching-Base" Data</u>

As part of the on-going organising, managing and progressive analysis of qualitative data (Bogdan & Biklen, 1982; Merriam, 1988) I entered the students' comments into six separate computer files, for former first years, for fourth/fifth final years, and for postgraduates in each institution. I used their pseudonyms, institution, and branch of engineering as organisation markers and subsumed the comment corresponding to each question asked on the relevant year 'touching-base' form. This provided a useful way to

pick out similarities and contradictions. With ease, I was able to abstract a single life-career history (eg, Cecilia, Sara, Billie). I recorded who had graduated or chosen to withdraw, or even those who came back on board from their own volition. I was able to add to and create further spread-sheets from these data, to produce contextualised "life-span, life-space" rainbow career impression of the participants' lives between 1968 and 1998 (see Appendix H, Tables A – F).

(B) THE PROFESSORS AND THE CONCRETE OTHER ORGANISATIONAL CAREER PERSPECTIVE

Interviewing The Professors - The Organisational View of Engineering

> Taping interviews of professors - very important to hear how they talked to me.... in what sort of a relationship did they put me to them... it will be very telling. I wanted to find out how they saw the settings and institution of engineering. It was unashamedly political in nature on one hand, and on the other it was talking as educators about good education in our society (Lesley Journal, 24 November 1995).

From my socialist feminist standpoint, I considered that the professors of engineering needed to listen to the marginalised voices of women (Astin, 1984; Lewis & Simon, 1986) to evaluate the appropriateness, efficiency and efficacy of curriculum, the nature of the socio-cultural milieu, and structural organisation, and then adapt for inclusivity accordingly. This was my plan, backed by other researchers' deliberations on developing a community of learners in universities (Belenky et al, 1986; Claxton & Murrell, 1987; Palmer, 1987; Thomas, 1990).

I pre-arranged a semi-structured interview with each of the 8 professors in their own university offices setting in early 1993, mindful that:

> This dialogue is a critical one. "It brings political discussion to the heart of the academic process (Gaskell, 1990, p. 231)" (Lesley Journal, 24 November 1995).

I was also aware that the "interviewer" makes a difference to the process and outcome of interviews (Clayton, 1991; Eagly & Carli, 1981; Oakley, 1981; Williams & Heikles, 1993, June). Basically, I wanted to construct the "concrete other" (Benhabib, 1986b) organisational career from face to face interaction, as a same-age colleague where both of us were, at least, in the establishment stage of career. I ultimately wanted to identify discrepancies between each man's ideology and perceptions of reality of his women student's subjective careers, in the micro-ecological context of his engineering faculty and department. According to Dale (1972), the better the internalised match between the two constructs of subjective career and "concrete other" organisational career, the more encouraged the career and structures of opportunity of students, and the greater their personal and professional identity integration in education.

The Concrete Other Organisational Career (OC) Construction and Analysis

With a central focus on the three research questions, and central issues arising from the review of the literature in Chapter Three, I formulated an interview schedule (OCI - OCVI) to construct the "concrete other" organisational career perspective (Barley, 1989; Dale, 1972; Hughes, 1937; Super, 1990) on women in engineering. These are identified overleaf:

OCI. What awareness was there concerning the value system undergirding their construction of engineer and the construct of engineering, as "masculine"? How did they conceptualise women engineers and were they aware of the feminine construction of engineering? [Link Research Question 2 "Present Career" on engineering and women engineers].

OCII. What policies and organisational structures had been established in the department to accommodate to the inclusion of women students and the recruitment of female academics? How did professors promote engineering as a career path for women?
[Link Research Questions 2 & 3 "Present/Future Career" on policies and practices for women's career pathways].

OCIII. How cognisant were the professors of the purported 'glass ceilings' and 'glass brick-walls' in women's career paths from university entry to their establishment of a career in the field of engineering? What was their perceived role in facilitating women's "structure of opportunity"? Were women students who withdrew from their courses followed up to ascertain why? [Link Research Questions 2 & 3 on Women's "Present /Future Career" pathways].

OCIV. What awareness was there of the influences of gender relations and its influence on the cultural milieu and the dynamics of the teaching-learning situation in particular? [Link Research Question 2 "Present Career" on the gender regimes in engineering].

OCV. In terms of curriculum development in engineering, what aspects of women's previous achievements in school, interests, values and needs were readily identified by the professors? [Link Research Questions 1 & 2 "Past" to "Present" career].

OCVI. What were the professors conceptions of curriculum? How did their departments of engineering accommodate to women's preferred ways of learning and problem-solving to enable their talent and potential to flourish, in the planning, curriculum organisation, the resourcing, implementation and evaluation of the curriculum? [Link Research Question 2 "Present Career" on curriculum and women's ways of learning].

Method of Interview

I produced and sent out focus questions, with a covering letter, prior to each semi-structured interview (see Appendix C). These questions related to women and engineering education policies, structural organisation, women's career pathways as engineers, the cultural milieu, the nature of women as learners (past and present) and conceptions of curriculum. Each interview was taped and transcribed, and feedback was

provided to each professor for verification. Data were organised and filed on computer for each professor's answer to each question (OCI-OCVI).

Analysing and Interpreting the Organisational Career - A Cautionary Tale

I was very mindful how zealous I was, in 1993, to find discrepancies between the "concrete other" subjective and organisational career perspectives, and in 1997, it was a cautionary tale when I recognised a fundamental methodology hiccup of mine in re-interpreting one professor's transcript:

> I re-did X's transcript in full using the tape recording. As I am reworking through this interview - I see how blind I was to some of his remarks in trying to express about how he helped the students to learn, problem-solve and make connections with the real world. Fidelity, that Nodding's mentions. Listen to their voices too and tell their organisational career stories, with fidelity - feminist methodology! (Lesley Journal, 13 October 1997).

It was important then to tape, transcribe and re-listen to interviews during the final phase of analysis to recognise and correct any interpretive distortions or bias. Similarly, it was important to revisit my construction of the "generalised other" organisational career (Parr & Johnston, 1994) to avoid falling into the same biased trap of neglecting even the smallest hint of transformative change in the conference papers towards gender equity in the curriculum, milieu, and structural organisation.

Learning Styles of the Professors

To find "sweet waters" (Stake, 1988) of complementarity, I extended the opportunity to the women's professors of completing a composite learning style inventory, as master engineers and educators in their particular field. I planned the same strategy for them as the women, but with the intent that my feedback would deliberately link their preferred learning styles to their preferred ways of teaching and managing in a personalised letter. I saw this exercise as a way to improve higher educational practices, which Claxton and Murrell (1987) and Thomas (1990) had envisaged in Britain. For example, I hoped it would encourage some professors to consciously focus on individual learning styles to maximise the efficacy of small group problem-solving or individualised projects in engineering laboratories. (see Professors' Learning Style Profiles Table E & Table F).

Constructing The "Generalised Other" Organisational Present Career

In 1994, my supervisor provided me with the future oriented conference proceedings *Inspiring Integration* (Parr & Johnston, 1994), which represented the views of educators and professional engineers throughout Australia. Using Excel, I categorised the content and the authorship of the papers under the various institutions to develop a sense of the changing gender regimes of different Australian universities. To construct the "generalised other" (Benhabib, 1986b) organisational career I used the interview focus questions (OCI-OCVI) to analyse the papers. In this way, the degree of comparison between the generalised other and the concrete other organisational career perspectives contextualising the participants' subjective careers could be ascertained (see Chapter Five).

NARRATIVE CRITICISM AND COMPARISON

As indicated above, my analysis was not confined to the end stage of the study. Rather, an approach characterised by the "constant interplay of data gathering and analysis" was at "the heart" of this qualitative research (Wiseman, 1974, p. 317). This was also the process undertaken to affirm the validity and the notion of reliability in a qualitative study.

With the art of the "bricoleur", organising and managing information, from the autobiographical questionnaire, learning style inventory, and touching base-form, helped me to compose the women's life-histories. Analysis during the data collection was illuminative, and, as narrator, I found the suggestions of Bogdan and Bilken (1982), Merriam (1988), Okely (1978) and Wiseman (1974) helpful for keeping the purpose of the study in focus and directing my analysis from the outset of this life-history research. This process of analysis has been supported by a number of other qualitative researchers in the field (Bryman & Burgess, 1994; Gaskell, 1990; Giarelli, 1988; Potter & Wetherall, 1994; Purvis, 1987; Reissman, 1993). Specifically, with the use of my journal, or putting notes in the margins to comment on data, I captured my reflections in search of themes. I was able to continue my analysis by comparing sets of data (eg, first and final year experiences; differences between chemical engineering and other

branches regarding critical mass of women). Each set of data informed the next site of data collection. It was, as Merriam (1988) intimated, both a "parsimonious and illuminating" process (p. 124), in pin-pointing key determinants of these women's life-career pathways and the gender agenda.

To reinforce the dialectical construction of the women's career in socio-historical context, I continue to complete summative life-career rainbows for women in Institution A and Institution B, using EXCEL (see Appendix H, Tables A-F). Similarly, I begin to create a set of life-career stage rainbows (see Appendix I, Tables G-I) to depict key events in Cecilia's career to track her quest for vocational identity and for group identity in educational and work milieux (Josselson 1987); her evaluation of educational curricula to meet her needs; and her self-evaluation of academic success, her resolution of critical incidents, the waxing and waning of career roles, leisurite role (general healthiness), and the roles of family/friends.

Ethic Of Care And Fidelity As Under-Girding Principles Of Action

Fidelity, as discussed earlier, is a key criterion for practising and evaluating narrative inquiry to effect educational reform (Baxter Magolda, 1992; Lather, 1986; Kolmos, 1993; Noddings, 1986; Weiner, 1990). This carried ethical implications for my analysis or "narrative criticism" (Cochran, 1990) of concrete other subjective life-careers, which focused on listening to and interpreting voices, particularly the women in an institution who would normally be passed over; and also the professors' organisational careers, as "key figures" in the women's lives. As Rudduck (1993) commented, this pointed to a tension that made this study interesting, because it challenged me to both keep trust with individual perspectives, while, at the same time, building some kind of composite picture of the events of engineering education that "both individuals and ..... staff as a whole" recognised (p. 8).

Comparative Analysis of Data from the Four Perspectives

I draw together the methodological and substantive findings from my analyses of first, the "generalised other" (GO) subjective perspective on women and girls in non-

traditional career pathways (Chapter Two); second, the concrete other (CO) subjective collective (nomothetic) narratives of 53 women in engineering (Chapter Six); third, the individual (idiographic) life-history of one of the women, Cecilia (Chapter Seven); fourth, the generalised other organisational career (eg, Parr & Johnston, 1994) and fifth, the concrete other organisational career of 8 professors in which the women's career pathways are contextualised (Chapter Five). I use my three research questions (related to Super's fourteen (14) propositions about past, present and future career (see Chapter Two), my domain assumptions, and variables abstracted from my review of the literature or Generalised other (GO) subjective perspective (Chapter Three) to compare and contrast the four career perspectives on non-traditional women's career (Figure 1. 1).

In terms of past career, I compare GO and CO subjective perspectives on the associated effects of the gender regimes (family, school, leisure, peers) on the personality and career development of non-traditional girls as "feminine ambivalents" (Douvan and Adelson, 1966) and potential "pavers of the way" (Josselson, 1987) in the historical time span (1967-1991). I also search for anomalies by contrasting to the GO subjective career perspective with the CO subjective collective story. I then compare the CO organisational perspective (professors') and the generalised other (GO) organisational perspective (Parr & Johnstone, 1994). In terms of women's present career, my comparison focuses on areas of concern drawn from the GO subjective career perspective, namely, the structural organisation, the lack of gender inclusivity in the curriculum, the 'chilly climate' of the cultural milieux, tokenism and bias in interviews, the need for leisure, and personal determinants (inter-personal and intrapersonal). I compare strategies used by women in engineering education in anchoring to new relationships (Josselson, 1987), and how each woman built her own construct of vocational identity in parallel with the curriculum offerings. I then make comparisons with the GO organisational career and the CO organisational career to search for evidence of transition in these areas of concern. In terms of future career, I search for evidence of convergence with the GO Subjective and GO Organisational perspectives on people-oriented workplace paradigms and the CO Subjective career of women graduates in 1993 and with Cecilia's story. I compare the career perspectives in regard to the

personal determinants that women take into the work-place and how women choose to position themselves (eg, ‘one of the boys). Similarly, I compare and contrast the four perspectives on women post-graduates for evidence of transition in academe in regard to the career development of women. I anticipate that discovering gaps between the subjective and organisational career perspectives will help point the way towards specific recommendations for change in conditions (Newhouse-Maiden & Parker, 1996b, 1997).

Final Evaluation of Jaggar/Super Convergence Theory and Models of Career

In parallel, I synthesise the evaluation of my Jaggar/Super convergence theory of career development, using Krumboltz's criteria of quality (see Chapter One, p. 8) in terms of its soundness and integrativeness; the explanatory power of Super's propositions in generating questions; the practical applicability of this type of research to empower people; and its adaptiveness in responding to newly discovered anomalies (pp. 27-28). Having also employed Super's technique of using conceptual models of life career as heuristic devices for analysis (Super, 1980, 1984, 1990, 1994), I evaluate the "robustness" of my Jaggar/Super models in terms of: accurately representing career and the soundness and integrativeness of my convergence theory; their practical application to empower people; and adaptiveness in response to newly discovered anomalies (pp. 27-28).

Levels of Dissemination of Findings - The on-going Writing Process

Writing up my thesis has been an on-going process (Wolcott, 1990, 1994). I disseminated findings on a variety of levels. From the very inception of the study, I kept the women participants informed of my research progress and my findings. Since 1995, abstracts of conference papers essentially "telling their stories” were sent out to all the women, including their WISE Coordinators. As a professional educator, papers and a journal article were produced for the benefit of engineering educators and lecturers in higher education (Newhouse-Maiden & Parker, 1995, 1996a, 1996b, 1997b, 1997c). Some of them, I anticipated, would listen and accommodate to meet these women's needs, interests and values.

CONCLUSION

In this chapter, I have described the methodology I used in construction and of the embedded life-career narratives of women in engineering, building on the philosophical and theoretical base discussed in Chapter Two. The research design with the construction of both "concrete other subjective and organisational career perspectives suggested to me that these are two sides of the same coin. One side is defined by the official "organisation" (and, in the case of a coin, bears the replica of the head of state, thus reinforcing this officialdom), while the other side allows for the individuality of the coin designer. For the coin to be seen as a coherent whole, these two sides must be of the same size and shape, and the designs, although different, must complement one another. Arguably, the degree to which the two sets of constructs are compatible will be important in terms of the quality of the women's educational experiences and career progression. Extrapolating from Dale's (1972) research, there appeared to me to be a danger that anachronistic definitions of career, tied to the previously all male population in engineering schools, might prejudice the success of women in engineering.

The research questions, derived from Super's propositions, helped to draw out commonalities and contradictions from the generalised other subjective career perspective, which was constructed from the review of the literature in Chapter Two. This was followed by a discussion on my multi-level approach to on-going data analysis, and the usefulness of my elaborated models of career and the creation of a computer data base. Methods, instruments, data collection procedures and the need to establish a well-organised data base were then discussed with regard to the research context and the inherent ethical dilemmas of a longitudinal life-history study. I focussed briefly on the issues of internal and external validity and the notion of reliability in qualitative studies. I concluded with brief discussion on the importance of on-going process of writing and the dissemination of findings, during and after the study is completed.

Bearing in mind my mentor's advice, the methods, instruments and forms of analysis and dissemination of findings, taken from both the traditional, the feminist and the new order of qualitative research, do "sit comfortably with me". In Chapter Five, I present the

"generalised other" and "concrete other" organisational career in which the women's collective subjective stories were contextualised in 1993-1994. The sub-text of the ensuing Chapters Seven and Eight will demonstrate how I tell and interpret these women's stories as the concrete other subjective perspective, by keeping their 'voices' to the fore, to give them 'social breath' and resulting empowerment to effect change in conditions.

CHAPTER FIVE

THE ORGANISATIONAL PRESENT CAREER OF ENGINEERING: THE GENERALISED OTHER AND CONCRETE OTHER PERSPECTIVES

THE PURPOSE AND OUTLINE OF THIS CHAPTER

The major purpose of this chapter is to construct and the generalised other and concrete other organisational career perspectives in which the career development of women in engineering is embedded. I construct the generalised other organisational standpoint from the proceedings of a specific conference on engineering education, which coincided with the early years of my study (Parr & Johnston, 1994). My interviews with the participants' professors provide the "concrete other" organisational perspective of gender regimes in particular faculties. I use the interview schedule (OCI-OCVI) for both exercises. These issues were distilled from my feminist review of engineering and of non-traditional career pathways for women and girls in Chapter Three and are linked to the three research questions on past, present and future career:

> **RQ1. What are the key determinants of the individual's background and how are these events perceived as influencing her construction of her personal and professional identity as an Engineering student and her career development as an Engineer? ("Past Career" [linked to Jaggar/Super's Propositions 1-11] and to OCV).**
>
> **RQ2. What events in the day-to-day interaction in the Engineering Degree course are critical to the development of the woman's personal and professional identity and competencies as an engineering student? ("Present Career" [linked to Jaggar/Super's propositions 1-14] and to OCI-VI).**
>
> **RQ3. What events in the day-to-day interaction in the Engineering work-place (final year or post-graduate studies) are critical to the development of personal and professional identities and competencies as engineers (and/or post-graduate student)? ("Future Career" [linked to Jaggar/Super's propositions 1-14] and to OCII & OCIII).**

In Super's (1990) terms, this critical analysis provided both the remote and immediate situational determinants of engineering education for the life-careers of the women participants. In this case, however, unlike Super, gender was my key construct of the

analysis. In my analysis, I looked for indicators of paradigm shifts in both the generalised other and concrete other organisational career. I aimed thereby to ascertain changes in conditions to accommodate women in their particular contexts of engineering education and first postings, and noted those still needed for gender inclusivity.

Methodologically, I continue to monitor the efficacy of my Jaggar/Super convergence models for the task of constructing the generalised other and concrete other organisational career perspectives:

> **How robust is the Super/Jaggar convergence conceptualisation of life-span life-space career in representing and facilitating the construction and interpretation of women's subjective life-career in non-traditional occupations in Australia in the 1990's?**

Generalised Other Organisational Career As Remote Situational Determinant

The year 1994 was a watershed for reviewing whether the recommendations of the Williams report (1988) had been implemented in Australian engineering education (Caldwell, Johnson & Anderson, 1994). From a feminist perspective, it was a time to establish how far the rhetoric of academic and professional engineering associations (Sargent, 1991; Haddad, 1985; Widnall, 1988) had actually been heeded in changing the conditions for women in engineering in Australia. The conference proceedings *Inspiring Integration* (Parr & Johnston, 1994) provided a powerful representation of engineering educators' and professional engineers' views of engineering education and the role of engineers in Australia. Using Benhabib's (1986b) terminology, I labelled this the "generalised other" construction of organisational career. It represented 200 contributors from 23 Australian universities and 3 other educational institutions, 2 advanced engineering centres, the National Centre for Women, APACE (Appropriate Technology for Community and Environment), and 7 professional and business enterprises, drawn from 5 Australian states. Contributors from overseas universities and polytechnics also provided views of engineers and engineering within the social order of New Zealand (3), United Kingdom (3), Canada (1), Fiji (1), Hong Kong (1) and Indonesia (1). Five papers contributed by academics from the mechanical engineering faculties of Institution A and Institution B indicated pockets of collaborative innovation

in computer-assisted learning (Devenish, Entwistle, Scott & Stone, 1994a, 1994b; Lyons, Li, & Stone, 1994; Stone, 1994) and in the reorganisation of the first year curriculum (Trevelyan, 1994).

Concrete Other Organisational Career as Immediate Situational Determinant

The Participants' Professors of Engineering 1993

To construct the immediate situational determinant, I analysed the voices of the women participants' professors gathered in 1993. The year 1993 was especially relevant to the study, because it was the time when the younger women in this study entered engineering education, and when the older women were either completing their final year, studying as postgraduates, or had just exited as new graduates going into the work place. This analysis also enabled me to establish the professors' beliefs about the nature of, and educational experiences of, their women students, and likewise for women in academe and the workplace.

As Super's key figures or superiors in the women's present career, the professors were in the "maintenance" stage of Super's (1990) life-career rainbow. The eight (8) men varied in their willingness to debate issues in depth with me and I became increasingly aware of the sub-text of resistance in their responses, as other women had found with male academics when discussing change (eg. Aiken et al, 1987; Andersen, 1987; Benckert & Staberg, 1993). Part of my dialogue with five (5) of these men concerned their own preferred learning style profiles (Personal Communications, October, 7th, 1993). I also found that transformation of higher learning institutions required the graciousness of those in leadership, where "pre-requisites for educational and administrative reform include political will" (Randall, 1987, p. 204).

RQ1. What are the key determinants of the individual's background and how are these events perceived as influencing her construction of her personal and professional identity as an Engineering student and her career development as an Engineer? (Women's "Past Career" [linked to Jaggar/Super's Propositions 1-11] and to OCV).

Generalised Other and Concrete Other - Feminine Ambivalents on Entry

First year women, along with the men, were regarded as "competent and capable" (Ford, 1994, p. 560), with a pool of scientific and mathematical knowledge (McKay, 1994). Ford (1994) pointed out that, although most students were male from Australian high schools, there were significant numbers of full fee-paying students, who encompassed a wide range of ethnic backgrounds and levels of competence in English language. Pratt & Else (1994) concerned about the implications of the changing needs of society, and the increase in women undergraduates and other minorities, developed a list of desirable characteristics of the engineer and commensurate university course characteristics (p. 81). Grenquist (1994) found "women (both in science and engineering) better prepared to perform well in the courses, and more persistent in their pursuit of success" (p. 566).

As previously alluded to, Lewis and Roberts (1994) emphasised the need for first year students and lecturers to formally address the gender agenda to promote inclusivity in engineering education and in the work-place. Collaborative learning styles were considered important in improving cross-gender and cross-cultural communication skills with students and lecturers (McGregor & Marks, 1994; Trigg, 1994). Waddell and Taylor (1994) were pressing for an inter-disciplinary curriculum undergirded by an ethic of care for all engineers (pp. 23-27). Hands and Younger (1994) adapted curricula in response to individual differences associated with culture and race and language difficulties. Edgerton (1994) developed a differentiated model of curriculum with a technical and design orientation that identified students' strengths, and catered for the special needs of students from cultures with few technical traditions, like Fiji. Cross-cultural perspectives were also being introduced to Australian students, one using case-studies from other Asian countries, to develop their negotiation skills in business

(Blackman & Quinn, 1994), and another integrating the engineering curriculum with international studies (Parsanejad & Goodman, 1994). As a group, Grenquist (1994) found women scored higher in laboratories, tutorial attendance, and mid-semester tests than the men, but "worse than the men in their final examinations" (p. 566). His longer term goal was to set up remedial classes, when necessary after first year (p. 566).

From the "concrete other" perspective, Professors from both institutions emphasised the students' grasp of essential knowledge *per se* on entry to engineering education:

> ... students come in generally into the program sufficiently well prepared, [in terms of] Mathematical level and Physics level ... (ProfD, Institution A, 15 February 1993).

> ... have to be able to do maths ... to be able to cope ... [with] physics [and] chemistry [they] come in well-equipped (ProfF, Institution B, 9 February 1993).

Professor C blamed secondary schools for his students' lack of skills in "geometry" for mechanical engineering:

> I have had a running battle for 9 years ... shortcomings of the maths syllabus ... students coming in here ... [with] no idea of descriptive geometry whatsoever (ProfC, Institution A, 1 March 1993).

Professor D found "at the outset ... the female students" going into electrical engineering may not be "perceptual" people and are:

> ... more at risk - it [electrical engineering] wasn't quite as appropriate, it was the perception of what they were coming into that isn't quite as cemented in girls' minds as well as it might be in boys. Year 10 boys have a better conception of electrical engineering. you have to be perceptual person ... if you're not, then it is really not for you (ProfD, Institution A, 15 February 1993).

Competency in written and oral communication skills was valued by some professors. However, Professor D thought that standards in the level of English were low for students on entry:

> ... because of the wide diversity of background of the Australians we get (ProfD, Institution A, 15 February 1993).

In relation to Research Question 1, the generalised other organisational career was showing evidence of linking and valuing students' prior knowledge and competence, as well as diversity, in planning and implementing curricula. There was some transition in the generalised other organisational career towards the needs of women in engineering education, yet there was a tendency to use remedial measures rather than building on this group's strengths and achievements as probable "feminine ambivalents" (Douvan &

Adelson, 1966). The approach towards students with cultural differences was more transformative, since strengths and learning style preferences were considered, along with special needs.

In contrast, the concrete other organisational focus on the essential pool of scientific and mathematical knowledge (and the lack of literacy skills *per se*) equated with McIlwee and Robinson (1992) finding as the driving force of a traditional engineering curriculum, and the foremost credential for all students "entering the pipe-line that leads to engineering" (p. 28) irrespective of gender or cultural differences.

Generalised Other and Concrete Other - Technological and Computer Skills

There was a strong preoccupation with computer-assisted learning from the standpoint of the generalised other organisational career (Abdallah & Hood, 1994; Devenish et al, 1994a, 1994b; Lyons et al, 1994; Stone, 1994; Wilson & Luketina, 1994), From the concrete other perspective, Professor C saw the computer as an indispensable tool in:

> removing the back-breaking grind of mathematics ... and thinking in 3 dimensional mathematical models (ProfC, Institution, A, 1 March 1993).

Professor E emphasised its creative use, but placed responsibility on the schools, not his own, for computer skill development, because "an engineer's capability":

> links back to schools and [teachers need] re-educating for needs awareness [of its creative use in engineering] (ProfE, Institution A, 9 February 1993).

Professor H expressed concern for women students' growth in competence:

> No particular difference in these skills between men and women ... that sort of difference has not arisen with us. One of the points I put down is "self image" and then added "confidence" ... I think there is an element in it ... I don't want to imply all our women students ... Some feel ... not inferiority ... somehow [they are] overwhelmed ... at huge numbers of males (ProfH, Institution, B, 27 May. 1993).

Professor E was aware of a combination of spatial difficulties and fear in effectively translating two dimensional drawing into three dimensional computer models:

> One girl was from civil engineering ... and she transferred - absolute whizz on the drawing board ... She was a beautiful "draughtperson" as you say, (Ha Ha) ... but put her on a computer she couldn't handle it ... couldn't draw on a computer she couldn't handle it ... cos I think she was scared of the computer (ProfE, Institution A, 1 March 1993).

Professor D qualified that spatial concepts in "electrical":

> ... aren't really as demanding by any stretch of the imagination, but expectations of girls might play a part since I found in [my] high school workshop experiences that boys are more reality oriented" [even at] "year 10 as to what engineering is (ProfD, Institution A, 15 February 1993).

The professors recognised the low 'access' self efficacy of women in computing and technology, and their lack of understanding of "what engineering is" in reality compared with the men.

Generalised Other and Concrete Other - Productive Thinkers for Engineering

Like Bowden (1990), the generalised other and concrete other organisational career valued students' ability to think productively as engineering students. Professor F remembered a teacher who encouraged and had drawn out excellence in his daughter, in the early 1970's:

> ... I imagine (unless) one's aware it [gender discrimination] can go on without ever-surfacing. [The] atmosphere with my daughter at Senior high school ... [they] topped the state ... She had a very good teacher ... very able to bring them [girls] on ... [I] didn't realise at the time (ProfF, Institution B, 9 February 1993).

Currently, he blamed the schools in Western Australia for producing reproductive, rather than productive, thinkers:

> Most of them have been very bright at school and assimilated things very quickly. They have become addicts at giving back answers to teachers what the teacher wants (ProfF, Institution B, 9 February 1993).

In contrast, the generalised other organisational career (eg, Ferry & Brown, 1994) was proactive in working alongside the faculty of education in helping to inservice teachers in the design and make process.

Concrete Other and Organisational Career - Career Guidance and Transition

The generalised other perspective was taking responsibility for the special needs of new women students as an essential aspect of vocational guidance (Ford, 1994; Grenquist, 1994; Lewis & Roberts, 1994; Pratt & Else, 1994; Trigg, 1994). Women and men students were also encouraged to model equal partnership roles for engineers in high school recruitment drives (Howard & McNamee, 1994).

In contrast, the "concrete other" organisational career was blaming teachers, especially in all-girls' schools, for "not linking girls to engineering":

> It is all very disappointing, I think it goes back to the high school student ... leaving high school not so sure and so on ... talk of engineering as an option, ... hard work ... it will kill (you),... probably they are taught like that ... or their parents. Like all kids my daughter had all the qualifications ... wouldn't go anywhere near engineering ... and the teacher directly and sometimes indirectly telling her to do commerce ... that disappointed me ... [it was] erroneous advise (ProfE, Institution A, 9 February 1993).

> I really do believe that ... one of the disturbing things is that disciplines like engineering are actively discouraged in some girls' schools. [I] found that so when my daughter went through ... these people were actually being restrictive and discouraging this broadening ... (ProfH, Institution B, 11 February 1993).

Professor C was "stymied" in recruiting girls:

> ... I don't know whether it is the high school's fault or not, whether the image of Mechanical engineering is left to the Manual Arts teacher to push, whereas Electronic/Electrical tend to be recruited by Science masters (ProfC, Institution A. 15 February 1993).

Professor G found that fathers were encouraging daughters to be engineers:

> Yes, perhaps we should be directing our advertising at fathers as well as the girls ... percentage ... 7 or 8% four or five years ago ... last year ... tremendous increase (ProfG, Institution B, 9 February 1993).

Laudably, both faculties had appointed a WISE (Women in Science and Engineering) coordinator, where some of these professors were "actively involved" with recruitment of, and workshops for, high school girls and boys (WISE Coordinators' Feedback, November, 1992):

> We have had a very active programme for many years to actually get more girls into engineering. What we have done ... for many years ... is going out into schools ... in particular saying ... look engineering is not just for males it is for females too (ProfG, Institution B, 9 February 1993).

In Josselson's (1987) terms, WISE coordinators, faculty and students (from the generalised other perspective), professors and fathers (from the concrete other perspective), were "anchors" helping adolescent girls to choose and make the transition to engineering as "pavers of the way".

RQ2. What events in the day-to-day interaction in the Engineering Degree course are critical to the development of the woman's personal and professional identity and competencies as an engineering student? ("Present Career" [linked to Jaggar/Super's propositions 1-14] and to OCI-VI).

Generalised Other - Organisational Constructs of Engineer and Engineering

One of the principal outcomes to emerge from the conference papers was that graduate engineers were to be the "fore-most leaders" in innovative technology and in entrepreneurial management, both locally and globally (Cole, 1994; Imberger, Johnson and Peterson, 1994; Johnson & Cameron, 1994; Liston, 1994; Munoz, 1994; Pratt & Else, 1994). There was a range of conceptions of engineer and engineering, with some intimations of a paradigm shift from the goal of wealth creation in a rapidly changing technological world, to ethical accountability for the community and environment through the use of appropriate technology (Koehn, 1991; Waddell & Taylor, 1994; Wilkins, 1994). Definitions of engineer and engineering suggested to me a continuum of ideological change.

At the transformational end of the continuum, Australian women were entering the discourse of the "organisational" career, regarding the recognition of the diversity of student background, especially the influence of gender on the construct of engineering and the future role of engineers (Ford & Ford, 1994; Boman & Lewis, 1994; Lewis & Roberts, 1994; Waddell & Taylor, 1994) As engineers, women raised key issues about their own social construction as masculine and ways to break the vicious cycle regarding women's lack of participation and exclusion from discourses related to engineering education, the workplace, equitable career opportunities, sustainability of the environment and the needs of the community (Armstrong & Godfrey, 1994; Waddell & Taylor, 1994). Waddell and Taylor, 1994, like Thomas (1990) earlier in the UK, urged both lecturers and students to enter the changing debate about "certainty and choice in engineering" to try to ensure that curriculum developers would begin to adapt equitably to changes required for women as well as men. Pratt and Else (1994) and Edgerton

(1994) emphasised the importance of educators investigating their students' backgrounds, cultural diversity, and students' constructs of engineering on entry.

At the traditional end of the continuum, McKay (1994) conceived the engineer with "the skill, the capacity and the opportunity to make a significant contribution within their chosen employment" (p. 15). He used the constructs of science, technology and engineering of Fairclough (1994) and Morita (1992), to define how engineers use science as their "pool of knowledge that is constantly added to through research" to make technology "happen" by employing and manipulating science in concepts, processes and devices, which in turn they use to make "our life and work more efficient, convenient and powerful" (p. 15). Engineering then was the "activity that turns technology into economic use", where "economic growth flows from making and selling competitive products of increasing value" (p. 15). Although race and ethnic differences were addressed, it was in terms of wealth opportunities in third world countries (Blackman & Quinn, 1994; Parsanejad & Goodman, 1994). This was the masculinist conception of engineering identified by Hacker (1989) and McIlwee and Robinson (1992), where technology emphasised power over people, and lacked the inclusion of relationships of care.

I identified a transitional construct of future engineer from the contributions of Abdallah and Hood (1994), Imberger, Johnson and Peterson (1994) and Pratt and Else (1994), which I positioned centrally on my continuum. Learning from overseas innovations, Pratt and Else (1994) used a consultative process involving all stakeholders, to produce a set of "desirable characteristics of the 21 century engineer" (p. 81). Engineers were logical thinkers with a strong foundation in mathematics, physics and chemistry, highly capable creative problem solvers with a practical bent, and the flexibility to work individually and with others. Pratt & Else (1994) added that engineers should have "advanced knowledge" of professional technologies and skills related to engineering practice, be enthusiastic "life-long learners" of engineering, with a "strong social conscience", a wide range of oral and written communication competencies, and an understanding of "corporate and business practices" (p. 81). Unlike Newhouse (1989)

they did not highlight the need for interests, which were both traditionally masculine and feminine. They did however emphasise the importance of faculty's adapting their curriculum to effect these student outcomes, by being flexible in adapting to the "changing skills and knowledge of students entering the course" and to the changing requirements of employers of their graduates" (p. 81). Pratt's and Else's perspective equated with Hesketh's (1985) and Thomas's (1990) views that adaptive style of both the organisational and subjective career was essential for transformative change to occur.

The transitional "generalised other" conceptualisations of engineers of the future equated with their expert use of multimedia (eg, Abdallah & Hood, 1994; Allen & Mackenzie, 1994; Haddi, 1994; Taplin, 1994; Ulmer, 1994). Abdallah and Hood (1994), quoting from Sparks (1993), added that engineers will require a "degree of flexibility and a technical skills base difficult to imagine at this time" (p. 55) in a world of "rapidly changing technology" (p. 58), which linked well with Astin's (1984) assumptions of its impact on careers. Imberger, Johnson and Peterson (1994) emphasised the need for engineers' ability to be innovative, to be tempered by practising efficient productivity at university for "a competitive market" (pp. 288-289). There were some transitional voices, both men and women, who valued the diversity of students entering engineering education and their conceptions of engineering more as a craft and a design process than a science (Edgerton, 1994; Hands & Younger, 1994; McGregor, 1994; Trigg, 1994). This transitional construct of future engineer was commensurate with Australian feminists in engineering (Lewis & Roberts, 1994; Waddell & Taylor, 1994) and with Van der Vorst (1994), who presented a British female perspective. Quoting from the Engineering Council (1992), Van der Vorst emphasised the heart of the engineer of tomorrow, who must be "environmentally sensitive and responsive to human needs" as well as "technically competent, market conscious [and] commercially adept" (p. 45).

In relation to Research Question 2, collectively, Australian educators represented a "generalised other" organisational career in transition. However, their tendency was to preserve the invisibility of the women, and was encapsulated in Ford's (1994) comment

that "most students were male, but operating in an environment where considerations of equal opportunity are of increasing importance" (p. 557). I also noted, with a rare exception (eg, Spencer & McGrath-Champ 1994), that the satisfaction of personal and vocational needs of the engineer tended to be sublimated.

Concrete Other - Organisational Constructs of Engineer and Engineering

Professor F highlighted that a "professional engineer in generalities" is:

> ... concerned with producing wealth and infra-structure in that sense [they are] a lot of altruistic professionals - not entrepreneurs ... [they] perceive there are society's needs, help identify problems, tackle it, carry it out and manage the process through to completion (ProfF, Institution B, 9 February 1993).

Professor F's construct and frame of reference equated with the "generalised other" traditional organisational construct of the wealth producing engineer (McKay, 1994) and with the ethic of care undergirding the transitional organisational perspective (Armstrong & Godfrey, 1994; Pratt & Else, 1994; Waddell & Taylor, 1994).

Professor F also saw the "engineering" profession as:

> ... the professional choice of the "working class" in contrast to the middle-class choice of "law" or "medicine" (ProfF, Institution B, 9 February 1993).

Socio-economic differences were highlighted in contrast to cultural differences by the "generalised other" organisational career (eg, Edgerton, 1994). Other professors focussed on specific attributes of different fields of engineering. For example, Professor D's vocational construct of electrical engineering:

> Ah, well it's the application of ingenuity to the generation, utilisation, and distribution of electrical energy. Part of the utilisation being, of course, the field of electronics and communication (ProfD, Institution A, 15 February 1993).

He reinforced that electrical engineers:

> ... are *per se* not demanding in spatial knowledge. They are demanding in terms of clear thinking and are demanding in terms of analytical ability. And they are demanding in terms of clear perception of what ..... you're after (ProfD, Institution A, 15 February 1993).

He expanded on how the tasks of the electrical engineer differ from those of the mechanical and civil engineer:

> The people in mechanical and civil might well say slightly different, ... with civil engineering you might require the spatial concept far greater than the electricals (ProfD, Institution A, 15 February 1993).

> ... The electrical are not actually building things and trying to imagine industrial designs and structures from A to B, we deal with something in a very simple manner which is usually on a line from A to B and it is the analytical aspects of the connection from A to B that is more applicable to us (ProfD, Institution A, 15 February 1993).

Yet, he emphasised that "creativity requires to be very high in all areas of engineering, certainly no less in electrical areas":

> It is a creativity like handling an unseen. Creativity of the appreciative practical outcomes of what really are ... the mathematical models in your mind. [See those models]. It takes a fairly special type of person to do that (ProfD, 15 February 1993).

His view on creative craft was reinforced by Professor C:

> ... ingenious - Ingenue - that's French for engineering ... [they deal with] the conversion of energy in its various forms ... [producing] maximum efficiency ... [and the] elimination of uncontrollable vibrations (ProfC, Institution A, 1 March 1993).

This rich construct of the process of engineering as a craft, its practical nature and engineers needing mathematics and applied science, with the ability to problem-solve and be creative linked well with the transitional generalised other standpoint.

Professor B and Professor H too identified engineers as "designers" who:

> ... have the ability to design a chemical process ... and large scale plants (ProfB, Institution A, 9 February 1993).

> ... are specialist developers of technology through the application of scientific knowledge' ... (they are) dealing with large energy systems ... with designing at the heart of everything we produce (ProfH, Institution B, 27 February 1993).

The latter, however. emphasised electronic engineering as the "application of scientific knowledge", rather than design evolving from a craft. This foundation equated more with the standpoint of the traditional generalised other.

Unlike the others, Professor A emphasised the role of electronic engineers as managers, who would provide Australia with "enlightenment", especially by becoming internationally-minded:

> good people are the engine of success. Oz has stoneage management. It's an enabling process for twenty of the best engineering undergraduates to visit world wide ... when things should happen (ProfA, Institution A, Telephone Call, February, 1993).

This view of entrepreneurial management, both locally and internationally equated with the transitional "generalised other", where ingenuity was not limited to either the actual process of engineering or to local management.

Both Professor C and Professor E commented on how computers have had the power to revolutionise the "lock-step tradition of the engineering process" (Professor C, Institution A, 1 March 1993) with:

> The capacity to explore the solutions that computers are giving to people ... people working on common problems and the thought processes, it is going to be remarkable ... computer integrates architecture, electrical, mechanical bring them all together ... [We have] the potential to comprehend all at once ... people can leap-frog roles ... (ProfE, Institution A, 9 February 1993).

These two professors were envisaging the amazing possibilities of the engineer to creatively represent and construct new realities through the prosthetic technological arm of computer soft and hard ware systems (eg, McLeod & Cropley, 1989), which equated with the transitional "generalised other" conceptualisation.

Professor J added the final dimension of the caring engineer "collaboratively":

> working in a team of like-minded others ... they are the most motivated problem-solvers for the needs of society (ProfJ, Institution B, 3 February 1993).

His altruistic disposition had implications for transforming the undergirding values and practices of the profession.

In relation to Research Question 2, like the generalised other, the collective concrete other perspective was transitional in its conception of engineering as a synthesis of traditional craft and ingenuity with computerisation and the application of principles of applied science, undergirded by an ethic of care and the need for engineers to be collaborative.

Generalised Other and Concrete Other - Positioning of Women as Engineers.

In view of the gender agenda, I probed the place of women in engineering and engineering education further. Like Sargent (1991), McKay (1994) saw the need for more women in engineering both at university and in employment to help the profession cater more equitably for the needs of its clients. He believed that leading enterprises should be supporting programs to enhance their recruitment (p. 17). His motives were related to sustainable competitive advantage and business success, rather than focussing on catering for women's intellectual needs or humanising the profession. In

consequence, the issue of potential discrimination and lack of adaptability of the profession towards women was not his central concern (p. 17), as it was with feminist researchers in the field (see Chapter Three), the feminist voices at the Australian conference (Armstrong & Godfrey, 1994; Boman & Lewis, 1994; Lewis & Roberts, 1994; Trigg, 1994) and a few concerned educators working collaboratively with women (eg, Ford & Ford, 1994; McGregor & Marks).

From the concrete other perspective, Professor G challenged my conception of engineering as a 'male dominated' profession:

> I do not think there has ever been any real obstacles in the way for women to do engineering and there has been a public perception. Women in engineering go back a long way ... [there was a] very well known woman in engineering before the turn of the century ... (ProfG, Institution B, 2 February 1993).

Interestingly, he did not name her and added that "such obstacles":

> come from outside rather than inside the profession ... so that it is viewed as a male dominated profession and is for males only, that not being the profession's view (ProfG, Institution B, 2 February 1993).

The following response from Professor C, which I have dubbed the "pedestal" response, was characteristic of the older heads of department:

> ... female ... a mechanical engineer of the North-West ... if we could have had her cast in bronze and put outside the building we would have done. She took the course seriously and she worked hard ... She didn't take any unfair advantage, she was a lone woman ... no one thought of her as a woman student ... just as an engineering student ... and it's just the same for most of the young ladies who are sensible enough to choose mechanical engineering (ProfC, Institution A, 1 March 1993).

This reflected a view of women as engineers "existing as exceptions" (Andersen, 1987), where such a belief system could "never imagine women and other underclasses as fundamental to social change and continuity" (p. 235). Of his female students, whom he classed as "young ladies" he added:

> Most ... are treated no differently from the fellas. Most ... have been an absolute pleasure to work with ... if they need their horoscopes reading to them, they get it read ... if late with a lab report, [they] get a short sharp jolt ... no preferential treatment (ProfC, Institution A, 15 February 1993).

Professor C also named and positioned some women students as "girls" flaunting their sexuality:

> Some girls just come to enjoy the good life ... [they] move around with a band of fellows ... so few of them ... give me a population of 50/50, then we can start getting some meaning for figures ... [We're] getting (the) best through on the whole ... some take advantage of their sexuality and their popularity, being the only fish in a big pond ... and Some you have to get in here and say

> you are using the wrong organs, use these (points to eyes and ears) instead (ProfC, Institution A, 15 February 1993).

A woman's acceptability in engineering education from his traditional standpoint was that she was acceptable if she was a 'lady' and fitted into a group identity as 'one of the boys' (ProfD, Institution A, 15 February 1993). As Jaggar (1989) suggested men's heightened awareness of women's sexuality served to alienate women from their intellectual pursuits and value as individuals.

Some faculty attempted to rationalise the issue of differences between male and female engineering students by creating a "person-vocational environment" fit, in matching a whole group personality with their chosen branch of engineering. Professor G's viewed his students as a:

> Different type of person ... both male and female ... women come in because [they] are motivated ... they come in against that from other people ... and they are a different sort of person (ProfG, Institution B, 9 February 1993).

> There are hardly any smokers ... [this is] not a new phenomenon ... out of a class of 100, there was about two that smoked. Typical in university ... 60 out of 100 that smoked. Very few hyper-active ... particularly civil and chemical. On the surface, a different type of person that does something like electronic engineering ... more like scientists (ProfG, Institution B, 9 February 1993).

Professor H held a similar perspective:

> Perhaps a little quieter side of student body ... we enjoy having girls in class ... they have a moderating influence ... in contrast to mechanical engineering, always a perception of a man's profession ... because the size of things is not the issue ... my speciality is micro-chip design ... [There is] not a perceived strength aspect or manliness aspect (ProfH, Institution B, 27 May 1993).

The personality differences between engineers from different branches was an unanticipated outcome and had not raised by the generalised other organisational career. Although I sensed that it was an attempt by Professor G and Professor H to avoid the gender agenda, his way of breaking down the stereotype of the macho engineer was positive.

In sharp contrast, Professors E and F were more socially critical about their own attitudes towards women and gender differences. Both reflected on their own, women's (including wives), and their children's career patterns, choices and decision-making:

> We have never yet valued the contribution of women ... society has set up certain expectations ... when our daughter said she'd like to do engineering ... we never questioned our children's choice" (ProfF, Institution, B, 9 February 1993).

Professor E admired the way one women had managed the role of engineer, with all her other roles:

> An Engineer ... a woman [with] three children ... [in the] main roads department ... A part-time worker ... [she] still impresses me very much ... successful, also as a woman. Life-balance ... [is] a personal-professional great achievement (ProfE, Institution A, 9 February 1993);

and acknowledged women's disadvantage in engineering as a minority:

> If you are a minority, you will be pulled down. With study ... these girls have the will power to get over it, if they make up (their) mind to succeed (ProfE, Institution A, 9 February 1993).

This awareness was carried into his educational practice, where he exercised affirmative action in his selection of a female doctoral student, because the "profession would be enhanced with my PhD student":

> ... in her lab work, working like anyone else ... physical naturally there is a physical difference ... lab classes lifting of heavy things ... some adjustments [had] to be made (ProfE, Institution A, 9 February 1993).

He was also sensitive to an obstructive husband at home and her career doubling as a mother and doctoral student:

> I am sure Astrid will do well as a researcher and contributor to the profession ... ... Astrid has a little boy ... (along with the very poor attitude of her husband) ... it takes a lot of understanding ... (ProfE, Institution A, 9 February 1993).

Overall, in relation to Research Question 2, there was a range of positioning of women from the concrete other perspective. Men's understanding of gender relations, especially Professor E was transforming, and rare from both the concrete other and generalised other perspectives (eg, Ford & Ford, 1994). This showed a small shift in treating women as individuals.

Generalised Other Organisational Career - Structural Organisation

Fairclough's (1994) catch cry was "engineering our future". The impact of the recommendations of the Williams report (1988) had been assessed by Caldwell, Johnson and Anderson (1994). There was a range of responses in the conference papers. Cole (1994), by comparing changes in engineering overseas, bemoaned its lack of vision and focus on issues pertinent to the actual preparation of engineers and to promoting research in the Australian context. Aspects of the report dealing with gender equity in

engineering education were interpreted in a limited way by traditionalists (eg, McKay, 1994), but interpretations of gender justice that were designing education to prepare women for an occupation that would only enhance the economy was under close scrutiny by transformist feminist educators (Armstrong & Godfrey, 1994; Boman & Lewis, 1994; Lewis & Roberts, 1994; Trigg, 1994). As major stakeholders, students, as individuals (Lawson, 1994) and collectively (Duggins, 1994), were finding a voice on engineering education, lecturers' effectiveness and their own future roles as engineers. Their negative view of lecturers may have been exacerbated, because as selected undergraduates they expected higher standards, and/or perhaps it was the result of "unsatisfactory staffing" where the better professionals were not being financially "tempted" to pursue a university teaching career (Duggins, 1994, p. 311).

The gender regimes of engineering education were changing. Women in academe were present, but in the minority as leaders in engineering education (eg, Buckowska, 1994; Ginige & Ginige, 1994; Johnson, 1994; McGregor, 1994; Munoz, 1994). Most tended to work collaboratively with men to effect transformative change (eg, Howard & McNamee; McGregor & Marks, 1994; Tibbitts, Collits & Lucas, 1994; Waddell & Taylor, 1994). There was evidence that women across universities were working to promote gender equity through dialogue with male engineering educators (Bowman & Lewis, 1994).

In defence of the "generalised other" organisational career, there was a concern for the professional development of lecturers (eg, Grenquist, 1994; Trigg, 1994). Like Trigg (1994), Lewis and Roberts (1994) at the *National Centre for Women*, were working collaboratively to encourage faculty to initiate a first year unit so that lecturers and students could examine the way traditional gender expectations had affected the masculinist construction of engineering and engineer, and the culture of engineering; and to develop equitable social relations and communication skills befitting men and women professionals at the outset of their education. These latter partnerships of women were still working against, what I have deemed, the 'hard edges of engineering' to effect change.

I also found that organisational structures in engineering were in transition where regime boundaries were breaking down to work cooperatively with other stakeholders. According to Spencer & McGrath-Champ (1994), the thrust was towards "continuous improvement in professional practice", where the interrelation between the industry and the universities was "one of mutual need" in "preparing new engineers" by sharing the "burden of financial support" (p. 57). They urged educators to lead by example within the Institution of Engineers by credibly exceeding the standards set by government, industry and community expectations (p. 58). Some faculties were working collaboratively with consultants from industry (eg, Birtwhistle & McKinnon, 1994). Some were forming partnerships of "workplace mentors", university staff and students to improve practicums and be enriching for all (Gowing, 1994, p. 419) and other companies were supporting students financially (Linley, 1994; Saini, 1994). Inter-university colleagues were combining expertise by using videoconferencing technology to enhance the quality of courses for post-graduates (eg, Town, Braun & Hudson, 1994). There was also a move for engineering to work as a team with other faculties, such as: using the expertise of a centre for effective learning and teaching (Else, Nunn & Maconachie, 1994); collaborating with a director of Asian studies and the school of humanities and social sciences (Blackman & Quinn, 1994); and working with equity officers to enrol more women and change current students' image of engineers (Howard & McNamee, 1994).

Industry, likewise, was seeking "University trained brains" to "solve detailed manufacturing problems" (McArthur, 1994, p. 217), and putting forward their own ideas for undergraduate courses to produce engineers of this calibre (p. 218-222). Similarly, Walkington (1994) benchmarked faculties of mechanical engineering on their ability to formally promote teamwork as an outcome from the perspectives of final year students. Drew (1994) focussed on the new world of technology and the need for universities to meet "market needs of cost effective holistic development of students", yet conserving the "notion that learning is fun" (p. 75).

Concrete Other Organisational Career - Structural Organisation

Given Professor E's and Professor F's acknowledgment of the need for affirmative action for women, I probed further on the standpoint of the other men in regard to their implementation of policies (eg, Williams, 1988). Professor D explained that in electrical engineering:

> We don't have any women on staff. That's sad - I wish we did. ... We don't have women applying for the positions - they can all do far better outside ... I think we unfortunately can't be allowed the capability of patronisation (ProfD, Institution A, 15 February 1993).

Similarly, Professor H found:

> At the end of the day, fewer [women are] going into the profession ... inevitable ... applications come from men. We have 24 academic staff and 1 female, we'd like more ... I haven't looked at the latest batch to see if there are any women ... With equal potential I would be inclined to select the woman. I believe equality does mean equality, it does not mean patronage ... it would be an insult ... if you applied simply because of your sex ... now what you should ask me is how I perceive all things are equal (laughs) (ProfH, Institution B, 27 May, 1993);

and Professor J agreed that:

> At present [we have] no women staff members ... nor had any apply in the past 5 years ... so far it's no (disadvantage), I see the reality in running a department is to be truly competitive you hire the best and if that happens to be a woman that is the person you should hire. You can't afford to discriminate if you want quality people on your staff (ProfJ, Institution B, 2 February 1993).

Professor D and Professor G had appointed postgraduate women students as tutors:

> Yes, we do have post-graduate women helping. [Involved] to some degree [in] tutorials - but mainly in the laboratory ... that is where we prefer the post graduates to be rather than into the tutorials and lecture situation (ProfD, Institution A, 15 February 1993).

> ... I've just appointed two part-time women ... Ph D's not awarded yet ... So few women professionals ... many in very good jobs ... it would be perceived as a step down to take an academic job ... certainly in salary ... [there] aren't many women experienced in design (ProfG, Institution B, 9 February 1993).

Like others, Professor G perceived that women were at fault in never applying. He presumed women did not want a post in academe and inadequate in design.

In relation to Research Question 2, the professors lacked awareness of their own "organisational resistance" (Cockman, 1991) and the "glass-ceilings" (Bacchi, 1993) that they were imposing on women's entry and career progression as possible academics. This was in sharp contrast to the "generalised other" organisational career, where women academics were working collaboratively with men and a minority had adopted leadership roles.

As discussed earlier in the chapter, some professors were actively involved with recruitment, alongside the WISE coordinators. In regard to affirmative action for girls' recruitment, Professor G explained:

> We have had a very active programme for many years going out into schools ... in particular saying ... look engineering is not just for males it is for females too ... this is way before the socialistic affirmative action programmes were introduced ... so we don't practise Affirmative Action here, because I have seen the destructiveness of affirmative action ... we would be happy to have even numbers ... (ProfG, Institution B, 9 February 1993).

More disturbing to me was the under-current of antagonism exemplified in the "sub-text" (Aiken et al, 1987) of most other responses:

> … to focus too much on the gender issue is to trivialise my mission ... young women like JC & JW have the capability to move onward ... women, with a will, succeed (ProfA, Institution A. Telephone Call, February, 1993).

> Important? - not at all - in fact if anything affirmative action is a negative for women, because it tends to get people's backs up - so we have never practised affirmative action here ... we have been very fortunate we haven't had any radical feminists in last year ... well balanced [women students] (ProfG, Institution B, 9 February 1993).

> Getting back to this equal opportunity and affirmative action - I believe it has no effect on the way we operate in this department - it is not necessary - there hasn't been negative nor has there been positive - it just happened (ProfB, Institution A, 9 February 1993).

> Equal opportunity /Affirmative action policies haven't made any difference to the operation of this department as far as engineering students, be they male or female [are concerned]... but what we have found is the small number of females is damned good ..." (ProfC, Institution A, 1 March 1993).

Even Professor F warned against the "danger of social engineering ... ":

> … [it] has some questions to answer ... in general reason with wisdom [prevails] ... 'Dean, I said, if get more than 20% you are doing well' ... it is a critical mass ... once [you've] broken 15% ... [with] good support ... [it bears] fruits on our corridors, largely of the operation of the WISE coordinator (ProfF, Institution B, 9 February 1993).

My question about affirmative action was often re-focussed by the professors on the needs and problems of male students (Aiken et al, 1987), a representative response was:

> We have a certain problem with the male students ... parents wanted them to be doctors ... [they] come into engineering against parental wishes and advise ... particularly now ... medicine is seen as getting a prize for getting a good TEE mark which is unfortunate (ProfG, Institution B, 9 February 1993).

Whilst I did not dispute the legitimacy of this issue of men's career choice and engineering education experiences (eg, Duggins, 1994; Lawson, 1994), there was a decided unease in these male academics' discussion of policies related to women

students' issues. Their responses reminded me in a salutary way of Aiken's (1987) belief that "men remain the measure of human significance and signification" (p. 268).

Generalised Other Organisational Career - Gender and Cultural Milieu

There was an increased awareness and sensitivity by a few mainstream educators regarding the gendered cultural milieu of engineering education (Ford & Ford, 1994; Grenquist, 1994; Hands & Younger, 1994). The issue of the "masculine" and the taken-for-granted nature of engineering as a neutral, objective practice was raised (by a male engineering educator working with a female sociologist) as a key philosophical issue for men in 1994 (Ford & Ford, 1994). The latter advocated that these assumptions must be challenged and reflected upon by men as a necessary first step to promote gender inclusivity in engineering. They, with a few women (eg, Lewis & Roberts; Trigg, 1994), were implementing changes by revealing the hidden curriculum of gender to the new generation of men and women students in the forum of the formal curriculum. Women were deliberately teaching for change in this conference setting, by looking with the men at deep-seated values related to gender, class and race in a non-coercive and non-threatening way (Lewis & Bowman, 1994; Lewis & Roberts, 1994). This indicated to me, what Berger and Luckmann (1966) referred to as, a "rupture" between men's "visible conduct in the larger community" and each man's "invisible identification as a person in transition" (p. 187) within the context of engineering education. These were welcome exceptions, although the issue of "power-over" gender relations and the chilly climate for women was for the most part still embedded in the culture of engineering education in Australia (eg, Lewis, 1994).

Concrete Other Organisational Career - Gender and Cultural Milieu

Professor D believed there was no longer a problem for women students:

> I perceive zero harassment, I think we are dealing with a slightly different student population from half a dozen years ago ... [they are] enlightened ... [we've] shifted from the sort of national background of a dozen years ago, [now we're] characterised as a New Australian. I have not detected the slightest hint of harassment in any form (ProfD, Institution A, 15 February 1993);

and he was positive about the quality of interaction that lecturers exhibit, as teachers and counsellors:

> I cannot speak for every situation in every class, or every period of counselling in an office it is my perception that as close as one could define/perceive there is a quality approach from staff and male students when dealing with a colleague in a laboratory male/female - there seems to be, to me, an absolutely quality approach. I cannot detect any difference when I am in a laboratory (ProfD, Institution A, 15 February 1993).

In contrast, Professor F had noticed the positive ambience created by the women students:

> Corridors [have] changed ... girls are more conscientious ... [they] follow up assignments. (I'm) more conscious of [their] presence than numbers (ProfF, Institution B, 9 February 1993).

He targeted the male students, rather than staff, for harassment of women:

> The biggest problem for women students is the male students ... not sexual harassment, simply 'putting them down' and suggesting they are 'not up to it' ... well it is very difficult (to counter) because it does not always come out ... never comes to staff (ProfF, Institution A, 9 February 1993).

Professor G, too, had received complaints about men students' arrogance from women students:

> Certainly I have had complaints in the past from girls in physics laboratory class where the male sort of takes over and say "we'll run this you stand there and do what we tell you sort of thing" - that's certainly a disadvantage to the 'girls' ... (ProfG, Institution B, 9 February 1993).

Yet he emphasised the full equality of his women students and the disadvantage of the men, because women were "better" known by them:

> ... but the 'girls', now with women being in such small numbers, that you get to know a lot of those ... So in some respects they do have an unfair advantage, because people know them better ... our girls very much tend to be leaders rather than followers and they (women) are playing an active part ... I would say certainly full equality of engineering (ProfG, Institution B, 9 February 1993).

That some professors had awareness of gender power over relations of male students, though not their lecturers, supported the literature on continuing gender harassment in engineering education in Australia (eg, Lewis, 1994).

Concrete Other - Policy in Action for Pastoral Care of Women Students

Professor D placed responsibility for his women students' pastoral care and welfare needs on the institution, rather than his own department:

> We operate on the assumption that the necessary difficulties, but not that difficulties will be necessarily worked out prior to the time they arrive and throughout the course - not by us - but by elements that are put in place by the university, child-care comes obviously to mind (ProfD, Institution A, 15 February 1993).

Such comments, in contrast to the transitional trends in the generalised other organisational career, tended to confirm a limited construct of equality of opportunity in action.

In terms of women students' first year, Professor D was aware "there is a slight hiccup" for women, explaining:

> … their perception [of their ability] isn't necessarily there. No they ... the women are not [followed up to ascertain reasons why]. Almost through lack of resources. Neither are the males (ProfD, Institution A, 15 February 1993).

Regarding the lack of counselling, he explained "I guess everybody else says it is somebody else's problem":

> ... We operate on the assumption that the necessary difficulties, [will] not ... necessarily [be] worked out prior to [the] time they arrive ... elements are put in place by the university (child care comes obviously to mind) ... (ProfD, Institution A, 15 February 1993).

He added:

> Once they are in and doing it and it is what they want to do ... they go ahead the same as the boys. ... we have had females perform too well to say that we are putting some hidden obstacles in their way (ProfD, Institution A, 15 February 1993).

When asked about women student drop-outs from the course, Professor G rationalised that:

> … we certainly had a lot of women fail in the early years ... just as we had lots of males fail. Has to do with the particular personality attracted towards engineering (ProfG, Institution B, 9 February 1993).

Professor J "did not know the breakdown of men to women" dropping out in first year, but explained the phenomenon in a different way:

> The work-load is very high, the realities of dealing with heavy course, motivation, professional standards of Institute of Engineers, are more the causes of attrition rate (ProfJ, Institution B, 3 February 1993).

Dropping out was equated with personality mismatch with engineering and with external situational standards determining the difficulty of the course. As a counter to following up drop-outs, Professor J remarked:

> I'm not up to date with failures, but [we're] tracking successes ... It's helpful establishing that linking (ProfJ, Institution B, 3 February 1993).

It was, in his opinion, the role of the WISE project coordinator "to recruit the best and maintain [and] support the best women" (ProfJ, Institution B, 3 February, 1993).

> We want the best [students]... [they] seem to be women ... [we have] need of enhancing engineering by "building up like-minded others in terms of the best, most motivated, future problem-solvers for the needs of society (ProfJ, Institution B, 2 February 1993).

He did not appear to connect the presence of women faculty as an advantage in attracting and mentoring female students. Only successful women appeared to be valued by the professors. In contrast to the "generalised other", the retention of all the women, including potential drop-outs, did not appear to be a priority.

Generalised Other - The Gendered Nature of the Engineering Curriculum

I found that the conceptions on curriculum were closely allied to the underlying values espoused by its proponents and could, with ease, be placed along the change continuum from traditional at one end, to transitional in the centre and transformational at the opposite end.

<u>Generalised Other - Recent Graduates' Voices on the Curriculum</u>

Lawson (1994), as a student, focussed on the specific ethical issue of sustainability and its impact on his decision-making as a future engineer.

Duggins (1994) analysed the views of 52,000 graduates from 29 universities *per se,* on the quality of engineering education. It was the opinion of graduates in engineering that learning ought to be constructed from the real world of engineering, Collectively, the perception was that they were worked "hardest of all disciplines", with a comparative lack of clear goals and standards (p. 311). They considered that the teaching they received was of poor quality. However, these graduates had been helped by the content selection to become "more skilful" in generic skills, such as "problem-solving, analysis, team work, written communication and planning" (p. 311). They

criticised assessment because of its inappropriateness and heavy emphasis on "knowledge of facts" and the "excessive part played by memory" (p. 311).

Generalised Other - Masculine Conceptions of Engineering Curriculum

The major frame of reference for the traditional masculine standpoint was the wealth and power needs of our society (Dunlop, 1991). The curriculum reflected this in its strong focus on changing roles of engineers, the learning outcomes set down by the profession of engineering (Pratt & Else, 1994), and in meeting the needs of an increasing number of private consultancies in Australia and overseas (Avery & Kaminski, 1994). Drew (1994) advocated a praxis model for students with its motivating link to vocational training.

Sirkka (1993) had expressed the need for a global challenge to link engineering with environmental issues. Hence, it was not surprising to me to find that some contributors were from faculties looking at the macro context of engineering in regard to the plight of third world countries and the need for engineers to play a significant role in maintaining the political, social, economic and environmental stability of the planet (eg, Bryce, 1994; Waddell & Taylor, 1994). Bryce (1994) found this was best effected through project management in these countries where the recipients' had control over their own destiny, strengthened by participatory community structures, with an assurance of the equitable distribution of benefits and costs. Others, like Travers (1994) introduced units of study for Australian students in ecology and legal systems. Such concern represented a transition in thinking about the implications of engineering and the role of engineers. This was, in part, commensurate with the feminist "ethic of care" discussed elsewhere (eg, Kock, 1990; Noddings, 1984; Rose, 1994).

Generalised Other - Impact of Feminist Conception of Engineering Education

I found that papers by feminist researchers emphasised the special needs of women as their major frame of reference. Hence, they advocated the need for collaborative learning for women and quality participation in groups (Armstrong & Godfrey, 1994; Boman & Lewis, 1994; Trigg, 1994). It was apparent that women, working with

engineering educators, were transformational in introducing deliberate interventions to develop students' awareness of gender imbalance, and to change men's perceptions of the experiences and beliefs of girls in non-traditional areas, more specifically in engineering. Wilkins (1994) was concerned about ways of introducing ethics and professionalism into the engineering curriculum, starting with self reflection and the use of Koehn's (1991) survey approach.

Generalised Other Curriculum Organisation - Connections for First Years

There were efforts to develop a "multidimensional model for curriculum design" to link the formal curriculum to individual learning styles, career development, and to the profession, from the outset of their degree course to graduation (eg, McGregor & Marks, 1994). The first year programs represented in the Conference papers could be described as transitional, where lecturers were linking students more closely to an expanded and more inclusive concept of engineers, real-life engineering, and different branches of engineering and to mathematics, technology, and creative problem-solving (Bradley, 1994; Ford, 1994; Jackson, 1994; Lewis & Roberts, 1994; McGregor & Marks, 1994; Silyn-Roberts & Fenwick, 1994; Tibbetts, Collits & Lucas, 1994; Trevelyan, 1994; Trigg, 1994), sometimes in collaboration with WISE coordinators (eg, Armstrong & Godfrey, 1994; Lewis & Roberts, 1994). Other units focused on the ethic of care, by creating awareness of environmental and societal issues (eg, Silyn-Roberts & Fenwick, 1994) and how gender equity might be achieved between men and women in engineering (eg, Lewis & Roberts, 1994). In practice, women and men students were encouraged to work in teams and model equal partnership roles in and outside the faculty (Howard & McNamee, 1994).

Generalised Other Paradigm shift - Design in Engineering Curriculum

The paradigm shift in curriculum development also emphasised the importance of design and documentation for engineers (McGregor & Marks, 1994; Lawson, 1994). There were units where applications of multi-media (Durack & van Erp, 1994) facilitated a "design and make and redo if need be" approach for students (Luketina, 1994); a project based approach in a design education unit (Boysen, 1994); and a unit

where a "design and build" competition was incorporated (Magin & Churches, 1994). These were initiatives that were very much in the spirit of constructing engineering as a collaborative creative craft and with the feminist conception of engineering education as real-life problem-solving (Armstrong & Godfrey, 1994, p. 62), rather than evolving from the discourses of science and commerce (McGregor 1994, p. 106).

Generalised Other Curriculum - Knowledge, Process, and Thinking

Strongly influenced by the research of Ramsden (1985, 1992, 1993), there was a transitional curriculum focus on how students learn and think, with increased student involvement in constructing knowledge in engineering (Drew, 1994; Hanley & Hadcraft, 1994; Hargreaves & Wallace, 1994). In addition to understanding student perceptions of learning, how they process information and what motivates them, educators were appreciating the value of experimentation in practising generic skills and problem-solving (Kanapathipillai & Magin, 1994; Thambiratnam, Ferreira & Franz 1994; Ulmer, 1994). Greater attempts were being made to help students acquire concepts in structural engineering, by encouraging a deep approach to learning (Taplin, 1994) and the use of reflective professional journalling (Murgatroyd & Button, 1994). Several papers highlighted the importance of a curriculum that also provided a comprehensive range of creative problem-solving learning opportunities for students (Seidel, Hadcraft & Eley, 1994; Magin & Churches, 1994; Walkington, 1994), with a strong emphasis on team approaches to foster creativity. The students were assessed on a competency basis, and encouraged to evaluate the process, in regard to how well they performed "the work of a professional", "thought like a practitioner" and used "their brains autonomously" (eg, Ford, 1994, p. 558).

Generalised Other Curriculum - Changing Role of the Lecturer and Student

Commensurate with the adoption of a deep approach to learning, the central role of the lecturer as facilitator was emphasised (Hadi, 1994; Liston, 1994). Consequently the role of students changed with encouragement to reflect and grow as engineer and to become more expert (Ulmer, 1994) with a focus on the use of professional journals to evaluate their own professional development (Murgatroyd & Button, 1994) and to self-evaluate

products (Liston, 1994). Lecturers, as advocated by Evans, Bleakley, Crouch & Yamaguchi, (1993), were increasingly catering for differences in student learning styles (Hargreaves & Wallis, 1994; McGregor & Marks, 1994; Pratt & Else, 1994). There was no reference of these lecturers assessing their own preferred learning and management styles (eg, Claxton & Murrell, 1987) as facilitators when implementing such a problem-posing curriculum to enhance the quality of learning (Duggins, 1994) of an increasing variety of students, including women. I raise this omission in discussion of the "concrete other" organisational standpoint later in this chapter.

Generalised Other Curriculum - Generic Skills and Fun

Other educators emphasised the need to develop student awareness of, and competence in, generic skills in engineering (Aubrey, Boswell, Jarman, Leaney, Lewis, Lowe, Mallon, McKain, Scott, Taylor, Webster, & Yasukawa, 1994), including visual skills and drawing skills (Trevelyan, 1994; Taplin, 1994) and literacy competence in documentation for the new engineer (McGregor, 1994). Some papers were self-evaluation reports of lecturers on better ways they themselves had found to teach and learn fundamental principles of engineering (Karim, 1994); to develop visual skills through drawing (Taplin, 1994); and to help students to think more deeply through play with hands-on simulation experiences (Liston & Heldt, 1994), as Kerr & Pipes (1987) had advocated. These approaches were valued most by recent graduates from Australian universities (Duggins, 1994), which supported Bordin's (1994) theory on the interconnection of work, play, and curiosity.

Generalised Other Curriculum - Computer-Assisted Learning

A continuing trend (Quinn, 1993) was the strong emphasis in using computers, as the prosthetic arm in problem-based learning (Luketina, 1994); for problem-solving, problem-posing, and design (Allen & McKenzie, 1994; Ford, 1994; Hadi, 1994; Taplin, 1994) for real-life situations (Paks, 1994; Seidel et al, 1994), and through virtual reality (Ulmer, 1994). Others reinvented the undergraduate laboratory by integrating theory with practice using virtual reality (Teakle & Radcliffe, 1994). Computer-assisted learning was becoming the norm (Devenish et al, 1994a, 1994b; Lyons et al, 1994; B. J.

Stone, 1994; Wilson & Luketina, 1994) and used in a variety of ways ranging from facilitating understanding of fuzzy logic in engineering (Hu, 1994; Reznik, 1994); multimedia delivery in maintenance management (Saini, 1994); to exploiting non-linear information structures to deliver computer assisted education using hypermedia to support different learning styles (Ginige & Ginige, 1994) and to encourage student-centred learning and problem-solving (Hadgraft, 1994). Computers were also being used to create an interactive multi-media interface between student and teacher for development of problem-solving skills in the field of mathematics that can be applied later in engineering education (Durack & Durack, 1994). Interestingly enough, the issue of computer-assisted learning and women's level of self-efficacy was not raised. Feminists had signalled this as a critical issue (see Chapter Three) and will be re-addressed by me through the "concrete other" organisational standpoint later in this chapter.

Generalised Other - Vexed Question of Availability of Valuable Resources

Whilst there has been an escalation in multimedia delivery (Luketina, 1994; Saini, 1994); and the use of hypermedia materials, to encourage student-centred learning (Ginige & Ginige, 1994; Hadgraft, 1994), there were undergirding concerns about cost reduction in course delivery regarding human and material resources, the production of "affordable" computer programs (Hadgraft, 1994) and financing of computer infrastructures (Ginige & Ginige, 1994). Postgraduate courses, such as "maintenance management" (Saini, 1994) were integrating learning by linking with industry and sharing scarce resources (Drew, 1994). Due to shortage of resources, third year chemical engineering students were encouraged to complete practical work in structured groups of three (Crosthwaite, 1994), which fostered the collaborative learning outcome required for future engineers.

Generalised Other - Assessment of Quality Education in Engineering

To enhance quality in engineering education, there was a move from the traditional lecturer-led pedagogic subject based curriculum model to a competency-based, outcomes-driven curriculum (Pratt & Else, 1994). This was characteristic of an

"andragogical" or adult learning model (Attard, 1994). Alternative assessment procedures to promote deep learning and student responsibility for their own learning were evident in a number of papers. This led to levels of competency being defined with clear indicators of such performances for engineers (Hessami, 1994a). There were also positive moves towards lecturers' self-assessment of teaching strategies and innovative programs (Parr & Johnston, 1994). This was pervaded by an eagerness to gain feedback on their efficacy from other professionals in the field (eg, Reznik, 1994) and their own students (Tibbetts, Collits & Lucas, 1994).

Changes in student assessment include a range of innovations. Research on computer managed learning and student self-paced assessment was being funded and implemented (Devenish et al, 1994b; Ilango & Cook, 1994), with an emphasis on "user friendliness" and diagnostic feedback (Stone, 1994). There were assessment strategies to ensure learning from laboratory work, with interactive and immediate feedback and report writing (Dabke & Phillips, 1994). It was found that when laboratory sessions incorporated formative peer evaluation, this served to improve design and problem-solving strategies, as well as communication skills for future engineers (Reizes & Magin, 1994; Young & Barnes, 1994). Peer assessment (Scott & Watson, 1994) was also serving to promote students' sensitivity in recognising and evaluating quality in design, both process and product. The use of a logbook for distance education students to record specified practical work experiences fostered their critical observation, interpretation and assessment skills (Gowing, 1994; Walkington, Pemberton, & Fulcher, 1994). This transformational model of assessment also opened the debate regarding open and closed book examinations. For example, one lecturer was developing quality in problem-solving by providing "lecture prepared formulae sheets" on how to study and problem-solve at the start of semester (Hessami, 1994b). Based on research and observation, students reported that they learned better when diversified assessment methods were used (Nag & Abdel-Aziz, 1994).

Concrete Other Organisational Career - Conceptions of Curriculum

Again, I compared the "concrete other" conceptions (obtained from my interviews with the professors) with curriculum-related aspects of the "generalised other" described above. Professor D held an eclectic curriculum conception that was transitional. Although he imparted knowledge through lectures, he favoured the "practical laboratory":

> ... where students can in fact solve a problem, that is produce a model of how things behave in a laboratory, just as well as they can mathematically by derivation on the board (ProfD, Institution A, 15 February 1993).

He also emphasised the importance of technological skill development and competent use of the computer. He saw his "effective skill" as progressively helping the student to become an independent or "good" learner, and to make himself "redundant":

> ... In fact that is part of the open door policy. The students come, in the early days, expecting answers and they find they don't get answers, but they get more questions which point them in the direction of the answers (ProfD, Institution A, 15 February 1993).

He found that the student who "avails" him/her self of that, are:

> Middle of the road towards the struggler ... more than the bright student [and they learn to ask] "Hey look, I'm at this point but I'm stuck here?" or "what do you think of this idea?" (ProfD, Institution A, 15 February 1993).

He encouraged informal discussions on problems with their peers:

> ... usually sorting things out by themselves which is excellent [and] what you have to do as a engineer... (ProfD, Institution A, 15 February 1993).

> Certainly when I was a student ... one has a group ... and a problem arises whether A, B or C. You're going to chat it out. And that is the same now. [These] are to a large extent individual projects and the peer group should talk things through (ProfD, Institution A, 15 February 1993).

Professor H described how he moved his third year students towards creativity , where their focus:

> … is on the art of electronics ... asking them how to learn, how to be imaginative and to imagine design ... visualise what can happen in electronic terms ... that is where art stops and logical processes take over to meet certain specifications. Science certainly involves a lot of creativity (ProfH, Institution B, 27 May 1993).

Professor F also acknowledged that problem-solving activities in third year engineering required a "big conceptual switch":

> … students have to make is round about third year, [we] start teaching them to design and having to make them realise that they don't have a single answer (ProfF, Institution B, 9 February 1993).

With their more mature students, Professor F and Professor H had emphasised the development of cognitive processes, with creative design as the major outcome.

Professor C lauded the resurgence of the "sandwich course" model of engineering in the United Kingdom which is "still used" in Germany, France and Japan:

> Going back to that in U. K. ... [They, like me] have a high regard for apprenticeship at the same time as they learned technical knowledge ... I have a university undergraduate who comes out here ... [I] supervise his practice (ProfC, Institution A, 1.3.93).

Collectively, this was a transitional conception of curriculum that emphasised mastery learning by linking the engineering curriculum with concurrent work-place activities.

Concrete Other - Gender and the Curriculum in Engineering

Commerce and engineering courses, from the transitional "generalised other" organisational career, would serve to equip the new engineer with acumen in two essential fields (eg, Pratt & Else, 1994). In Institution B, these innovative course offerings included Science/Engineering, Commerce/ Engineering and Environmental Engineering. Professor G found the "joint degree" that was "most attractive to girls":

> ... is actually a joint degree with Chemistry as major ... rather than Physics, maths or computer science ... common thread ... and I have no explanations as to why (ProfG, Institution B, 9 February 1993).

He believed that double majors better met the needs of women. He also felt that mechanical engineering was attractive to women:

> … since "half of [my] course are women ... just as Chemical engineering is attractive ... as you would have seen at [Institution A] (ProfG, Institution B, 9 February 1993).

Professor G's conception of curriculum linked to the special interest of women. He was also concerned about the way overseas students isolated themselves in his laboratories and took action:

> Non-Australian students, we try to mix them up as much as possible ... I sort of select ... 'Right now you are group leader ... you're responsible for whole project' ... this works quite well for me (ProfG, Institution B, 9 February 1993).

Final year students in both institutions pursued an "issues" unit (which included gender issues), suggesting moves towards a transitional conception of a gender inclusive curriculum. This was an interesting inclusion in the engineering curriculum for those professors who tended to see gender equity of women students as limited to access and

not extended to participation or outcomes. In contrast, the transitional generalised other organisational career had scheduled such units in first year (Lewis & Roberts, 1994; Trigg, 1994).

Concrete Other - Curriculum Organisation in Engineering

Feedback from the professors indicated that their programs were organised as traditional 'applied science' models, where students learned essential scientific knowledge and skills in the earlier part of the programme, then developed engineering-related skills, including computing, mathematical modelling and drawing to the point where students were competent enough to complete their own projects in the 3rd, 4th or 5th year of the course. In a previous section, professors had talked of the difficulty of the course and the drop-out of students after first year. However there was no mention of the curriculum organisation as a contributing factor. Trevelyan (1994), from the generalised other career perspective, described how the first year curriculum was being reorganised in Institution B to reflect a more transitional approach to engineering education.

Concrete Other - Curriculum Resources and Expanding Structural Borders

As was evident with the generalised other organisational career, Professor C was hampered by the lack of resources provided by the University:

> We feel we are lacking in expertise because we are starved of funds ... we are desperately trying to catch up with the computer age and design here ...institutions need to support more funds into this ... coming from behind (ProfC, Institution A, 1 March 1993).

As advocated by some of those representing the "generalised other" career standpoint (Drew, 1994; Linley, 1994; Saini, 1994), some of Professor C's students were supported by the engineering industry:

> ... tremendous support from Western Mining ... Wesfarmers and Woodside particularly ... encourage students with prizes and working schemes (ProfC, Institution A, 1 March 1993).

In contrast, Professor J had a different purpose when he linked his students with future employers:

> We bring employer groups into our activities ... educate them into our activities ... it's in our best interests ... manager, employers ... are civil, etc not multi-disciplinary as our graduates (ProfJ, Institution B, 3 February 1993).

Professor G argued about the usefulness and timing of student projects in the work-place:

> Projects in the industry in the final three semesters of the student's career ... [are a] good introduction to industry (ProfG, Institution B, 9 February 1993);

but he found that the type of research associated with work-place experience:

> ... doesn't give 'correct' research experience to go on to a higher degree (ProfG, Institution B, 9 February 1993).

Concern for cost saving and the best use of valuable resources was shared by both organisational career perspectives. The former was perhaps more aggressive in its efforts to work collaboratively with inter- and intra-varsity faculties and employer groups.

Concrete Other - Approaches to Assessment and Evaluation

Professor D's eclectic conception of engineering education represented a transitional curriculum, yet his rationale for evaluation was an anomaly:

> ... [We] cannot cause artificial results through plagiarism or through cheating. We [examine] after 14 weeks of work as a large lump that should be capable of being swallowed to assess the person's ability as an engineer. We have a whole range from open book, closed book, the majority marks exam, marks [that include] the assignment [and] project. The range is wide as [a lecturer] wants (ProfD, Institution A, 15 February 1993).

Professor G, despite a move to cater for the special interests of women, had a similar view on evaluation to Professor D:

> I don't think it has changed that much ... we have very little faith in continuous assessment ... because we know that students cheat ... all the best lab reports were stolen last year ... continuous assessment programmes are generally a failure ... they tell you nothing about the students at all (ProfG, Institution B, 9 February 1993).

He emphasised that lecturers and students are safeguarded by the existence of:

> ... the Examiner Board or the Examiner Academic Committee, etc. for safety (ProfD, Institution A, 15 February 1993).

Collectively, the "concrete other" organisational career approach to summative evaluation was traditional, especially with regard to "rigour" in individualised assessment, testing of knowledge and skills, and the degree of mistrust in students. Such beliefs were neither in harmony with the other facets of the "concrete other" organisational conception of curriculum, nor those of the "generalised other" organisational career, which were more transformational.

I probed the professors further on the issue of more authentic methods of evaluation that would encourage independent problem-solving and creativity. Professor D explained that for him "continuous assessment is like a teaching tool":

> ... like the cattle prod, which gets the student to think continuously about the subject matter. ... We have [an] assignment [and a] laboratory component (ProfD, Institution A, 15 February 1993).

Professor G elaborated on how his older students were involved with lectures, laboratory workshops and tutorials:

> We get most of our feedback not in the laboratory situations, but in tutorial situations ... laboratories tend to be set pieces ... I am an engine man ... engine testing ... small tutorial groups as few as 10 or 15 ... [I give] a lot of feedback on assignment problems in that situation (ProfG, Institution B, 9 February 1993).

In regard to encouraging collaborative projects, Professor G said he used:

> Something of both situations where we design projects particularly ... [We have] groups of two or three ... [They] work together on a group support project (ProfG, Institution B, 9 February 1993);

but he had found joint small group assessment problematic:

> ... Common mark does have its problems ... a very good student may be pulled down ... A large proportion of the work is individual ... they won't dob in a friend. Very often the very good students will get together ... but they write up their own lab report with common results basically (ProfG, Institution B, 9 February 1993).

"Concrete other" assessment tended to be driven by the lecturers, with an emphasis on assessing individual students that ignored an assessment of working effectively with others. This again was somewhat of an anomaly in view of their adoption of a problem-solving approach to learning; and the "generalised other" organisational emphasis on developing team-work skills (Pratt & Else, 1994).

Concrete Other - Lecturer's Roles and Professional Development

In terms of lecturing, three major roles were adopted by the professors. As discussed in earlier sections, the first was as curriculum planners with real-life experiences of engineering to share and incorporate. The second was as effective teachers of processes, skills and content, and the third was as encouraging mentors. As an effective teacher, Professor J suggested that:

> You can't generalise ... I try to encourage them to think, than just learn. The onus is on them to problem solve. Individual assignments, Extensive Laboratories Prog (best labs ... anywhere) ... Hands on practical experience....in part these parallel lectures, but also deliberately stand alone. 3-4 hours...enrichment broadening experience. Illustrations of reality in lectures (ProfJ, Institution B, 3 February 1993).

Skilling students to be better problem-solvers, in light of their future roles in research or business/consultancy was commensurate with the transitional generalised organisational career standpoint (eg, Imberger, Johnson & Peterson, 1994). Professor J saw the importance of his role in linking students with his own real-engineering experiences in his teaching-learning sessions and in dynamic curriculum planning:

> Absolutely get peoples' attention at the very least ... worth the digression. Connections are there to be made. Our professional engineering experience is put back into the undergrad programme (ProfJ, Institution B, 3 February 1993).

In regard to the need for mentoring, both Professor E and Professor J saw this role as significant. Professor E perceived his role on two levels. At one level he was the traditional facilitator of learning during and after class for all students:

> We have lab sessions of course, and also they can come and see the lecturers and so on (ProfE, Institution A, 9 February 1993).

At the other level, like the traditional generalised other organisational career (McKay, 1994), he wanted to mentor women to "tap" them for engineering:

> Oh yes, definitely ... that is a neglected part of the population ... we need to do as much as we can to tap this resource and I am all for it and always encourage it ... with regard to achievement and assessment, in the learning process and classes there can't be any differences just because they are women (ProfE, Institution A, 9.2.93).

This he wished to achieve without any positive discrimination. When I asked Professor E about inservicing lecturers to become better mentors for women, he believed that it was important "but":

> ... what I must say depends on the individual ... no matter how much you tell him to do this/do that, their assumption and mind set is problematic (ProfE, Institution A, 9 February 1993).

In contrast, Professor J's beliefs about his role in encouraging women students were stronger and more committed to actively retaining women:

> Establishing Mentor role?... by making ourselves visible ... student's name will be known ... individuals are important ... possibly this is valued more by women. They can attach a name and face to a reputation in the area. We still live with large classes ... but there is distinct camaraderie with our students (ProfJ, Institution B, 3 February 1993).

> I think we try to convince them by saying that they are a valuable resource and for that reason we encourage them to stay in the programme. we must work on the motivation, provide stimulus and the drive to sustain (ProfJ, Institution B, 3 February 1993).

Professor J's standpoint on mentoring women was more aligned to the transformational generalised organisational career perspective, particularly from the perspective of feminist standpoints (Boman & Lewis, 1994; Lewis & Roberts, 1994; Waddell &

Taylor, 1994). Within the concrete other organisational career both the transitional and traditional standpoints on women and the role of the lecturers existed, which was commensurate with the "generalised other" positioning in 1993-1994.

Concrete Other Organisational Career - Initiating Change with the Professors

My perception at the end of the interviews was that I might have been perceived by some professors as "beating the equal opportunity drum where there really isn't any need to beat it ... in our courses" (Professor C, Institution A, February 9th 1993). I was encouraged by the warmth and reflectiveness of the dialogue with those who perceived me as an equal in the "maintenance" stage (Super, 1990) of our own subjective life-careers:

> I suppose engineers are misunderstood, they don't control like politicians do ... fascinated (by my) personal observation and experience ... even [now] to consider my wife ... a primary school teacher ... who is working largely from observation and intuition ... [which] is rarely discussed [in engineering education] (ProfF, Institution, B, 9 February 1993).

This comment was a ray of hope in his thinking about teaching style and the power of observing students and ascertaining their needs. Professor F, and four other professors, were willing to find out about their characteristic learning style and its association with preferred learning and management style. For example, I wrote back to Professor F, affirming his balanced profile as an engineer educator:

> … your learning style show a strong preference for the Theorist and Reflector styles with a moderate Activist and low Pragmatist preference. This shows an analytical person's profile, with an openness to new ideas. The Global preference towards understanding on the LSI is a characteristic of the creative mind, so too the Inductive preference to move from examples to general principles (Lesley, Response, 5 February 1994).

In contrast to the "generalised other" organisational career, these professors assessed their own preferred learning and management styles (Claxton & Murrell, 1987) as advocates of a problem posing and problem solving approach to engineering. I was able to use their profiles as benchmarks for, and possible influences on, the women participants in the next chapter.

RQ3. What events in the day-to-day interaction in the Engineering work-place (final year or post-graduate studies) are critical to the development of personal and professional identities and competencies as engineers (and/or post-graduate student)? ("Future Career" [linked to Jaggar/Super's propositions 1-14] and to OCII & OCIII).

Generalised Other - Structural Organisation and Women' Career Pathways

Women and the State of the Glass Ceiling - Cracked or Shattered?

There were intimations of thinking about structural organisational changes and equitable social relations with the discussion of different models of engineering - such as "people paradigms" (Bradley, 1994; McKay, 1994; Munoz, 1994) and new collaborative "industrial paradigms" in future careers (Lindley, 1994). Links with industry were facilitating transitions to the workplace (Lindley, 1994). Despite these paradigms, Armstrong and Godfrey (1994) were concerned about glass ceilings for women, where "the structure and culture of engineering education and the profession still represented a significant barrier to women's participation" and retention, because it was based on the "interests and life-styles of men" (p. 63). They concluded that professionals and educators needed to be committed to change, and to systemically adapt, to attract and retain more women, "under-represented minority groups", and a "more diverse group of men" (p. 64).

Generalised Other - Perspectives on Promotion of Life-long Learning

Duggins (1994), in his analysis of the views of 52,000 engineering graduates from 29 universities, did not address the gender agenda regarding women's education and structures of opportunity, rather he interpreted that lecturers were hampering the life-long learning of all students and must be remedied (p. 312). As inferred earlier, I found evidence of a push for continuous improvement in the professional practice of engineers and their personal development and commitment to life-long learning, through fostering reflective deep learning practices, starting from earliest undergraduate studies (eg, Spencer & McGrath-Champ, 1994). Whilst there was evidence of lecturers making

links to ease students' transition from school to university (eg, Ford, 1994), Ferry and Brown (1994) were the only contributors helping "preservice teachers" and "class teachers" to develop "future engineers" in school using multimedia for design and make (p. 639). A new paradigm in engineering communication was being promoted to improve engineers' professional capability in the "documentation" of the design process and product as a future consultant (eg, McGregor, 1994). This required rethinking the curriculum to help students to achieve a range of written, specific genre, and oral communication skills (McGregor & Marks, 1994). Although preferred learning styles were considered in this proposal, I found no reference to women students' previous knowledge and achievements in communication. Some engineering educators introduced "enterprise" engineering to foster development of competencies for leadership in business and technical engineering and personal development to help them transfer from technical engineering specialist to management (Bradley, 1994; Brown, 1994; Munoz, 1994), and to develop team-work skills as final year students (Ulmer, 1994; Walkington, 1994). I found no evidence that men in academe portrayed in the "generalised other" organisational career were actively helping women to deal with glass ceilings, to make future plans about life-long learning, nor in promoting special structures of opportunity to help women to care for family and advocating ways to implement and monitor family-friendly workplaces.

Concrete Other - Glass Ceilings in Women's Career Pathways

Women entering First Postings and Progress in Work and Academe

At length with the professors, I enquired about organisational constraints placed on women as professional engineers in the workplace. Professor J talked about the proactive behaviour and achievements of his women students:

> Women [are] more ready to actively seek you out, better statistically (prizes), more questions to ask, because they are brighter (ProfJ, Institution B, 3 February 1993);

and the "equitable" conditions women encountered when they first recruited in work:

> [Women] Graduates are absorbed by the work force (except one overseas and another eastern states). No discrimination as far as I can see. In future, we will want the best people ... we can't afford the luxury of discriminating (ProfJ, Institution B, 3 February 1993).

Yet, Professor J hinted at an early glass ceiling once women were in the work:

> … [women] have to be a little bit better to even be at first rung ... [even with] collaborative middle management (ProfJ, Institution B, 3 February 1993).

Professor F recollected that women "meet real barriers to the top":

> ..... absolute need to be totally dedicated ... Y (my daughter) is a bridge builder ... a pioneer of the early 1970's (ProfF, Institution B, 9 February 1993).

The issue of women's attrition from engineering was raised by Professor H:

> The attrition rate because of child-bearing - I don't know how to overcome that problem ... (ProfH, Institution B, 27 May 1993).

He offered no solution in regard to this career progression crisis for women in Super's (1990) "establishment" stage of life-career.

Professor G was aware of gender harassment in the industrial work-place:

> We have experienced the same sort of thing with women civil engineers ... [I] guess the mentality of the people [they are] dealing with [is] not of high standard (ProfG, Institution B, 9 February 1993);

and added that women needed strong personalities, competence and attractiveness to overcome such harassment:

> Certainly have three well-known 'girls' ... They've done a lot of site work ... fairly strong characters to be able to cope with those sorts of problems ... and also all three are very attractive women, I mean physically (ProfG, Institution B, 9 February 1993).

He believed it was a different agenda for married women with children:

> Once you've got out of any profession ... it is very hard to get back in ... in face of these three engineers that I was telling you about all married with children ... are proving [to be] very successful ... (ProfG, Institution B, 9 February 1993);

and added:

> ... whereas I am old fashioned enough to believe that mother should be where the children are ... (ProfG , Institution B, 9 February 1993).

In contrast to the "generalised other", the professors were aware of women's strong personality characteristics, of women having to be better than the men, and of work-place harassment. Although aware of, they had no solutions for, the glass ceilings women encountered as professionals in the work-place, in the establishment and maintenance stages of development. I inferred from the "concrete other" organisational

career perspective that women were considered capable of accommodating to the status quo of engineering and their own changing circumstances.

As discussed earlier, from the generalised other there were academic women in engineering faculties, and women were co-opted from other faculties, who were involved in teaching and research and 'making a difference' in changing, and monitoring adaptations in 1994. In contrast, the concrete other appeared to be opposed to affirmative action for women in academe and "any way women didn't apply". Hence, there were no full-time women academics in either faculty. Although post-graduate women and sessional women engineers were used in tutorial and laboratory sessions, there was a blindness towards valuing women as intellectual partners and mentors for women students. These events signified masculinist gender regimes in the concrete other organisational career.

COMPLEMENTARITY BETWEEN THE GENERALISED OTHER AND CONCRETE OTHER ORGANISATIONAL CAREER PERSPECTIVES

Summary - Trends and Gaps in Women's Past, Present and Future Careers

In this chapter, I constructed and compared the generalised other and concrete other organisational career perspectives. The former represented a synthesis of my feminist review of a specific set of conference papers (Parr & Johnston, 1994) which captured "engineering education" in 1994. The papers represented the *present* gender order in which to place my analysis of the concrete other organisational career, distilled from data obtained in professors' interviews. I now summarise the degree of complementarity between these two organisational perspectives.

In relation to Research Question 1 and past career, a gap existed between the organisational perspectives regarding women's competencies and special needs on entry: the generalised other emphasised differences between women and men and the concrete other focussed more on the women's deficiencies than attributes. The generalised other perspective indicated a growing focus on the gender and ethnic diversity of students entering engineering, and showed attempts to link prior knowledge and background to

the curriculum offerings. However, although first year students were regarded as "competent and capable" (Ford, 1994), there was little precise knowledge of their previous achievements. From the concrete other organisational career viewpoint, women and men students were considered to be equally well-qualified in mathematics and physics, yet there was a concern for women's self-efficacy in problem-solving, computing, and their lack of spatial aptitude. The professors often blamed school teachers for fostering reproductive thinking and poor vocational guidance in subject selection and choice of engineering. In regard to the gender agenda, the concrete other appeared to focus more on access of women students than participation and retention. Neither perspective focussed on "feminine ambivalent" girls' academic achievements and interests learned in the arts, design and technology, part-time work and in leisure. Knowledge of women's coping strategies, problem-solving capabilities, preferred learning styles and preparedness for the new organisational career constructs of engineering and engineer were also gaps in their story.

In relation to Research Question 2 and present career, I compared and contrasted ideological precepts, definitions of engineer and engineering suggested to me an ideological continuum. At one end of the continuum were those holding the traditional masculine focus on creating wealth and power in a society through science and technology. Centrally, there were those who had adopted a more balanced frame of reference where people and their well-being in a sustainable environment were also important. At the other end of the continuum, engineering was recognised by a few as a craft where there was an emphasis on people, their creative growth, and ethical use of technology.

Correspondingly the roles of engineers had extended, more so from the generalised other organisational career perspective, where engineers were expected to work collaboratively in teams; to be good communicators and effective managers of people; to display entrepreneurship; and to hold and practice an ethic of care. There was still an emphasis on preserving the traditional craft role (in a working class profession) with a capability to design, research and demonstrate ingenuity in all fields of engineering; and

to be practical problem-solvers, using computer-assisted programs. It was more evident from the concrete other organisational career that women engineers were still considered as exceptions, by being put on a pedestal and at the same time accepted only as "ladies" and "one of the boys". Their special competencies were not considered as contributing to the transition of engineering or the role of engineers.

In terms of the structural organisation in engineering, policies had been interpreted by educators in a limited way, where gender justice was simply designing education to prepare women for a vocation that would enhance the economy, with little regard for their special needs now, or at future stages of career. Women in academe were still in the minority as leaders in engineering education. However, women in the generalised other organisational career were protesting the paradigm of the dominant group by working to effect transitional changes towards gender inclusivity in the existing structural organisation, the cultural milieu and the curriculum, where the values and knowledge of men and women would be equally valued. Although research and knowledge constructed from feminist perspectives continued to be ignored by the majority of men, there were a few rainbow coalitions where dialogue about the gender agenda for men and women and equity for women was encouraged.

In relation to the cultural milieu, both organisational perspectives were aware of gender harassment by some male students towards women students. The generalised other career's creation of people paradigms and the use of collaborative strategies were positive innovations, designed to orientate students to equitable gender relations in future careers for the 21st century. More informally, pairs of female and male students were encouraged to be part of career nights to promote engineering for women and men. Both perspectives viewed women students as high achievers, who were strong leaders, made a positive difference, could look after themselves, and were attracted to fields of engineering that matched particular personality types, irrespective of gender. In contrast, a minority from the concrete other perspective viewed underachieving women students through a lens that heightened their sexuality, interpreting this as their motive for studying engineering.

Within the *historical dialogue* of 1994, engineering education with its outcomes based emphasis was in transition in Australia (DEET, 1991, June), where the curriculum and professional development for lecturers were developing in parallel. As a positive step, I was affirmed that educators in the generalised other career were being urged to evaluate their own gendered selves (Ford & Ford, 1994); and that professors from the concrete other were willing to complete learning style inventories. At the concrete other level there was a glimmer of a recognition about successful women in engineering in the recent past. The aim behind the development of double degrees with science or commerce and a school of environmental engineering in one faculty was to attract more women to engineering education. Although, there was some recognition of women students' needs, the concrete other curriculum organisation was inflexible in first year in 1993. The curriculum, then, was at Schuster and van Dyne's (1984) level three where women were still positioned as a disadvantaged, subordinate group (Kock, 1990).

In relation to Research Question 3 and future career, the generalised other perspective had a more malleable "structure of opportunity" for women to become engineers in Australia. There was also slight rupture in men's thinking about the new gender order of engineering in addressing their own masculinity and the way this affected their own definitions of the situation and the precarious status of women in the work-place. The concrete other organisational career was also empathically aware of the special needs of professional women engineers with families, yet there was no systematic plan to deal with potential drop-outs, glass ceilings, transitions to the work-place, or professional development and promotion as new woman graduate. There was also awareness of harassment of women engineers in the work-place, which was put down to the low "mentality of the people they were dealing with". The enigma here for me was the "concrete other's" dissociation of 'Academe' as legitimate and necessary work for professional women. In contrast to the generalised other, I had detected an under-current of antagonism about the implementation of affirmative action policies to attract and encourage women engineers as faculty in 1993.

Jaggar/Super Propositions and Models on Women in Engineering

In regard to the methodological question, Super's (1990) 3rd, 6th, 9th, 10th, 11th, 12th and 13th propositions were valid in investigating "key figure" perspectives on women's personal and situational pre-requisites for engineering and for my analysis of engineering education and its degree of adaptive style. There was affirmation of my domain assumptions about women in engineering from the concrete other organisational perspective, in terms of concerns about lack of self efficacy and harassment by "fellows". Both these tensions and potential harmony (eg, playful attitude" to work in the organisational career) were represented in my convergent archway model (Figure 2.3) in the milieu of engineering education and the workplace. The Super/Jaggar life-career rainbow model (Figure 2.4) captured the gender order and gender regimes affecting the career and personality development of women in engineering. My convergence ladder model (Figure, 2.6) helped me to construct both organisational career perspectives on women's climb up the status rungs to achieve tasks, particularly in engineering education.

In Chapter Six, I construct the concrete other subjective career perspective of women's past career and present career in engineering education and the workplace. I then draw out key themes from the concrete other subjective career perspective in telling Cecilia's life-career history in Chapter Seven.

CHAPTER SIX

WOMEN "EXPLORING" ENGINEERING - THE CONCRETE OTHER SUBJECTIVE COLLECTIVE CAREER

PURPOSE OF THIS CHAPTER

In this chapter, I recount the collective experiences of the fifty-three participants in engineering education and first postings, thus giving "social breath" to the voices of these women. As in Chapters Three and Five, I use the three research questions to guide the construction of the women's subjective "concrete other" life-career perspective. In presenting the collective voice, I was mindful that:

> [d]ifferent women have different stories to tell yet [there] are themes, threads and feelings that recur and experiences in common (McConnochie, Hollinsworth & Pettman 1988, p. 215).

I also searched for comparisons and contrasts between their perspectives and the "generalised other" career perspective of non-traditional girls and women (see Chapter Three), and with the generalised other and concrete other organisational career perspectives in which it was contextualised (see Chapter Five).

Throughout my analysis, I continued to evaluate how well my convergence of Jaggar's unified systems theory of social relations with Super's segmental theory served to frame and explain the participants' life-career histories. I used Super's propositions for successful career development as a point of reference in this chapter (Super, 1990, pp. 206-208). I monitored how effective my Jaggar/Super convergence models were, particularly the dynamic archway/spider web (Figure 2.3), elaborated life-career rainbow (Figure 2.4) and ladder model of developmental tasks (Figure 2.6), in helping me to construct the collective career; and to identify elements that were contributing to women's success or otherwise in coping with issues that arose. Taken as a whole this

chapter serves as the springboard for constructing the individual life history of Cecilia in Chapter Seven.

OUTLINE OF THIS CHAPTER

Firstly, guided by Research Question 1 on *past career*, I identify personal and remote/immediate situational determinants of the concrete other perspective on the participant's growth and exploration. Then, in terms of Research Question 2, I focus on the concrete other *present career* , identifying personal and remote/immediate situational determinants of participants in the late exploration stage in engineering education in the 1990's. I repeat the process, using Research Question 3 to gain insight into the concrete other *future career* of the women as new graduates in the establishment or maintenance life-career stages. I summarise the situational and personal determinants, draw out themes and gaps and determine the degree of complementarity between this and the other career perspectives.

Guided by the Methodological Question:

> **How robust is the Super/Jaggar convergence conceptualisation of life-span life-space career in representing and facilitating the construction and interpretation of women's subjective life-career in non-traditional occupations in Australia in the 1990's?**

I summarise how well the Jaggar /Super convergence theory of career, the propositions, and my elaborated models served my construction and analysis of the participants' "concrete other" collective career perspective.

PARTICIPANTS' "CONCRETE OTHER" PAST CAREER (1967-1992)

Growth and Exploration Stages - Were they "Feminine Ambivalents"?

RQ1. What are the key determinants of the individual's background and how are these events perceived as influencing her construction of personal and professional identity as an Engineering student and her career development as an Engineers? ("Past Career") [linked to Jaggar/Super's Propositions 1-11].

Situational Determinants of Women Participants' Careers

Remote Situational Determinants - Historical Context and Policies

As part of my study, I contextualised the life-histories of the women participants within the broader remote historical context of the time (see Chapters Three & Five). This provided me with a link with the era of their birth dates (1967-1975), and of family life, leisure and their schooling in the '70s and '80s, before they entered engineering education (1989-1993). In my *Simplified Life-Career Rainbows of Participants,* I represent this dialectical construction, including also relevant educational policies (see Table C & Table D, Appendix G).

Immediate Situational Determinants - Family Relationships and Values

The educational and professional qualifications of the participants' fathers and mothers (see Table A & Table B, Appendix G), with few exceptions, showed that most of the women were from professional middle-class homes. Several fathers were connected with engineering, technical or scientific jobs, which probably influenced participants' anticipatory vocational socialisation. Some fathers provided alternative models of social relations between spouses, with the father as key homemaker. The participants' mothers, and many were well-educated, represented a spectrum of career patterns. Most mothers had taken a "career-break" to raise children or (especially if divorced or widowed) maintained the "career-doubler" pattern in a range of professional and semi-professional roles. The latter group held strong beliefs about gender equity. Some of these mothers pursued non-traditional vocations. Six mothers adopted homemaker roles despite being qualified as, for example, an engineer, a nurse, a teacher or a secretary. Three mothers had returned to formal study in their "establishment" stage of career. Overall, and

consistent to some extent with the historical era of 1968 to 1993, the majority of the participants' mothers were positive key figures and role models, with whom the women could identify, both professionally and personally.

Parents and Older Siblings as "Key Figures" in Early Vocational Identity

As daughters, whether from two-parent or single-parent families, they conveyed to me an overall feeling of being "encouraged" and "given all the chances" they wanted:

> ... always to aim high and work hard because we ourselves create the chances for which we may grasp hold of (Steve, Final Chemical, 1993).

In my analysis, I saw the majority of women as having either a liberal feminine upbringing and orientation to life (N=35) or an androgynous (sex-role liberated) upbringing (N=15), rather than a stereotypically feminine upbringing (N=3). Collectively, they gave me the impression that they were content with life and "wouldn't change much" (Tammy, Final Mechanical, 1993). They told stories of parents who held a prevailing attitude of social equity towards all their children irrespective of birth order or gender:

> They were both engineers, mother did not practise. No differences - no distinction at all [between my two brothers and me]. Right from the start [we were] not put down, categorised or limited. [They had] the same expectations of all three of us ... [we are] all engineers now (Sara, Electronics Graduate, 1992).

Parents also tended to focus on the personality and special needs of each sibling. As Billie recalled "my parents saw me as more self-reliant" than "[my] 'wishy, washy girly' sister" (Billie, Final Civil, 1993). Two women, from single-parent families, confidently "expected to participate as equal to males"; and to be "successful" like their mothers in "whatever [they] wanted to pursue" (Mandy, Final Chemical & Mars, Final Mechanical, 1993). Beth was the exception; her mother, whose schooling had stopped at year 9, expected "only her son" should "go to uni":

> despite having topped almost every class from yrs 8-10 ... I was asked by mum if I really wanted to complete yrs 11 & 12. She supported my decision to do engineering ... but never believed I'd finish it (Beth, Electronics Graduate, May, 1993).

The older brothers of Carolyn, Beth and Sara made a positive difference to their early career development. Like Sara, Beth "adored and admired" her "older brother's initial ability in maths and science", adding that "... it was him who first introduced me to the

idea of engineering" (Electronics Graduates, May, 1993). Carolyn, a first year, was more matter-of-fact about "repelling [sic] from" her sisters' "too stereotypical & boring" careers and with having one brother "studying engineering ... I felt if he could do it, I could do it too" (First Chemical, 1993). Interestingly, Colleen and Ivonne each had a brother studying engineering, yet they were "hardly influenced by him, if at all". The older sisters of Caren, Christie, Sharon and Charlotte "inspired" them by "their accomplishments" and so they "never really thought about not going to university" (Sharon, First Civil, 1993). Emily's relationship with her older sisters, after her father's death, was the only anomaly "I felt smothered [by them] ... I always felt not capable of doing things ... I'm not sure of my life now" (Emily, First Commerce/Civil or Mechanical, 1993). Despite such tensions, what I have deemed as affective "circles of affirmation" pervaded the young lives of the participants in developing their self-concepts, interests, and sense of vocation.

Teachers and Peers as "Key Figures" - Finding Identity and Interests

The participants identified teachers as key figures in the growth and exploration stages. Forty-two out of fifty-three participants attended kindergarten (see Table A & Table B, Appendix G). They, like Beth, remembered kindergarten teachers, in the 1970's, providing a wealth of hands-on experiences:

> … the glorious sand-pit; playing with the water trough; running through sprinkler on hot days; fruit; the smell of my red plastic 'kindy-case'; visiting bee-hives ... and Parent's day when Dad came to Kindy & read me a story! (Beth, Graduate Electronics, May, 1993).

All, like Penny, Hettie and Beth "enjoyed playing with other children". They made "special male and female friends", who played together in kindy, and "after kindy, I ate fairy bread with Ken" (Beth, Graduate, 1993). Penny remembered not being "very confident" and Beth had mixed feelings about being "being bossed around by the Kindy bully - the tallest girl". "Kindy" was a key event where interaction with teachers and peers of both genders positively contributed to the women's early intellectual, social and emotional development.

Primary school teachers, in the late '70s to mid-'80s, were remembered for positive personality traits:

> My grade 2 teacher was my favourite because she was gentle, kind and always gave praise (Anna, First Mechanical, 1993).

Most participants' early interests were formally channelled in ways that were "so inspirational and energetic" in art (Caren, First Environmental, 1993) and "made science interesting and got us to go outside to learn about it" (Steve, Final Chemical, 1993). Some teachers, like Lois's, "always encouraged" girls to achieve success regardless of gender expectations:

> 1. Can be smart. 2. Never been told [these are only] "boys things" - I was told to do both - by teachers and parents - it makes a "big difference" (Lois, First Civil 1993).

Participants remembered the rare instances of discouragement:

> My junior school teachers considered me to be lower the(sic) average. I said I wanted to be a scientist in year seven and a teacher laughed at me and told me I was too dumb (Shelley, First Civil, 1993).

The women's estimations of high school teachers were generally positive about "inspiring everybody" (Angela, First Year Civil, 1993) and being "encouraged by teachers" (Lois, First Year Civil, 1993) in all-girls' and coeducational schools in the late '80s and early '90s. However, both younger and older women were conscious of gender harassment in non-traditional areas:

> … [my] Calculus teacher always made it very clear that males were better in that field of study. [I] used to get quite angry with him considering I was doing better than majority of males!?!! (Lee Min, First Science/ Eng, 1993).

In a similar vein, Billie's excellence in technical drawing was not recognised:

> Of course, I was refused the Tech Drawing prize for upper school, even though my results were outstanding because quote 'I wouldn't use it as much as the boys' (Billie, Final Civil, 1993).

Most women found that "friends" in their early adolescence in co-educational (mixed friendships) or all-girls' high schools were "very influential" as far as leisure interests, dress and social activities were concerned (Jenny, Final Chemical, 1993), but "not very influential" on their "career path", even if under some peer pressure to "conform to the female stereotype" (Lola, First Year Chemical, 1993). Participants like Vivienne, Sara and Christie, who experienced the effects of lack of critical mass of females in upper school non-traditional classes, found the issue was the absence of "close girl-friends" with a common interest in mathematics and physics, rather than gender harassment by

the boys. Lois, who experienced both types of school, found that she "learnt a lot more" from "boys' different ideas and better ideas".

Participants' Personal Determinants for Engineering Education

Interests of "Feminine Ambivalents"? - "Motivational Hub" of Work

The women recalled their initial development of interests with a wealth of early childhood activities. Their time was filled with exploration and feelings of adventure, where the fun of playing, riding their bikes, and swimming with friends was often recalled. "I was the only girl in a group of 8 boys" (Angela, First Year Civil, 1993). They made cubbies, enjoyed the sand-pit, kept pets, played with dolls, lego and/or meccano, bricks, and "trucks, inherited from cousins". "I liked making and building things ... and 'sciency' discussions with dad, a physicist" (Wendy, Final Civil, 1993). Wendy observed that years later in upper school:

> Year 11 [so called] "new" concepts, I [had] struggled with years before. It was really helpful, like a spiral of understanding and integration (Wendy, Final Year Civil, 1993).

Wendy observed early gender differences in interest in computers:

> Computing for me was not social, [unlike my] 9 year old boy cousin. At four, he used the computer before he could read (Wendy, Final Civil, 1993).

Only Cecilia, Louise, Lin and Zumei listed "computer games" as a specific early interest. Such disinterest in playing with computers was despite the fact that those with home computers were "encouraged" by mothers and/or fathers, often through modelling, for work and play.

From mid-childhood, the participants started to engage in a variety of pastimes and sports. Collectively their leisure pursuits were relatively intellectual, including listening to classical and pop music, playing a range of musical instruments, taking dancing lessons of many types, art/craft, a love of mathematics and physics, jigsaw puzzles, learning foreign languages, reading the classics, science fiction and mystery, astronomy, collecting (according to Rebecca, "coins, stamps, stickers") and "church activities" (Sharon and Rebecca). Team sports of all types were pursued, Guides and Brownies, just being with friends, where "peers ... (mostly girls) were influential in my early

development and behaviour" (Rebecca, First Mechanical, 1993) and "back-yard cricket with brothers" too (Sara, Electronics Graduate, Institution B, 1993).

In late adolescence, a smaller number of sports and hobbies remained an integral part of their "leisurite" role (Super, 1990). Sports were valued for physical recreation, health and socialising with friends. Hobbies, valued for aesthetic and creative reasons, developed more independently, and often those involved in the performing and visual arts received formal training in and out of school. Valerie, like others, also developed vocational interests by reading "a lot ... not just reading fantasy science fiction, [my] uncle from Canada sent books to do with Science". Rebecca, too, was "actively directed" towards "banishing social barriers" and advancing "scientific research" for a better life.

Computer and Generic Skills, Learning Styles, and Subjects for Engineering

In view of concern for emergence of computers as a new critical filter and the desire to broaden opportunities to increase girls' freedom (see Chapter Three), I investigated participants' attitudes towards, and competencies in, computing, generic skills, non-traditional upper school subjects and learning styles. Collectively, they believed that girls "are no less likely to study non-traditional subjects, particularly so for computer studies" (Mandy, Final Chemical, 1993).

I found that final year women and graduates in their formative years had not had consistent access to a home computer. Mandy, like Billie, had pursued two years of computer studies at high school, that compensated for the lack of a home computer. Yet, the reality for others in final year at Institution A, such as Lin, Aggie, Zumei, Anita and Steve was "no formal lessons at any level of schooling ... ". At Institution B, final year students had a similar mix of computer experience. Penny and Tammy had both home and secondary school experience. Robbie and Mars lacked experience at home, but had some high school experience. Wendy and Ivonne had no experience in schools. Sue and Haylia (Romanian) had no experience of computers at home or in school, but had become "quite proficient at university and able to adapt to different packages easily

now". Only Lin had linked her interest in computers to engineering, as a vocation, "since I choose (sic) computer system engineering". Robbie confided "I hate computers, they hate me, I've avoided it".

In contrast, first years in 1993, other than Carolyn and Michelle in Institution A and Anna in Institution B, had access to computers at home from childhood. Like the older women, most of the first year participants considered their competence in computer skills was "useful". All those in Institution A had computer classes at school. Two had practised computer skills in primary school only, two had computer classes in secondary school only, and four had both primary and secondary experience. Of the first years in Institution B, thirteen had formal education in computing skills, one at primary only, five in primary and secondary, seven in secondary school only. Two had no access to computers at school, and only one did not have access to a computer at school or home.

The majority of the first year participants in both institutions, in contrast to older women, were competent in using the computer: they "didn't like it ... but had no fear" (Marie, First Civil, 1993). Lola was the only participant who chose to pursue "computer studies in years 11 and 12" (First Chemical, 1993). With the wisdom of hind-sight, Sara stressed the "importance of computer skill development" for girls in schools and university to "allay fear" (Sara, Electronics Graduate, 1993).

In technical drawing, woodwork and metalwork, I also found age-related differences in the perceived self-efficacy of women participants. Maggie, a mature-aged engineer, who left school in 1975, lacked "drawing skills" and found it a "bit of a struggle" at university. Matriculating a decade later, Sara had taken compulsory industrial arts in Year 8, and "by choice in year 9", which "took away a lot of [my] fear" of "big machinery" and a liking for "things with wood ... but not metal" (Sara, Electronics Graduate, 1993). First years graduating from coeducational schools in 1992, like Marie "always enjoyed designing, [it] was one of the best things I did", but didn't study manual arts (Marie, First Civil, 1993). Vivienne, from the private co-educational sector, "loved technical drawing, and did woodwork, but metalwork I enjoyed a lot more". Ivonne and

Robbie missed out, although Robbie was aware of its importance, because "Mum's [a] draughtsman [sic]". The younger generation were confident and competent in technical drawing and/or woodwork/metalwork. Notwithstanding, I found participants from all-girls' schools, and some schools overseas, did not study these subjects.

My analysis of first year participants' preferred learning styles revealed variety, uniqueness, similarities, and contradictions in information processing. With regard to more general learning styles, which included managing life-skills and dealing competently with other people, the women displayed variability in strength, as activists, theorists, reflectors and pragmatists. Their profiles were not as mature and well-balanced as the final year women (see Table E & Table F, Appendix G). This suggested that learning style profiles, as an attribute of personality, were changed by interaction in educational and other contexts (such as work, leisure, home).

The phrase "broaden my options" was used frequently by the first years in 1993. The women's selection of upper school subjects included mathematics, physics and chemistry. Their choices, like Zumei's, were not only based on investment for engineering, but also on personal, often long-standing, enjoyment of the arts, "especially history ... played a part" (Zumei, Final year Electronics, Institution A, 1992). Sara enjoyed "discovering feelings in analysing ... English Literature and History in contrast to physics and maths" (Sara, Electronic, Graduate 1992).

"I want to be an Engineer" - Aspirations, Expectations, and Coping Strategies

I found that the majority of first years, like Lola, Sharon, Terry and Vivienne, associated engineering with an "interesting", "practical", not "too routine" application of their "favourite" mathematics, physics and chemistry subjects, which they were "good at". Terry, like others, showed personal agency in linking her intellectual needs for a varied "science related career", with "good employment prospects", and "international recognition of qualifications" (Terry First year Chemical, 1993). Only Marie was specific about her "passion" for "design in civil engineering":

> Building bridges - design [is] my passion Technology itself - is "inspiring" ... How it stayed up ... Affective makes me go! (Marie, First, Civil, 1993).

Most, like Emma, had fantasy and reality-based aspirations of future career:

> Hoped to be ... in a stable relationship with a wonderful guy. To be a well-established engineer with a good reputation and to still be healthy (Emma, First Commerce/Civil, 1993).

Women from co-educational schools, like Christie, were aware of "what to expect" in regard to their "future as women in engineering":

> I'm aware of ... the 'Token women syndrome', patriarchy and deference of First year women - not for me thanks, I do what I want to ... (Christie, First Environmental, 1993).

Women from girls' schools, like Katelyn, had "not encountered any discrimination about female engineering students" but were not "so naive as to think this will always be the case".

Given the probable challenge of lack of critical mass in a predominantly all-male culture, I asked the women about their "coping strategies" (Kvande, 1987). Only two first years students confined their way of dealing with issues or conflicts to one strategy: Helen to her "Diary" and Michelle to "tune out". Others, like Terry and Christie, used a range of approaches and people as "sounding boards":

> I often walk, run, cycle etc to clear the mind. Relaxation techniques do not solve problems but help in promoting rational approaches. If appropriate, I seek advice from parents or whoever is knowledgeable in the area (Terry, First Chemical, 1993).

Engineering as Her Profession - Whose Inspiration and Guidance Counted?

The participants' specific choice of engineering had been influenced in a variety of ways, by various people, and at different stages. First, there were those who made an early vocational commitment, like Billie, who "wanted to be one since [she] was 8 years old". They were inspired by family members directly associated with engineering and science like: an "uncle who came to stay who is a civil engineer"; "Dad's occupation made me aware"; "a cousin went to US to study engineering"; "mum's a draughtsman ... one of the first engineering women in Perth"; "mother's a research scientist"; "an older brother ... first introduced me to the idea".

Second, those making later decisions often had favourite male and female teachers "who sowed the seed" (Wendy, Final Civil, 1993) and encouraged them to "carry on as a career, the subjects" they were "good in" (Lola, First Chemical, 1993). Lois observed that "men seem to encourage females to take on predominantly male subjects".

Third, there were a few women who had made "a last minute choice". For example, Astrid (PhD, 1993) was "pushed" by an overzealous teacher to medicine, and having "no calling" chose engineering to "avoid doing medicine". Steve (Final year, 1993) "put Chemical engineering 2nd to medicine" and Emily "didn't know what was offered at uni, besides the basics" and thought:

> Eng[ineering] seemed quite a good idea. Thrust [came] from subject choice and a friend in England doing interesting work. I'll have a go at that! (Emily, First Com/Eng, 1993).

Participants, whatever their stage of commitment to engineering, were single-minded about their choice:

> I knew engineering was what I wanted when I attended the 1991 Engineering Camp ... Father ... cut out articles on Sc/Eng & put them in my room. Really sweet (Anna, First Civil).

This occurred even when a "Chem teacher", like Vivienne's, discouraged her, making her "want to do it more ... you have to be true to self". Older participants, like Jenny and Valerie, considered it was important for girls to make "an informed choice" and favoured speaking to women engineers to "avoid the frustrations of a course ... that is not enjoyable or suitable for you" and "to find out what they were getting in to".

Older women, like Sue and Tammy, were critical of teachers' lack of career counselling skills and not given "enough information about engineering in school" (Sue, Final Mechanical, 1993). In contrast, first year participants found more women teachers as models and advisers in non-traditional areas in both types of school in the early 1990's:

> Talked to my Physics teacher, she was really great (Angela, First Civil, 1993).

They found no gender bias "except to offer contacts in Engineering faculty" (Chantelle, First Electronics/Commerce, 1993). There was "no question of only the boys" in co-educational teachers' attitudes to participants' careers. Those from girls-only schools also commented on their teachers:

> My maths II/III teacher was influential, she encouraged girls to get into male dominated careers (Nichole, First Civil, 1993).

Notwithstanding, first year participants were aware of biased "negative advice" given by some teachers to girls:

> ... so they need to know that there are women in many science careers and that women can be successful (Rebecca, First Physics/Mechanical, 1993).

Katelyn's story, like Astrid's, was a salutary case of poor vocational guidance. In her case, a "really respected" Year 12 maths teacher, with "complete scorn", said she was "too smart to be a doctor":

> Her comment really impacted. They need to be careful what they say "don't do". [They] can change people's life by misinformation. I liked Maths and Science ... I need a different career [now] (Katelyn, First Sc/Eng, 1993).

Guidance officers were not considered to be competent career advisers:

> Because of the stereotyping in this society ... there is a need for such advise, but not from some of the current guidance officers. I have heard some dreadful things about some of them (Haylia, Final Electrical, 1993).

Anna was the only participant who had talked with a guidance officer:

> ... to see what options I had, but I always knew that science/maths was what I was interested in ... (Anna, First Sc/Math /Mechanical, 1993).

To test out their career decisions, like Anna, Christie, Rebecca, Shelley and Rosemary, they preferred accurate and unbiased advice from their "father's and mother's [professional] knowledge", "advice mainly from relatives and friends", "knowledge gained from careers nights, [and] talking to engineers".

Summary and Interpretation : Trends, Traits and Gaps in Past Career

In relation to Research Question 1 (RQ1), the influence of key figures in the women's middle class families, combined with "kindy", was consistent with Super's (1990) 1st, 5th, 6th and 9th propositions in providing the "conditions and characteristics", which were associated with the participants' early vocational maturity (Super, 1969, p. 17) and positive construction of self. Participants also told of parents who treated siblings of both genders in a fair and equitable way, taking due note of individual differences. This was similar to the findings of other researchers (eg, Carter & Kirkup, 1990b; Clark, 1992; Kerr, 1985; Newton, 1987; Robinson & McIlwee, 1992). Friends and siblings of both genders added enjoyment to play and early interest development in both contexts.

Contrary to the suggestions of other research, the girls' choice of non-traditional work could not be neatly matched with a particular birth order (Kerr, 1985; Lemkau, 1979). A range of older family members aided in "reality testing" as foreshadowed in Super's (1990) 9th proposition. Fathers' role in girls' anticipatory socialisation (along with older brothers, male cousins and uncles) was evident, as indicated in previous research of other women engineers (Anderson, 1992; Carter & Kirkup, 1990b; Newton, 1987; Robinson & McIlwee, 1992), However, the influence of professional role models, and feminist beliefs and values, of some mothers and older sisters was a key finding from my participants' stories. I noted that this situation was reminiscent of findings of fathers and mothers of "feminine ambivalents" (Benedek, 1979; Rothchild, 1979), which aligned with Super's (1990) 6th proposition (p. 207).

The participants developed a balance of traditional male interests (save for computing) and female interests, with serious "work" time for tinkering and exploration. This finding whilst contradicting the research on the traditional feminine play of American women engineers (McIlwee and Robinson, 1992, p. 33), added another dimension to the characteristics of the "feminine ambivalent" discussed in Chapter Three. Whilst, my finding supported Super's (1990) 1st proposition, the "dawning of maturity" for participants, as non-traditional girls, aligned more with Roe's research on the origin of interests and early determinants of vocational choice in early childhood (Roe, 1956; Super, 1983), rather than in middle childhood as Super (1954) had suggested for boys.

Contrary to research findings on the psychological distress of girls of ability in primary school (Burton, 1985; Hubbard, 1992; Kerr, 1988), I found that teachers had met participants' needs and aptitudes, fostered interests and fantasy, and nurtured healthy self concepts, with minimal gender bias. Friends continued to add to the enjoyment and further development of interests in and out of school. Such positive support of "superiors and fellows" aligned with Super's (1990) 1st, 9th, 10th and 11th propositions. My findings also suggested that the internalisation of the "femininity / cleverness" dichotomy by self and others was less of a concern, than previous studies had indicated (Clark, 1992; Gottfredson, 1978, 1981; Hesketh, Elmslie, & Kaldor, 1990). I found that

parents' support of participants was complementary to the primary teachers, rather than compensatory as indicated in previous research (Askew & Ross, 1988; Maccoby, 1990; Martin and Halverson, 1983). Participants' stories indicated to me that reciprocal interaction between school-work and leisure had contributed to their vocational identity development, along with a "playful" attitude to work as indicated in the research of others (Bordin, 1994; Swanson, 1992).

In adolescence, most participants expected to become professional women. They had progressively developed a wide, gender inclusive, range of vocational and avocational interests. Their stories also revealed a growing interest in the ethic of care and related scientific work, as Kock (1990) had found earlier with women in engineering. This interest added a new dimension to the characteristics of the "feminine ambivalent". In parallel, I found that the girls' had an increasing need for "approval" of friends, in terms of leisure interests, dress, and social activities. However, their single-minded vocational orientation, even if under peer pressure to conform, was characteristic of the "feminine ambivalent" and the "paver of the way" (Josselson, 1987).

The stories of first year participants indicated that they considered themselves "proper users of computers" (Gribbon, 1984, cited in Burton, 1986), more than final year women. This reflected the implementation of policies for technological change in curriculum provision (see Chapter Three). I found that, although, participants had achieved without fear through this "new critical filter" (Spender & Sarah, 1988), they lacked passion for computers. Sara had found this was an increasing challenge for her in the work-place, which echoed the concerns of other researchers (Clarke, 1990b; Crawford, Groundwater-Smith & Milan, 1990; Sanders, 1989; Secada, 1989; Towns, 1985). Their stories also indicated inter-generational variations in participants' experiences of technical drawing, woodwork, and metalwork. Participants from all-girls' schools had had no opportunities to learn these "marketable skills" (Spender & Sarah, 1988) for engineering, which was problematic in terms of gender inclusive provision (DEET, 1991 June; Hildebrand, 1989).

I found that their high school teachers, whether facilitating or inhibiting the participants' achievements and sense of group identity, were important key figures which supported Super's (1990) 9th, 10th and 11th propositions. I found that first year women experienced less discouraging behaviour from high school teachers than the final year women. Few of the younger women in coeducational schools could recall instances of gender bias or harassment in classroom interaction. Typically during the late 1980's, education policies and professional development had stressed the need for teachers to be gender equitable and may have contributed to their change in behaviour (see Chapter Three).

Peers, present or absent, made a difference to learning as "fellows" Super's (1990) 10th & 11th propositions), and in the possibilities for peer mentoring (Super's 9th proposition). I was unable to substantiate aggression by the boys found by others (Askew, 1989; DEET 1992b; Murphy & Murphy, 1990; Spender & Sarah, 1988), abuse of girls (Noble, 1987; Robertson, 1993) or the superiority of male success (DEET, 1991 March). Yet, participants had experienced the aloneness associated with lack of critical mass of girls in upper school physics and mathematics. The issue of the relative merits of co-educational and single-sex classrooms for quality in girls' learning (eg, Jones, 1990; Spender & Sarah, 1988) emerged from their collective voices.

Learning in schools tended to occur in what Super (1969a) would have described as "intellectually and culturally stimulating " environments (p. 17). High school teachers encouraged participants to achieve in all subject areas; and to pursue non-traditional occupations. This was contrary to other researchers' findings about teacher's gender stereotyping of these subjects and associated occupations (eg, Leder, 1980, 1981; DEET, 1991). By having had both male and female teachers as mentors (Kingsland, 1989; McPherson, 1989; Parker, 1989), participants did not appear to have been hindered by the lack of women teachers in science (Parker & Offer, 1989).
In upper school, the participants had made informed subject choices which indicated they were well prepared for a number of occupations, as suggested by Super's (1990) 1st, 2nd and 3rd propositions (p. 206) and for leisure, which linked with Super's 1st,

12th, 13th, and 14th propositions (pp. 206-7). This corroborated research on women in engineering conducted elsewhere (eg, Anderson, 1992; Carter & Kirkup, 1992; McIllwee & Robinson, 1992; Thomas, 1990), and from the generalised other organisational perspective (Parr & Johnstone, 1994).

The participants also tended to have achieved a balance in satisfying creative and scientific thinking through their choice of both arts and science subjects. This finding was significant in the light of the concern of researchers that girls' creativity and preferred learning styles were being hampered (eg, Beruldson, 1989; Doenau, 1987; Hildebrand, 1989; Sjoberg, 1989; Staberg, 1991; Stocklmayer, 1989). Indeed, their learning styles were an important attribute of their unique personalities and in their practical problem-solving.

Collectively, first year women equated engineering with applied science, rarely with design. They chose engineering because of their love of mathematics, chemistry and physics and its practical nature, as indicated in previous research (Carter & Kirkup, 1990; Evetts, 1993; Godfrey, 1991; Hackett, 1985; McIlwee & Robinson, 1992; Newhouse, 1989). They were also pragmatic about good job prospects and international recognition for engineers. Those who had made an early commitment, supported Super's 4th proposition regarding the construction of self around clear vocational preferences and associated competencies (interests).

Overall, the participants preferred a social model of guidance, by seeking affirmation from trusted others, which supported Super's (1990) 5th and 9th propositions (pp. 206-207). They conceded that guidance from professionals in the field of engineering was valuable in making final decisions, as envisaged by an aspect of Super's (1990) 9th proposition. However, they avoided guidance officers, but they were more positive about teachers as career counsellors, especially those women who had made later occupational choices. This supported aspects of Super's (1990) 10th and 11th propositions about the testing of the "approval of superiors". This change may be attributed to Australian policies for equity and excellence since the late 70's, when

student teachers routinely studied social and gender equity units, and units catering for individual differences (see Chapter Three). The women's synthesising process, where they exhibited a strong internal locus of control, curiosity, and active exploration of career information in their decision-making (Watt et al, 1981), was characteristic of Douvan and Adelson's (1966) "feminine ambivalents" and matched Josselson's (1987) "pavers of the way" group (see Chapter Three). Super's (1990) 6th, 7th, 8th, 9th, 10th and 11th propositions linked to these continuing structures of opportunity. This finding was contrary to the Carter and Kirkup (1990) interpretation of their women engineers' retrospectives for whom choice had been a somewhat haphazard process. Participants displayed career maturity and individual differences in leisure arts and sport. Career adaptability was evident in their reality based aspirations and realistic expectations, with a range of coping strategies to deal with the demands of engineering education where women were expected to be in the minority. These were strengths that aligned with Super's (1990) 7th and 8th propositions. Successful transition to engineering education, according to Josselson (1987), would need "new anchors" created by "superiors and fellows" (Super, 1990).

PARTICIPANTS' "CONCRETE OTHER" PRESENT CAREER (1992-1994)

Exploration in Engineering Education - "Pavers of the Way"

RQ2. What events in the day-to-day interaction in the Engineering Degree course are critical to the development of women's personal and professional identities and competencies as engineering students? ("Present Career") [linked to Jaggar/Super's propositions 1-14].

Areas of Concern Arising From the Generalised Other Subjective Career

Guided by my domain assumptions about women in higher education and non-traditional professions, I continued to focus on six areas of concern evolving from the generalised other subjective career (Chapter Three). I had found that there was more progress in meeting the special needs of Australian women from the generalised other organisational career on engineering education than the concrete other organisational career (Chapter Five) in which the collective present career was embedded. I linked the

life-space experiences of first year, final year, and post-graduate participants to construct their collective story between 1992 and 1994.

Embedded Present Career in the "Concrete Other" Gender Regime 1993

Structural Organisation - Women in Academe and Support for Women

Lois, a first year in Institution B, commented to me that "all my lecturers are male", except one "a female", who is "taken as a joke by the guys":

> ... [who] gave her a hard time ... she wasn't as dynamic. [There were] cliques, jokes and lonliness [sic] for me ... after a while it was okay (Lois, First Commerce/Civil, TB, 1993).

Final years too had little experience of women in academe in both faculties:

> Only time I ever came across a woman doing a PhD in Chem Engineering (South Australia) - [She] took us for one assignment - [but] the thought of spending x number of years [in study] - is not for me! (Valerie, Final Chemical, TB, 1994).

Sandie, a doctoral student, spoke positively of a "wonderful mentor":

> ... whilst doing my fourth year project ... My aims, like her are to gain some industry experience following completion of my PhD & then go back into research ... but who left angry and frustrated ... so sorry, but I didn't know the story (Sandie, Civil, TB, 1993).

Astrid was aware of the "lack of women in the department", even though her "Prof" was "actively supportive" of her role as a "part-time tutor":

> [I] like the teaching side, 1 unit lab component (when [ProfE] is away I take his class). I help the WISE coordinator - with student seminars, workshops - I really enjoy teaching at secondary level (Astrid, Doctoral student, 1993).

Sara, although in the work-place, had aspirations to teach in academe and was enrolled in a Master's program:

> I want to teach others one day. I changed to the 'Software' section. I find as a woman this is more to my liking, than 'hardware' (Sara, TB, October, 1993).

Collectively, I found that graduates would have valued women lecturers. In terms of their own orientation, two of them aspired to become educators. The rarity of women in academe continued to preserve the masculine nature of the structural organisation in 1993.

Like most of the final years, Wendy's and Haylia's understanding of the WISE coordinator role was limited to "helping introduce school girls to engineering" at a "WISE night". First years appreciated the WISE coordinator's role as a bridge and

support in their transition to engineering, but expected peer mentoring from older women students:

> When I have to decide which branch of engineering, I would seek ... especially [older] female students before making a final choice (Rosemary, First Science /Mechanical, 1993).

A reason that older participants gave for not being "buddies" was because they were facing their own transition to the work-place:

> Not much mingling between years, [even though I know] more interaction helps you to know how it goes ... (Penny, Environmental, 1993).

Other excuses given at both institutions were that the "current WISE coordinator is not well known, [and] not involved" (Wendy, Final Civil, 1993). Tammy, as "a UEC committee member" had "not got very involved" and, anyway, "was not invited to the 1st year girls' lunch" (Tammy, Mechanical, 1993). The transition process to engineering education was not as helpful as first year participants wanted in 1993.

The "Black-Hole" of First Year - Persistence of the Cultural Milieux in 1993?

First year participants described their initial encounters with engineering education as a "black-hole" type of experience, in terms of both curricula and socio-cultural milieux:

> What am I doing here? - [No] design/just black science ... with my peer group I feel very alone (Charlotte, Chemical, TB, July, 1994).

Christie summed up the sexist nature of the culture:

> One of the main obstacles to many women in engineering is the reputation of engineers at uni ... and the fact that they live up to it by being blatantly sexist at social events ... having female strippers. I think some women find it intimidating and oppressive, I ... find it offensive (Christie, Environmental, 1993).

Their feelings of "black" echoed the recollections of the older participants, like Sally (Final Chemical, December, 1994) and Robbie's "first impressions on orientation day ":

> ..., were basically 'get me out of here'. After spending five years at an all girls' school and not a lot of socialising , intimidation only mildly describes how I felt. I[sic] few "explicit sketches" on the chair and desk didn't help much either! (Robbie, Graduate Electronics, 1993).

In the context of this study, little had changed in the intervening years in the cultural milieux to alleviate the initial loneliness, and disappointment of women, in their first year.

On the issue of lack of critical mass, Steve, like most participants, had immediately recognised engineering as a "bloke's domain", and yet for her "it was not really totally off-putting" because of the "35% critical mass of women in chemical" (Steve, Final Chemical, TB, Institution A, 1994). By contrast, in civil engineering with a low critical mass of women, students commented:

> Helen [and I] are the only two in same class - good we get along. Really awful if we didn't like each other. Same thinking (Marie, Civil, TB, July 1994).

Lois and Shelley found the "boys" were "really rude" to "females":

> ... its hard to explain, but if I had a question they had a laugh - 'easy' - eventhough they knew it was hard. Makes you feel horrible (Shelley First Civil, December, 1993).

Shelley, from a girls' school, also found some lecturers added to her discomfort:

> ... by focussing on girls only - "Do you understand?" - never the boys. In this engineering context they don't want to explain the rules to you (Shelley First Civil, December, 1993).

Vivienne was also offended by " the crude comments of a lecturer":

> when he compared the computer to a woman's body, ... even the men's reaction showed that they were ashamed of him too (Vivienne, First Institution B, December, 1993).

Angela concluded that lecturers behaved in this way because they "don't really have much ... personal contact" with women (First Civil, December 1993).

Helen and Marie complained about the "bad apple" behaviour of one lecturer, despite "the fear" they might "be penalised":

> ... in my final exam if I do so ... I would appreciate some advise on what I should do ... or can do ... for new girls coming through ... [we've] got to stand up and not let them get away with it (Helen, First Civil, 1993).

They found that efforts by academe to counter such sexual harassment were "ineffectual", with a "bit of a boys' club going on" (Helen, Civil, July, 1994), which some male students were "embarrassed about it too" (Marie, Civil, July, 1994).

In both faculties in 1993 and 1994, lecturers (and some male peers) appeared to be hindering first year women's development of a group identity as engineers. Whether flagrant sexist behaviour or not, women were positioned as "other" up against, what I coined as, the "hard edges of engineering". However, most women were realists about the culture of engineering and like, Lois, conceded that it would not be a "bed of roses in the workforce". Lois, also, anticipated bias in her "career selection" because "Asian appointments say males only wanted in a job" (First Civil, 1993).

Curriculum in Engineering Education in the Two Institutions 1993-1994

Curriculum Organisation, Its Nature in Building Engineering Constructs

Sylvia observed that first year was "not like any other year or engineering itself" (Sylvia, Environmental/Science, December 1993). Katelyn's description of her "stark and grey foundation course", encapsulated feelings of loss in the women's learning:

> ... really missed Arts, literature ... [I am] enduring lectures/tutorials - [My] interest/ motivation lag depressed [me] (Katelyn , First Sci/Eng, July 1993).

Charlotte's "black science" and Colleen's "dry" descriptions of engineering education matched those of the older women, like Sandie, who found its "bottley applied science" emphasis confused them as to "what it was all about". Charlotte told me how she had been lured into chemical engineering, because she liked "Chemistry", but found it had a "mainly Physics base", yet she was prepared to "give it a go any way". Women, who had enrolled in double degrees in Institution B, were less confused about the nature of engineering. For example, Lois was able to "put the computer to use in Civil" and "as part of Mechanical " by "drawing on computer graphics" in commerce. (Commerce/Civil, January 1994). There was a general consensus amongst the women that a "profs' run down would have been helpful" (Charlotte, First Chemical, TB, 1993).

Women's First Year Progress in 1993 - Lecturers, Lectures and Workshops

Collectively, the participants valued the academic support of lecturers and evaluated a number of qualities of an effective lecturer:

> Some good - keeping everyone's attention. Visual aids - overheads - some only [used them]. Some gave interesting explanations - anecdotes, actual situation - not always. Content influenced quality and how interested he's in [the]topic. Helps if [he's] enthusiastic about what lecturing in (Michelle, First Civil, 1994).

Charlotte, like others, valued those lecturers who made deliberate linkages:

> ... of Maths/Science to Chem Engineering ... Slow awakening ... through [the] lecturer, [we] actually do structural analysis /dynamics (link Mechanical) (Charlotte, First Chemical, TB, 1993).

Chance encounters also made a positive difference to their achievements:

> Physics tutor - great tutes. Knew his stuff and explained well and so I managed to pass at the end of the year (Angela, Civil, February 1994).

Christie found hierarchical hindrances in accessing her professor's "better sources of knowledge":

> ... "go find a tutor" ... some [of them] don't speak English ... tutor (fluid mechanics) didn't help ... solutions in Spanish were given out, one of the other engineers gave translations (Christie, First Environmental/Science, TB, February, 1994).

This led many participants, like Christie, to "work problems through informally with their peers" or "alone".

In computer and generic skills workshops, women began to compare themselves with their "smart tute group" of men:

> … the boys 'know everything' - 'commonsense' wise - it's their hobby for life (electrical design) - in their spare time their passion. We were never really a computing family! (Katelyn , Sci/Eng , 1993).

Chantelle was the only woman with a specific adult hobby in "role-playing computer games". However, women who built up their skills early in the course appeared to be able to construct a self image of confidence and competence around computers:

> … when I learned Excel - a valuable package [for] process analysis. Use all others - I'm grasping it easier - plugging in values (Charlotte, Chemical, July, 1994).

Charlotte represented women with fears about their lack of generic skills and "expertise" in engineering workshops, but the individual and team approach taken by one lecturer built Charlotte's confidence, her generic skills, and collegiality:

> Mainly not good at things ... [I'm] afraid I'm going to be wrong. It's big machinery, [I've] never seen half the stuff. [It's a] man's world ... they play with them in their spare time (Charlotte, First Chemical, TB, 1993).

She found "most" lecturers were "pretty good" with supervision:

> ... they explain slowly. No horrible men. Whilst next to you, [confidence increases] - when they go away- you've got to do it by yourself (Charlotte, First Chemical, TB, 1993).

Working in "pairs in some labs" was also "helpful":

> ... that's a lot better - more confidence ... discussing with other person - [we] can work out what actually is right (Charlotte, First Chemical, TB, 1993).

Collectively, the women preferred to learning interactively with knowledgeable lecturers, and build their skills with peers in workshops. They learned to problem-solve informally with peers or alone.

First Year Participants' Achievements and Personality Development 1994

Creating Difference: Other Career Events and Personal Decisions

Differences, as well as similarities, in career pathways began to emerge from each woman's story. For example, Terry applied for and won a scholarship that linked her into early "work experience":

> [I was] assigned to a senior engineer (Never met one). More opportunity in smaller company - new initiative - whole new way. Completed 6 wks work experience ... over Summer - great, wonderful (Terry, TB, Late, 1993).

She also chose to attend evening seminars:

> Chemical Engineering - [I did] not know a great deal. We had [a] talk in the evening in the middle of the year - tells us what it is all about. It had a different emphasis - talking about Ethics (Terry, First Chemical, TB, Late, 1993).

In contrast, Lois chose to "live away from home" and bore the consequences:

> In first year, it was really hard. It made a big difference - [I] got caught up in the social life. Subjects came very easily [leading to] a blaze attitude (Lois, Civil, 1993).

As part of their on-going career development, both women had learned from the consequences of individual choices, both successful and poor.

Outcomes of First Year - Building on Constructs of Engineering

Participants added progressively to their construct of engineering. For example, Marie defined "civil engineering" as:

> ... a discipline [that] involves lots of logical thinking, may be a little hard work and lots of imagination which is later directed on real-life problem solving (Marie, TB, July 1994).

Louise differentiated engineering into types and personal preferences:

> Mechanical Engineering of all different engineering , I like ... best. Never liked Electronics with 'circuits and all that'. Civil just statistics, all it is 'structures and make sure they are stable' - Movement in Mechanical appeals and enjoyed more (Louise, Mechanical/Chemistry, Institution B, TB, December 1993).

At the end of first year, their definitions of engineering were more specifically defined into fields, which involved their logical thinking and creativity, with a growing sense of personal vocation.

Success in First Year Examinations and Coping with "Put Downs"

Like most other first year women in 1993, Shelley passed her examinations, but again endured "put downs" by competitive male peers:

> With results, boys wouldn't tell you unless [you have] a lower mark than they did ... if [yours is] higher it must have been 'an easy exam' - Girls congratulate if [a person's mark] is higher (Shelley First Civil, December, 1993).

Her way of coping was to say:

> [It's] fun now, I don't think about it any more (Shelley, First Civil, December, 1993).

Those who completed their first year of a double degree "worked very hard":

> I felt so much maths/science ... 4 different units - 7 exams- Maths(2), Physics, Chem, Engineering (3). Passed everything A+A Maths, A+ Chemistry, B+ Eng/Physics. (Louise, Mechanical/Chemistry, December, 1993).

Christie, despite her maturity on entry, confided that she was "scared about the whole thing" and because marks were "very important" to her "the C's threw" her (Christie, TB, August 9th, 1997). This suggested to me that the "put downs" from male peers, the heavy work-load and fear of failure, affected the quality of some women's academic grades in first year.

Intellectual Outcome - Learning Styles for Engineering

I found that first year women at Institution B were more inclined to be strong pragmatists at the outset, than those in the first year at Institution A, and final years in both institutions. Like the older women, the younger women began to relate the first year curriculum to their learning styles:

> [It was] all v. quick - I changed ... my "reflecting " style [because of] so much material (Terry, First Chemical, Late, 1993).

As a "very strong reflector", Charlotte was also critical of assessment that encouraged "up to last minute cramming" and "not enough reflection" time between examinations (First Chemical, 1993). Rebecca benefited from reflecting on how she learned:

> ... in first year, you believe that you do labs on your own. Now in second year, you can actually ask for help and its a good tactic you need ... (to know) when to ask ... my peers (Rebecca, Mechanical, July, 1994).

The women were critical of the mismatch between the curriculum and reflective learning styles**.** However, I found that some women had adapted their learning style to the nature of the delivery of the program and/or to become better learners.

Outcome - First Year Drop-outs From the First Year Program in 1993

Three women, Katelyn, Colleen and Vivienne told me they were withdrawing from engineering during or at the end of first year. Each had based her reasoning on being "true to self" (Vivienne, First Civil, December 1993). Colleen left "in September in the hope of entering medicine" (TB, September, 1993). Early in 1994, Katelyn called to explain:

> I liked Mathematics and science, I had to use that ... I don't have [the opportunity] to use parts of me ... I need a different career, [my] personality disposition needs to be met. To work with people ... (Katelyn, First Science/Engineering, TB, 14 February 1994).

Katelyn, in contrast to Colleen, completed her year in engineering to keep her options open and achieved "excellent" grades. In Super's terms, she worked through a "mini-cycle" crisis of lack of person fit (Super, 1990). Although Vivienne was successful in her double degree, she "was not keen on ... the snobbish pseudo-intellectual engineering ethos and the rigid structure":

> … [and]... [its] very mathematical ... [there is] not much practical ... I hear it is more practical, friendlier and better for women in civil at [A] (Vivienne, First, December 1993).

She resolved her crisis by transferring to the other institution and repeating the year. The three women chose to withdrew of their own volition and were not followed up by their Faculty.

"Daughters of Crisis"? - Countering Lowered Motivation in Second Year

The toll on the emotional health of Carolyn and her withdrawal from engineering in second year was salutary:

> Fired up ... led to more selfish thinking ... very hard [I reached] a plateau - a 'can't be bothered' period. How I feel about things ... [it was] useful to write how I feel and [I] look back figuring the way I first studied and the way I feel now (Carolyn, Pilot Study, Chemical , 1994).

The majority of younger participants were academic achievers, but they too lacked motivation. For example, Helen:

> Lost a bit last semester - [went] "down" to get back up. Definitely want to be [a Civil engineer] - boredom - depression - I had enough studying (Helen, TB, July, 1994).

Although the emotional well-being of some of these women was at risk in both engineering faculties, I found that they were sustained in four ways. The first was through the development of an interest in a specific aspect of engineering. For Nicole, like Sandie, it was "Geomechanics" (Nichole, Civil, January, 1994), especially when she "caught the enthusiasm" of the lecturer. Secondly, making time for leisure was a life-saver:

> Fencing - & still time for recreation each day (Rebecca, Mechanical, 1993).

> Hard slog ... I enrolled in a painting course at the community centre ... aesthetic respite! (Louise, Chemistry/Mechanical engineering, May 1993).

Thirdly, Jane found that personal qualities were helping her to become "a successful woman in engineering", such as:

> ... level of courage, awareness of women's issues and how prepared [we] are to fulfil [our] desires regardless of society's expectations (Jane, First Civil, September, 1993).

Charlotte valued and promoted her feminine attributes, along with the masculine, in engineering:

> Strength female - ability to get job done rapidly and properly. Bit of creativity - "just do it this way" men say - Oh, well - slowly work at changing this attitude. Strength male - always willing to check lecturer and other students - make sure what [they're] doing is right (Charlotte, Chemical, TB, July, 1994).

Finally, women were supported by loved ones. For Sylvia, "Dad, an engineer, kept me going" and now she was:

> Looking forward to specialising and doing engineering than this first year (Sylvia, Environmental/Science, December, 1993).

Collectively, they took personal responsibility to resolve their dilemma of lowered motivation by: developing a vocational interest; making time for leisure; valuing what they, as women, brought to engineering; and having continued family support.

Final Year Participants' Collective Story of Engineering Education

Self-Evaluation of Personal Determinants of Life-Career as Future Engineers

Most of the final year women had achieved highly, but some, like Zumei, had struggled:

> I failed one paper in 'control', which I redo next year. The rest were 65%. Just one subject left behind, involves a lot of calculations. I'm practising with all my notes already (Zumei, TB, 24 July 1992).

Final year women reflected on their characteristic traits and dispositions, study and social skills, learning styles, coping strategies, vocational and avocational interests and aspirations with regard to their goodness of fit for engineering (see Tables A & B *Personality Determinants).* Haylia, Penny, Robbie, Ivonne and Mars identified perseverance as a strength. Wendy agreed, but admitted "it takes 'an act of will' for me to be so". Sue also bemoaned her "lack of perseverance and ability to apply myself". They agreed with Ivonne that they had to be "hard-working". Mars believed "you must be methodical in getting work done, therefore [you] must be self-motivated " and "be able to work alone". Sally found that being "pro-active leads to interest" in engineering. Aggie experienced the negative reality of "being [too] feminine" in engineering education:

> ... [it] gives an impression that one cannot handle tough project [sic] or things that a male engineer can do ... [It leads a woman to] under-estimate one's ability (Aggie, final year Electronics & Information Systems, Institution A, 1993).

Aggie's observation was salutary in the context of engineering in 1993.

In the milieux of engineering, all (other than Mars), agreed about the need for "good social skills" and to be "outgoing". Sue said "you must be able to get on with class mates" and Robbie laughingly bemoaned "[I'm not outgoing], so no fun, no friends!". Wendy commented "I'm the Rep ... so I'm now labelled as a 'people person'". "Being happy" was considered to be a strength by most. "I'm practically always happy," said

Tammy, and being "outgoing leads to good group work". Sue, like Wendy, Penny and Tammy, found "flexibility is a strength". All valued being "caring". Robbie added facetiously "about some things, [I have a] very feminine [concern] about relationships and affairs!". Wendy considered that a sense of humour "depending on the recipient" was an added strength.

Ivonne considered that "good study and work skills were where "women might outshine men". To "like to study was a plus", said Tammy. Intuition and reflection were considered to be desirable strengths by all the women. They had increasingly adapted their learning style preferences (ie sensory/intuitive, auditory/visual, actively/reflectively, deductively, sequentially/global) to the type of problem encountered (eg, Haylia, Wendy, Ivonne). For example, Wendy, a strong reflector on both dimensions, commented "I learn how to learn as I go along":

> [I was] crowing in 1st year, I worked and got 4A+'s. I found it useful to learn from application in a 2nd year learning situation. [I achieved] 1C, 3A's, 3B's. Down spiral in 3rd year, with 1A+, C, C, I reflected on that ... (Wendy, Final Year Civil, December 1993).

They were also responsible learners. For example, Zumei, with an overload, had a well organised plan of action and extended her course:

> Two assignments due. Exams in two weeks. Term's very heavy with overloading. [I] finish next semester ... [I'm] building components for future students to use. I design, work and build it and complete it in the summer holidays (Zumei, 3 November, 1992).

In terms of creativity, Penny and Ivonne did not think "being innovative" was a strength that women "overly possess". Wendy thought this was because innovation was "situational" in its manifestation "like an architect".

Like Billie, most women, had refined their coping strategies by methodically linking specific strategies with the roles and challenges they faced in different contexts:

> Assignments - seek fellow students then lecturers. Personal problems ... and social ... patients (sic) and talking . Work - bluff, hard nosed tough... Choices - thinking and then hard decisions. Professional - imagination, inner strength. Personal - self esteem pep ups (Billie, Construction, Institution A, 1993).

The majority tried to make time for leisure (see Table E & Table F). Valerie, like others, was "not satisfied in Engineering", with its focus on "facts", and compensated through leisure and socialising:

> ... Read[ing] big vice, rarely TV. Balance boy friend and life. Friday Valburgers, massive constructions. [My] creative outlet - Cooking - ... with relatively little effort and tasteful and in a reasonably short amount of time [I] see results (Valerie, Final Chemical, TB, 1994).

A few, like Ivonne, found part-time work to satisfy an interest in the arts:

> Was in the youth orchestra but did not choose to do 100% music. I play flute in a trio at weddings. [I] miss the creativity ... Melbourne uni has an engineers' orchestra! (Ivonne, Electronic, 1993).

Others found their outlet in sports and community work:

> Sport, less than I used to. Enjoying kayaking. Surf harbour - help there and teach others (Anne, Chemical Final Year, -TB July 1994).

A minority, like Sally, found it took "quite a long time to sort out life":

> Occasionally badminton, must step this up. Hard to get involved (Sally, TB, 1994).

For many of the "stayers" their motivation for remaining tended to be, at least in part, to "show them I can do it" and "looking forward to the job" with some trepidation:

> ... How well skilled am I? Got to get through the next 8 weeks. It's hectic I need a break. As I get closer to work I start to ask what's being involved. I'm writing down a list of questions. Was it a good decision to make? and will I survive for a couple of years? (Penny, Final Environmental, 1994).

Most aspirations, like Wendy's and Anita's, included vocational interests for their future roles as engineers:

> Work in mining ... more of mining organisational and structural. (I) like mining operations. As a Civil engineer, I hope to progress to quarry manager (open cut mining professionally). Personal - married / children (Wendy, Final Civil, July, 1993).

> Consultancy, after these experiences (Anita, Final Chemical, July 1994).

For some, like Wendy, personal life relationships were still a remote possibility. Others, like Sally, had "started to think about the situation":

> When to decide on a family. I see a lot of problems. - how to maintain chemical engineering and raise a family at the same time ... quite seriously - juggling time too! (Sally, TB, 1994).

As Haylia (Electrical, 1994) remarked, the wide range of positive personality characteristics made them "very suited to engineering, especially engineering management". Each had a vocational interest and aspirations for a position in engineering, balanced by leisure interests. Although they were determined to succeed, there were vestiges of low self-efficacy with some feeling that one's femininity was a handicap to success.

Participants' Views on Situational Determinants in Final Year Engineering

Gender Regimes, Affirmative Action, and the WISE Coordinator's Role

As Wendy indicated earlier, the WISE (Women in Science and Engineering) Coordinator was generally recognised in recruitment and early access, rather than support to enhance women's participation and retention. Sue felt that such support:

> … [was] OK, but... [I] haven't really needed any support (Sue, Final Mechanical, 1993).

Mars valued the WISE support role, provided she kept a low profile:

> Only contact I've ever had was a lunch in the first week of first year. She/he seems to keep a very low profile, which is probably good as long as she is contactable. This is because there is a certain amount of resentment for perceived 'favouratism'(sic) of women (Mars, Final, Mechanical, 1993).

Penny was more antagonistic:

> [I] dislike positive discrimination ... Weak ... I have sufficient support elsewhere (Penny, Final Environmental 1993).

Anita blamed the feminist movement for such provision:

> ... women chose to be there ... [its the] feminist movement, they push too hard for the sake of the issue (Anita, Final Chemical, July 1994).

Mandy was more concerned that the "guys were in uproar" about the WISE coordinator's proposal to help women in engineering:

> Yes. I think I have only had a meeting with her once - that was just when she was introducing herself and she was saying how she get perhaps organise to get separate tutorials for the females alone and the guys were in uproar. "What - why don't we have this, [too]?" (Mandy, Chemical, Final, 1993).

Final year participants, in both faculties, ranged from cautious to vehemently opposed to positive discrimination, and not offending the" guys". Astrid, a staunch supporter of the WISE coordinator, defended their position:

> Undergrad women don't want to be singled out - they want to blend in, I struggle with this (Astrid, PhD Civil, 1993).

Their attitude of "blending in" at all costs, neither challenged the status quo at the structural organisational level, nor their consideration of help from the WISE coordinator to assist in their transition to work.

Final Years' Views - Cultural Milieux and Critical Mass of Women

Women in chemical engineering valued their situation, compared to:

> Mechanical Engineering - I can't believe it is 1 female / 35 males. That would be difficult with no female support. Friendship, [we have] level and choice. Guys in our class do not feel threatened if I say "can I have a go?". I am quite vocal/assertive, not over-ridden (Valerie, Final Chemical, TB, 1994).

In contrast, Beth found "a common belief amongst the guys" in electronics was "the existance[sic] of the 'woman factor'":

> This was a ficticious[sic] mark added to the raw score of many pieces of work completed by a female! In most cases it was a friendly joke ... (Beth, Graduate Electronics, 1993).

She came "across one of the tutors that used it, regardless of what I did":

> We worked this out because my lab partner and I always wrote the lab reports together, and they were identical. On a couple of occaisions[sic] I had clearly not done better ... [Lecturer] was a bit socially inept, and I think he felt intimidated by the presence of a female in his class (Beth, Graduate Electronics, 1993).

Other than chemical engineering, lack of critical mass was still a disadvantage for women in terms of academic and inter-personal interaction.

There was a paradox in that older women had developed varying needs for interaction and support from peers in engineering. A few preferred to be self-sufficient:

> Not much contact with other engineering students. Talk to my boyfriend ... or a girlfriend (Haylia, Electrical, 1993).

Most considered "not talking to others" would be "a problem":

> Talk to friends, quite happy to ask, there's quite a bit of talking. We know each other, [we're] a mixed group 'me and them' (There's been attrition 6-->1). It's different at other unis! (Ivonne, Electronic, 1993).

They needed to make time to "talk to each other" to prevent "losing sight" of women friends in engineering, but were selective with others:

> ... Some in my class I don't know all that well are the 'get drunk type' (Wendy, Final Civil, 1993).

Sue found she had more in common with men, than her women peers:

> Difficult with the small critical number of women. In the middle of the year, two of us had jobs. [We] 4 don't socialise. We have quite different personalities. Not very likely to stick together. All of us have closer friends in male groups (Sue, Final Mechanical, September 1993).

Although becoming increasingly independent, final year women valued good working relationships with men and women peers, who were also friends.

Intra-Personal and Inter-Personal Sustainers - Outside the Faculty

Those who continued to survive the course had the support and companionship of their families and special friends:

> A network of friends in different areas is great - definitely need some non-engineering friends (Mars, Final Mechanical, 1993).
>
> Yes, my best girl-friend, Janie, says don't worry about it. We give mutual support (Mandy, Final Chemical, 1993).

Women now talked of special boyfriends, but remained single-minded in their pursuit of engineering:

> My "Partner" is supportive. Chemical engineer, 4 years. Halfway through his final year. Part-time here. We don't necessarily understand differently - I have a tendency to talk to female friends (Sally, TB, 1994).

The women continued to value the role of "loved ones", girlfriends (non-engineers and engineers), and for some women, a special boyfriend, in satisfying personal and professional "needs and interests".

Women and Engineering Curriculum in Final Year, 1993-1994

Participants' Evaluation of their Engineering Education Program

Tammy was typical of women who valued the progression to a team-based, practical problem-solving approach:

> At first the course was quite theoretical maths, physics, computing etc. That was fine - I'm good at that kind of thing. In 3rd and 4th year, the Mech[anical] course ... became [it's] more practically oriented. There is a wide variation of units and teaching styles. Design is emphasised - how to do it - and practically every exam is open book. Also there is heaps of group work ... I think that this has taught me to learn in ways that are not natural to me, which is very beneficial ... I don't feel I've learnt much "material" in the past two years - just methods ... It's really good when I apply knowledge to a situation (Tammy, Final Mechanical, 3/11/93).

This approach linked to the women's personal determinants of career (see previous section) and identity with engineering.

Participants also continued to refine their skills in computer programming, technical drawing, and other practical generic skills. They knew that "in the work force":

> ... you have to be computer literate. Only in the past few months has there been more emphasis on programming (Robbie, Environmental, 1993).

Most women, like Mars, found the course "very deficient in both drawing and computer development" (Mechanical, 1993). As a result, women's competencies in computer programming developed through practice, rather than formally

> I bought a computer a year ago ... I have become quite proficient in using the computer (Haylia, Electrical, 1993).

There were also electives in both institutions, with an issues unit related to equity and society. At Institution A, Anita suggested improvements to this unit to better prepare men and women for the work-place:

> … we needed skilling in a) Quality accreditation b) Standard procedures c) Some issues [were] not covered [in the] "4th year general unit " (Anita, Chemical Final Year, TB July 1994).

The participants understood the overall assessment process:

> The evaluation is fair, quite good. Course work is collated. Weighted average over each year - 4 at 4th year, 3 at 3rd, 2 at 2nd, 1 at 1st. Lot of importance on the project. The thesis project is on a separate scale. They use a graph to collate and plot the class of honours [you gain] (Penny, Environmental, 1993).

Projects were individual not collaborative, despite the trend the participants found in industry for increasing use of teams in design and build. Women's perceptions of the "final year project" and learning process differed:

> ... Not your beaut analysis stuff, data processing! So much is open-ended - how much time to spend [on what] it all seems to take all of your time ... With vac work its 'solving a problem', with more of 'you know when you come to an end' (Wendy, Final Year Civil, 1993).

> The project I chose myself. It was practically based, a fieldwork and interpretive type. Designed sampling project - a management option that can be implemented in real life if they wish (Penny, Final Environmental, 1993).

Robbie begrudged having an individual project:

> Can't get help from my friends ... no idea of the project ... [it's] very much an individual thing ... [I'm] better when I've got someone to do it with (Robbie, Final Environmental, September, 1993).

Women were most content when their projects were interest-based and involved real-life problem-solving.

Women's Expectations of Academe - Lecturers and Supervisors

Final years expanded their evaluation of lecturers as conveyors of knowledge to supervisors of individual projects. The general consensus about lecturers was that

they were "more interactive and understanding", with positives and negatives associated with satisfying participants' learning needs:

> ... In lectures, they give brief outlines and use diagrams and models. There is less talking and more doing. More holistic [views] and others are crucial assets for engineering ... I need lots of examples to support, which is lack[ing]. (Jenny, Final Chemical, 1993).

> Have a good text that's well set out with examples on basics and general methods ... [I] tend to turn to friends in same year for help, not lecturers ... (Valerie, Final Chemical, 1994).

Others, like Robbie, linked the effectiveness of lecturing methods to the lecturer's teaching style and its match with the student's learning style:

> Structure and content depends very heavily on the individual lecturer and many of those tend to place much emphasis (at least in 4th year) on researching and designing new methods. As far as the course goes it is very much geared to a "pragmatic" way of thinking. For example Fluid Mechanics and Mechanical engineering are very design-oriented. There are only one or two lecturers I would classify as "theorists", their units are aimed at learning a set of techniques, methods etc & then applying them to real-life problems ... (Robbie, Environmental, 1993).

She deduced that "different fields of engineering would show distinct differences" and she was comfortable in "environmental engineering":

> ... I feel the course structure and assessment tends to focus on integrating various disciplines together, analysing whole systems (which I enjoy). Generalists, which sets it a bit apart. Overall, I think people, who tend to be pragmatists/theorists, get the best marks, because the course is geared to this kind of learning (Robbie, Environmental, 1993).

Women's reflections on their own learning styles and needs were insightful, especially in assessing how the lecturers' learning and teaching styles affected their grades and preparation for real-life-applications in specific fields (see also Table E & Table F, Appendix G).

The women's evaluation of the efficacy of their lecturers as project supervisors was less favourable. Steve was one of the few women who identified the characteristics of the "mentor" role and the benefits to her:

> Project - my mentor relationship is not too bad. ProfB offered ideas and asked what you thought. His availability helped with deadlines (Steve, TB, 1994).

Many participants were critical of "supervisors", who were "busy all the time", because "you're not welcome, if [they're] busy":

> ... stress for him too [He's got] 4-5 people on average. He was doing some other type of work, he didn't tell us ... there was not enough time. He'd go away when (it was) a critical time for me (Tammy, Mechanical, Final year, Institution B, 1993).

Wendy's lecturer "in practical terms, was not very helpful", but she conceded that:

> It was not his fault - I was too long before finding what I was supposed to be finding (Wendy, Final Year Civil, 1993).

Penny was "paralysed for 4 weeks" because of "joint supervision":

> ... [because of] two specialties [which] fell down. [There is a] blend of independence and individual [mentoring], at the supervisor's discretion, [it] relates to the difficulty and nature of your project (Penny, Final Environmental, 1993).

Others tried to compensate with positive thoughts about future career:

> 4th year project mentoring leads to Engineering, leads to success. Combining home and career leads to me considering consultancy, leads to managerial (Sally, Final Chemical, TB, July, 1994).

Mentoring with individual projects was valued by the women. However its effectiveness depended on the "luck of the draw", the complexity of the tasks and number of supervisors, the qualities of the supervisor, his availability, the numbers he supervised, and whether the women asked for early guidance.

Final Year's Views on Work Experience and "Learning the Ropes"

Sue, represented the variety of positive stories about work-experiences:

> ... what engineers did and ... the practical side of things. I learned something different and tackled the more diplomatic side of things, [that] I'll get in various industries. I observed the dynamics of firms. Seconded out [I learned] ... how to work as a team. I always asked for advise on vacation work [such as] how to get a job and what to expect (Sue, Mechanical, 1993).

Work-experience was powerful for sustaining their intellectual needs, and enabling them to practise practical and interpersonal skills. The outcomes were increased motivation through investment of self in tasks and work-satisfaction.

Academic Achievements and "Other Successes" for Final Years in 1993

The women's concept of success was broad. The women valued academic achievements, even those who struggled:

> Barely graduated ... In 4th year, I had 44% on a steel design, and a better average (Wendy, Final Year Civil, December 1993).

Their assessment of success was not only achievement-oriented, but also process-oriented:

> Initially I was determined to get a 1st class honours. I feel very good about it, [I'm] finding out about 'real things'. Have done as well as I could have, as well as having a life. Getting an engineering degree - not every one could do it and do it well (Robbie, Environmental, 1994).

Their evaluations of the process were realistic in terms of best effort, interest level, and having a balanced life-style. Such adaptation by the women positively endorsed personal aspects of Super's (1990) 10th and 11th propositions (pp. 207-208).

They assessed overall success in their individual final year project in terms marks and level of self-efficacy:

> Still doubtful about engineering skills, marks reasonably good. Project affected my confidence. Group of two other girls. Usually sit down and work out how to do it. Building up confidence. Am I doing it right? Probably guys don't have trouble with building up confidence, tend to be confident. Job offer! (Penny, Final Chemical, 1993).

Robbie (Final Environmental) summed up the general feeling "Application in engineering, I am least competent with self". They varied in their perceived levels of self efficacy in the application of generic and technical drawing skills to civil, mechanical and environmental engineering. For example, Wendy considered that she had gained the "practical skills" in the "craft" of civil engineering", whereas Penny in environmental engineering labelled herself as "weak ". In mechanical engineering, Tammy confided "I have very little knowledge on car engines", whereas Sue evaluated herself as having " no freehand skills gained, but technically OK".

Their final feedback on computer skills also indicated a range of competence and confidence. Penny was the most confident:

> I'm very advanced in packaging and programming (Penny, Environmental, 1993).

In terms of outcomes in the issues unit, Haylia, like Wendy and Ivonne, wrote to me after presenting a paper on women and society:

> I was rather uncomfortable talking about women's issues and rights to a group of men, but it went well. One admitted he was sexist even though he doesn't want to be and basically all of them are as a result of being raised in a sexist environment. It will take a long time to reach [gender] equity because people need to make a concious (?spelling) effort not to be discriminating (Haylia, Electrical, 20th August, 1993).

These women were encouraged to teach peers for change through the curriculum. Their presentations impacted on some of the male audience in a positive inquiring way.

Milieux - Women's Constructs of Engineering and Identity as Engineers

At the end of the exploration stage, the participants' group identity was influenced by their interaction with male peers. As Beth remarked:

> There were a couple of times when I almost felt like I was a man simply from spending so much time around guys at uni, and especially since many of my closest friends were guys. This got a little frustrating every now and then (Beth, Graduate Electronics, 1993).

With an element of frustration, they compromised their feminine identity by positioning themselves as "one of the guys" to belong.

The women also identified a broad range of characteristics of engineering that aligned to individual constructs of engineer, represented here by Jenny, Mandy, Anita and Valerie in chemical engineering:

> Concrete profession, with a diversity [of roles], a combination of technical and administration work, with a challenge [and] visible measures of achievement (ie I am an "engineer") (Jenny, Final, Chemical, 1993).

> … involving something new, not monotonous, involves seeking and providing help to / from others (Mandy, Chemical, 1993).

> [In] essence designing plant equipment, precise safety ---> chemical plant ---> refine, working with people in plant to make sure the group work well (leadership). (Valerie, Chemical, Graduated 1993).

> Be able to say "I built that" one day about a plant designed and constructed (Anita, Final Chemical, 1993).

In attaining vocational identity, most women positioned themselves as "one of the guys", yet had a special interest, accepted a leadership role, favoured becoming designers, and held an ethic of care (see also Table E & Table F, Appendix G).

Transition to Work - Views of Participants on the Gender Agenda

I focus in this section on the women's expectations of the workplace, perceptions of the Institution of Engineers, and experiences of tokenism and their interviews. Wendy, like others, had realistic expectations about the culture of engineering and the subtleties of gender relations from their work-place experiences:

> [I have] my 'guard' up ... I am not likely to go out and get drunk, its part of the culture ... it depends ... young engineers where I am at the moment, but last year older engineers and a few younger. They're different people. Swearing - it runs off a bit, not to me or at me. Most respect me (Wendy, Final year Civil, 1993).

In their view, engineering was a profession in transition in 1993, where men had the potential to approve or compromise women's professional position.

There was a mixed response from the participants regarding the help that their professional body, the Institution of Engineers, could provide women in transition to work:

> Wasn't aware of the existence of an institute (Mandy, Chemical, 1993).

A few women had already used some aspects of networking:

> Engineering women's Institute/Newsletter. Fairly accurate. Strong tendency for it to be scheduled during exams ... 2 mixed meetings were beneficial. Too much, too narrow not geared to students (Anita, TB, 1994).

Anita criticised the women's branch's lack of contact with women students:

> No major effort to contact [University A] women. I do know they have more contact with [University B women] (Anita, Chemical Final Year, -TB July 1994).

Penny was really enthusiastic about the Institution of Engineers:

> [There are] a lot of girls, particularly the radically feminist, [who are] pro-discrimination, categorically associated with needs and experience. More now are being promoted to upper management ... [This is] better for us, with child-care and standards [because bias] is not immediately obvious (Penny, Environmental, 1993).

She was the only woman who understood the importance of networking, advocacy, and the mentoring role of women for younger women's career development in transition to work in 1993.

The participants went to interviews sharing the common expectation of becoming a successful career woman in a traditionally masculine profession. In regard to the issue of tokenism and bias in interviews, Sara, a new graduate, compared her interview in 1992 with that of another woman who was made to "prove" herself:

> ... she lost an interview - [there was] no woman on panel - she protested (Sara, TB, 19 October 1993).

Sara's interviewers were less problematic, but they made "sexist" comments:

> … such as ... getting [my] "hands-dirty" [and] "competency in engineering". They avoided talking about clothes! [They] suss you out - "Can you stand the conditions?" Do you mind hot, dirty environments with "men"? I got an offer ... I didn't take that job (Sara, TB, 19 October 1993).

Sara thought this was because "engineers want us to be male clones":

> ... I am missing out on reflective caring images of women. Time to change people's idea on what an engineer is. [I am] considering higher studies in the final analysis (Sara, TB, 19 October 1993).

Sue, Billie and Jenny, were interviewed for positions in the autumn of 1993. Sue prepared well for her interview whilst "on vacation work":

> I always asked ... this guy's advise [sic] ... on how to get a job: interview techniques, type of questions to ask and what to expect. I was also seconded out to several firms, [where] I observed the dynamics. I found with X, [it was] directed at team work and how [you] worked as a team (Sue, Final Mechanical, 1993).

Sue was realistic about first postings:

> At this time you take what you get, I just happened to be lucky I got the job I really wanted (Sue, Mechanical, 1993).

Billie found that "guys don't interview women like the men", so she "deliberately" changed her own behaviour:

> ... and so I make eye contact ... I have a more normal interview as a result and things fell into place. I am really different and they don't understand (Billie, TB, 23. 9.1993).

Jenny's three interviews were "not too good" with "no second round" offers:

> The questions varied. Past instances of what I'd done ... lab projects, how? ... what qualities I had? ... [I was] quite relaxed [about those questions] ... [A female asked] an unnecessary question ... if I had a boyfriend and about moving away. Gives the implication he was my keeper not friend ... ownership of women! (Jenny, Final Chemical, 1993).

Collectively, these women had shown maturity in preparing for the interview, wanting to effect change in interviews and their future role as professional engineers. The persistence of sexist questions, regardless of the interviewer's gender, remained an issue for participants in 1994.

Some women, like Sue, found that when they were offered a job, the men students became derogatory:

> Every time a woman got a job, boys barrack ... "It's all the advantages you get". They never stop talking about it. It did upset me for a quite a while ... As a woman I did appear to strive a lot more (Sue, Final Mechanical, 1993).

Over-competitiveness of male peers pervaded the culture of both faculties. By ascribing success to affirmative action, rather than to merit, the "boys" questioned the integrity of the participants as engineers and as women.

Summary and Interpretation: Traits, Trends and Gaps in Present Career

In relation to Research Question 2 (RQ2), the collective voice of the participants highlighted the continuing limitations of engineering education provision in meeting their special needs as feminine ambivalents.

Structural Organisation in 1993-4

Despite realistic expectations of the challenges for women in engineering education, and the support of WISE coordinators, most participants' experienced a cultural "black hole" on entry. The young participants' stories indicated the rarity of women in academe, and a sense of hierarchical remoteness of their professors that hindered their connection to the engineering community. They also voiced their need for older women students as peer mentors. Generally, final year women were too busy to be peer mentors to provide the needed "new anchor" (Josselson, 1987, p. 175) for first year women to "consolidate an independent identity" (Josselson, 1987, p. 139). The women's early awareness of the technical self-confidence of their male peers and feelings of their own inadequacies, also created for them a "technocratic culture", which made it difficult for them to be accepted, as found in research on women engineering students elsewhere (McIlwee & Robinson, 1992). With an element of frustration, the older women had compromised their feminine identity by positioning themselves as "one of the boys" to belong. This would, by inference, indicate that engineering for the women did not yet have "tolerance wide enough for a variety of individuals within an occupation" (p. 206) and had the potential to create situations for women of the "daughters of crisis" type (Josselson, 1987). I concluded that all these factors had contributed to preserving the status quo of a hegemonic masculine gender regime in 1993.

Cultural Milieux of Engineering Education and Lack of Critical Mass

I found no dissenting voice about the culture mirroring a "bloke's domain". Older participants in chemical engineering, who appreciated their own critical mass of women, were aware of women's vulnerability in other fields. Participants' stories indicated little difference between the first and final year women's initial experience of a 'chilly' climate in lectures by both male students and lecturers, which echoed women's voices in

research elsewhere (Anderson, 1992; Brush, 1992; Carter & Kirkup, 1990b: Erhhart & Sandler, 1987; Hacker, 1981, 1983, 1989; Lewis, 1995; McIlwee & Robinson, 1992; Willoughby & Carter, 1993). In my study, I found that women valued making friends with both men and women peers, but were selective irrespective of gender. However, they had to strive to gain acceptance with the men by adapting to degrees of gender harassment in different ways.

The participants' harassment from male peers erupted whenever examination results were posted, when the "woman factor" was exacerbated by lecturers in workshop assessments, or when women had chances of work. The younger women dealt with such put downs from "the boys" as "fun". In contrast, when dealing with gender harassment by "bad apple" lecturers, the younger women in both institutions, who were aware of feminist issues, challenged the unacceptable gender regime with courage and support of their WISE coordinators,. They told me some men students were "embarrassed too" by the behaviour of these lecturers. In contrast to the older women students, these younger women had actively begun to challenge the status quo in 1994. My findings lent support to my domain assumptions about work as a gendered construct and the lack of value given to women. In relation to Super's (1990) 10th and 11th propositions, women experienced inappropriate behaviour by "superiors and fellows" (p. 208), with intermittent "broken truces" (Collin, 1986, 1990), which compromised the development of self (as women and engineers), the achievement of an equitable group identity, and alienation from developing intellectual potential (Jaggar, 1983, 1989).

Curriculum Opportunities and Experiences

The participants were disillusioned with the "black hole" technocratic, applied science, nature of the first year program where their learning needs, interests, and values were not well met. The result for most first year participants (less so for those doing double degrees) was a significant drop in motivation, confusion about the concept of engineering and lack of real world connections, feelings of lowered self-efficacy, and lower than expected grades. One woman suffered a breakdown. A key concern for three achieving women was the seeming lack of an ethic of care they needed as future

professionals. They withdrew of their own volition, as indicated in research on women by others (Kvande, 1987; Wolffensperger, 1993). The remainder were re-energised by a special interest in engineering, as found in Anderson's (1992) study. I also found they regained motivation through forward looking self-talk and personal action. Collectively their resolution of this motivation dilemma was consistent with Super's (1990) 4th and 5th propositions about a qualitative process of change when a secure self concept provided continuity in choice and positive adjustment (p. 206). Both propositions interconnected with personal elements of Super's 1st, 2nd, 6th, 7th, 8th, 10th, 11th and 14th propositions for healthy career development and forward looking motivations.

However, low self-efficacy continued to be an issue for women especially in a learning culture where men peers displayed technical self-confidence and passion. They valued small group work and thrived on assistance and feedback from lecturers when their technical abilities began to "let them down". The participants' commented that first year examination grades were not commensurate with past high school achievements, as indicated in relation to women in other studies (Anderson, 1992; Thomas, 1991). This suggested to me that the "put downs" from some men, the heavy work-load and fear of failure, had affected their academic grades in first year.

Like the older participants, most of them recognised that it was a man's world so they doggedly persisted in developing vocational interests, devising ways of coping with, adapting to, and learning from the culture and the curriculum, and prepared to adapt their learning styles. They did so with courage, by valuing the masculine and feminine aspects of self, developing greater awareness of feminist issues, and finding time for leisure. These personal determinants, together with support from parental and friends, served to compensate for deficiencies in the first year program.

In final year, women found their lecturers were more interactive, which made a positive difference to the learning process and outcomes. Women were insightful in the way they had linked and adapted their own learning styles to the lecturers' teaching styles. They were knowledgeable about, and accepted, the overall assessment process, and were

pre-occupied with the completion of the individual project. A few of the women's projects provided outlets for their abilities and special interest which supported elements of Super's 12th and 13th propositions. Collectively they valued guidance and feedback with their individual projects, which aligned with Super's (1990) 9th, 10th, and 11th propositions (p. 207), but in reality they experienced different standards of supervision. On a positive note, two participants, who led discussions on gender in the social issues unit, were encouraged when some male students were prepared to interrogate the nature of masculinity and femininity in the construction of knowledge about self, knowledge and the world.

Their reflections on the way some lecturers' practical and theoretical expertise had helped them to learn for real-life-application and given them a sense of vocation in specific fields of engineering aligned with Super's (1990) 9th, 10th and 11th propositions on the importance of the enabling role of "superiors" (pp. 207-208). The women also valued work-place experience, which had helped them to consolidate their personal constructs of engineer and develop a greater affiliation towards engineering as their personal vocation rather than simply an occupation, which supported Super (1976) vocational theory and linked to his 12th/13th propositions (Super, 1990). I also found that the women could judge how professionally acceptable they were to different age groups of men in the work-place.

Personal Development of Feminine Ambivalents

In attaining vocational identity, most women were "pavers of the way" in that they had a special interest, accepted a leadership role, some favoured becoming designers and others managers, and held an ethic of care (Josselson, 1987, p. 181). Their definitions confirmed part of Super's 3rd proposition regarding "some variety of occupation for each person" (p. 206). The increased complexity of their constructs of engineer and of engineering, supported Super's (1990) view of the intimacy of personality and career development, where each woman was "becoming the type of person ... she wants to become" (pp. 225-226).

Collectively, the participants learned to be adaptive (perhaps over adaptive) and single-minded in engineering. They developed career maturity and adaptability through their own resolve to construct a personal and vocational identity. They showed perseverance, initiative, courage, developed an internal locus of control, and fostered leisure and work interests. They also developed strong coping strategies, which other researchers suggested would happen in stressful occupational contexts (eg, Folkman, Lazarus, Gruen, & DeLongis, 1986; Hegarty-Hazel, 1991; Kvande, 1987; Osipow, & Davies, 1988; Parkes, 1986; Thomas, 1990; Wolffensperger, 1993). The women's preferred learning styles were diverse (Table E & Table F), yet reminiscent of the characteristics of Douvan & Adelson's (1966) "ambivalents" and a combination of characteristics identified by other researchers on women's ways of knowing generally (Belenky et al, 1986; Baxter Magolda, 1992; Foster, 1989; Lemkau, 1979; Thomas, 1990); and in engineering (Anderson, 1992; Bickart, 1991; Carter & Kirkup, 1990; Evetts, 1993; Hall & Sandler, 1982; Kock, 1990; Scholer, 1993). For example, at university, they leaned towards ideas and things and to the social environment; they valued group work yet could work independently; they enjoyed problem-solving but needed the assurance and help from lecturers and male and female peers. I found, even when participants had successfully graduated, they expressed lingering doubts about technical self-efficacy and being innovative as engineers.

Bias in job interviews, tokenism, and transition to work

Collectively, I found the women had anticipated gender bias in interviews and were well prepared. They had foreshadowed their future vocational role aspirations, and some were wanting to effect change in interviews and the role of professional women in engineering. Even though they had shown career maturity and adaptability (link Super's 7th & 8th propositions), the persistence of sexist questions, regardless of the interviewer's gender, remained an issue for participants in 1994. The abusive remarks from peers after the interview was the antithesis of Super's 10th and 11th propositions on the role of "fellows". Their behaviour affirmed Jaggar's (1983) theory on the ways men continue to alienate women from their intellectual capacities and their sexuality in "gender mediated" experiences (p. 308). The final year participants, though successful

"pavers of the way" (Josselson, 1987) were again pushed up against the hard edges of engineering by men. They were generally negative about affirmative action and did not initiate support from other agencies, like the Institution of Engineers, which, in Josselson's (1987) terms, would have helped them to establish " webs of relatedness" for their transition to the profession (pp. 175-181).

Leisure, Chance, Personal Support Group and Personal Fortitude

Their stories also indicated to me how their personality traits, chance encounters, and other events (like opportunities for part-time work) created individual differences in their career pathways. The leisure side of their life, with the continued support of parents and special friends, appeared to compensate for any experiences of alienation in engineering education. Almost intuitively, I could 'read' from the participants' balancing of study, work and leisure how emotionally healthy they were. I was not able to ascertain from the collective story how outside events and leisure had enhanced creativity and passion in their vocational life-work. This required the telling of an individual story.

CONCRETE OTHER" PRESENT/FUTURE CAREER PERSPECTIVE OF RECENT GRADUATES (1992-1996)

Participants' Establishment Stage of Career - Transition to the Workplace

Transition towards the next life-stage of establishment was paramount in the older participants' and final year students' minds. In exploring their perceptions at this stage, I was guided by Research Question 3:

> **RQ3. What events in the day-to-day interaction in the Engineering work-place (final year or post-graduate studies) are critical to the development of personal and professional identities and competencies as engineers (and/or post-graduate student)? ("Future Career") [linked to Jaggar/Super's propositions 1-14].**

Structural Organisation of the Engineering Workplace

In my conversations with older women, I discovered that the gender regimes of some engineering firms were changing. For example, Maggie told me about her success as manager with a prestigious engineering firm and the extension of her community role to encourage and network with younger women in Institution B, her Alma Mater (Maggie, Civil, TB, 1993). Her story prepared me for the possibilities of adaptive institutional change, which the new graduate women's stories might reveal in their work-place and academe between 1992 and 1995.

Expectations of Structural Organisation - Revisioning Career Concepts

Several final year participants in transition to first postings anticipated career patterns such as career doublers and career breakers to accommodate raising a family. They learned vicariously about the place of married women in engineering and options available in the future. Some had observed the level of success of career doublers:

> One chemical engineer on her second baby - working couple of days a week - nanny looking after her children. Something I'd really want to do. Once you're out of it - its harder to break back in - technology gains and networking. (Valerie, Chemical, TB, 1994).

Others looked back to their "mums", as career-breakers:

> Family - to be as good a mum as she has been and devote time to them. Engineering - learn how, this is a big jump. After my family, I will get back to engineering at some stage. Travel and do things and experience things, I've never left Australia (Robbie, Environmental, 1993).

A few, like Haylia, were single-minded and self-centred towards a vocation:

> I want to do an MBA in a few years and hopefully hold a managerial position at the end of ten years. Career comes first for me and I have no particular plans for my personal life (Haylia, Electrical, 1993).

They anticipated the type of career pattern that best suited their needs, interests (including special boy-friends) and value systems (see Table E & Table F, Appendix G).

They described their initial career pathways as engineers in ways which portrayed their career selection and career progression as inseparable from other life events:

> Illness too much on my plate, robbing of time. I was good at making out I should be there. I've got a boyfriend whose an engineer. He says "don't be so stupid. Guy is still on site and he's approachable" (Anita, Final Chemical -TB July 1994).
>
> ... organising self with my partner are all inter-connected. See a lot of problems in maintaining Chemical engineering and rais[ing] a family at the same time. Work so far ... demands time ... seriously considering re-training. Juggling too! (Sally, TB, 1994).

Interpersonal and intra-personal conflicts were indeed paramount, characterised by "juggling time" and worrying about how to resolve present and future roles as a career woman.

Attaining Vocational Identity - Types of Cultural Milieux in Engineering?

The stories of Roberta, Sara and Billie indicated to me some of the ways women can choose to establish their niche in engineering:

Roberta's Story

Roberta's Story Touching Base December 1992-October 1993
December 1992 As a woman, I am an object of curiosity, makes people want to hear what you have to say, that could give you an 'unfair advantage' ... Getting on with your job or study ... and ignoring gender bias [I see] as the only effective means of showing you are serious.
May 1992 ... my only real gripe [is] having to be a 'female engineer' as opposed to an 'engineer' ... Many of the foremen I have to speak to tend to hold the conversation with my chest rather than looking me in the face.
October 1992 All my hard work on that project has resulted in my lack of ownership on completion. I may not have been a feminist then, but I am now ...

Roberta was a woman who learned the hard way in engineering, with her somewhat unrealistic expectation that, as a professional, she would be treated equitably and fairly by the men.

Sara's Story

Sara's Story (Touching Base 31 July 1995)
I had found men's more single-minded "flesh and blood" passion for, and a superior "wealth of knowledge" put them "ahead" of me in the workplace. I decided to move into software not hardware (Sara, Electronics Graduate, 1993). I sought out a mentor early as my career adviser. He told me the structure of the resume. Advised the choice of jobs in B... He said women 'peak earlier' than men - 'diversify before it comes around to family' and establish 'credibility' ... Men don't seem to have these issues. My move is to the communication industry where I am able to peak earlier and not to waiver away from it.

Professionally, after three years, I am not hindered because I am a women. In my team - I feel [men] do appreciate my input ... We have a weekly meeting - I am comfortable to say things. Everyone respects you when you know what you're talking about (Sara, TB, 31 July 1995). [Nevertheless], I am conscious too ... the customer drives anything here, bells and lights. I think [ethics] is an important area, but I have not been concerned with it until now. A body [that] restricts what is sent out on the Internet [is needed] ... it could be abused ... even licensing rules (for what we buy or is copied) ... It is a concern.

I am compensating with outside interests and generally increased people contact and human behaviour learning areas ... [For example, community work ... as a leader of a Christian youth group ... and telephone counselling will help my new position ... Rowing with women, enhances my leisure. Dreaming a future possibility - to be a lecturer in engineering education [helps]. An older female colleague [is] not only ... facing different priorities for that stage of life with a child and a husband's career to consider ... She has presented a challenge to authority and has been passed over for promotion and a higher salary ... I was not able to precisely pinpoint the 'woman element' ... That hasn't hit me just yet ... I have not entered the politics of the place ... How to resolve the issue of family and career is a ... bit of a puzzle ... I think I'll always have that ...

Sara actively sought out a mentor, who understood and acted upon her special career needs as a women in electronic engineering. Although, Sara was positive about her treatment by male peers, she developed insights into the "market-driven" ideology of engineering and the need for ethical standards. Sara balanced engineering with outside interests (both sport and vocationally oriented). She was aware of the precarious organisational status of older married female colleague especially when applying for promotion. At this stage, Sara had high self-efficacy in balancing her present career role as an engineer and as a woman in multi-roles in her private "life-space". Sara was unsure how to resolve the issue of family and career later. Realising her dream to "become a lecturer" perhaps?!

Billie's Story

Billie's Story (Touching Base September 22, 1993 - 8 February 1996)
As a qualified surveyor and now a structural engineer, I don't like some of ideas on the engineering side (not personal side). It is easier to get interesting incidents as a woman. The reason why I like it - engineering is very different all the time. The rules in engineering are complicated - so many - you have to be so careful as a woman - it's so stressful - not to shake or stigmatise - there's no stuffing up - you are never forgiven. At C..., on a different operation there was a female engineer, Project Manager - she was tiny, her ability was unrecognised.

Men give you a hard time, the answer is to let water roll off your back ... it takes time for men to start listening to you. On the 1st day, I met an 'old man' who drove me. 'This is Billie do you want to f... her?' Trying to shock me - 'Bet you give ... '. I diffused [this] with laughter and verbal responses. The foreman called 'check out this woman'. The only way is to become one of the boys ... this is the only way to deal with the culture at the moment. Hopefully not in the future ... I had to convince them - I was 'friendly not full of myself'. Not too 'stand offish' I know a little of engineering, it can come to a 'full stop' and your (sic) being ostracised - women need to pull their head in - it's a warning, and that's a real pity!! [In regard to the tasks]... so [I have] the same desk/same office as men, so "equality" in work. I get in and get grubby. I was jacked off with the engineer. I stuffed him around. He said 'right, go and do the strainer' - I'd never cleaned out a strainer! ... I pulled out all strainers, now I'm his mate!! From barely being spoken to, he's now very cooperative. At D... I had a ball - I got on well with everybody. I got a reference. I blended in with everyone on site and they said they 'would not have any hesitation in employing her again'.

In 1994, I left my job with D... [because of] a badly organised manager and because 'I could not hack the sexism' or the 'tokenism' towards women. I'm going well at L ... in M ... a male buddy has taken me under his wing, he's never experienced a woman before, but I pitch in ... and hope to work in the field eventually.. It is better with set hours and I'm back into hockey, a new house, which is fun and walking the dog ... I am supported by my boyfriend. ... Now my husband he says the thing he loves most about me is my persistence and perseverance ... [my] staying power. I believe sexism in Australia must be the worst in the world. I still overhear telephone conversations. 'We have a ... female engineer' ... 'she's a blonde' ... So my motto, based on a book by Patricia Cardwell, is 'my only revenge is success'.

I classified Billie as 'street-wise', with her assertive catch-cry "success is my only revenge". Initially, as "one of the boys", Billie developed her vocational and group identity by denying her femininity in an all-male gender regime. In her new job, she began to satisfy her identity as engineer and as woman, with her own tenacity and support from her husband. Like Roberta and Sara, she was pro-active, displaying adaptive style in establishing her "person-environment" fit in her interactive work context. Billie and Roberta showed that men's behaviour towards them too often bordered on gender and work harassment. There was little adaptation by men in these traditional masculinist regimes. In contrast, Sara's story reflected a transitional change in her work milieu, with the adaptive style of a "superior", who provided mentoring for her healthy transition and future planning.

Doctoral Students - Transition to Establishment Stage of Career in Academe

The stories of Hettie, Astrid, and Sandie provided me with scenarios of women establishing their niche as researchers in Academe between 1992-95:

Hettie's Story

> **Hettie's Story of Transition December 1992**
> I learned not to hold the sort of attitude that because I was female it didn't really matter whether I passed ... or not. I think conflict resolution is an important skill for a woman. I have no problem working with males. If males are difficult to be with, then a few words before things get out of hand are usually enough to settle the problem ... if they [women] have a problem with the male environment then they should not be there. Firms will not pander to females who think it is their born right to have female company at all times. It is a fact of life that engineering is 85-90% male - the sooner people realise it the better ... and that is that.

Hettie adopted the status quo position that " it was up to" women to be "adaptive" in engineering.

Astrid's Story

> **Astrid's Story of Life Before, During, and After Doctoral Studies 1993-1995**
> I'd worked overseas for a couple of years. In my research I tend to take things 1 step at a time - particularly in proving something. Recently I had to prove myself, and then to [my supervisor], that the course of analysis he suggested wasn't really logical. I worked on it for 1 week before presenting it to him & explaining why it wasn't the right approach.
> My husband and I lived originally next door - great hopes, same background ... fitted perfectly ... [but] he didn't view marriage as sharing. When the baby was born - he said 'you chose to work - you adjust with the added work load, [you] can always give up work. [His] attitude was destructive. He needed ... a traditional wife, [not one] wanting her own career. [There's a] tremendous need for re-educated men.
> 12 months ago - [I was] stressed, difficult illness and weight loss - lovely [being] away from constantly defensive environment. Baby's behaviour improved. I now have a new relationship - quite different - I 'flourish' - I am looking really well ... My prof was very supportive.
> December 1995, I received international recognition for my research. Happily remarried with a second child, I am writing papers and attending conferences to maintain my interest and profile in engineering ...

Astrid had the advantage of a supportive professor. As mentor, his approach matched her preferred research style. Her story highlighted the difficulties faced by a married woman in academe, when a husband is uncooperative in sharing home duties and child-rearing.

Sandie's Story

Sandie's Story of Doctoral Studies Touching Base 18 October 1993-30 August 1995
My Early Days 18 October 1993 Supervisor [was] stubborn, teaching approach needs to be learned... shaky research relevance ... I suggest [its] a learning curve for both ... bland assumption that a Ph. D. engineer can teach. Should be compulsory [for supervisors] to have a Dip. Ed. [My study] was actually - very problem oriented. You get given the theory, but every assignment you get the problem, and told all these little buts. When I look back I [couldn't] see all the linkages ...
18 October 1993 News of Lily [remember, we graduated with top honours]. She says there are no sexist comments ... She doesn't get any hassling at all for being a female, everything is very equal over there on the West Coast and says she wouldn't want to be on the East Coast. When she came back for 8 weeks, she couldn't handle the sexist comments, but I don't pick them up ... (Sandie, TB, 18 October 1993). She says it's a wonder system of study too. She's done her masters ... then [went] on to do [her] PhD. I know because I have spent a year and a half floundering on a PhD because I should have done a Masters to work out what research is all about - and what I'd really wanted to do. That, we are not given the opportunity to do (Sandie, TB, 18.10.1993).
30 August 1995 A new Supervisor I could'nt quite do it - I had a bit of a tantrum. I pulled through 1993-4. [I've] had it how it is ... He says 'you'll get there'. [We] organise weekly meetings - so setting weekly targets - & then if there is a problem say Computer program, the Supervisor can help fix it if it is a simple computer problem that is easily fixable. If not [we] can work on the real "current" problem/hitch.
Re-balancing my life My boyfriend understands what [I am] going through. Sport- relieves tension a bit. At night I'm too tired. Walk a lot and ... not stressed. Good for motivation - work till 6 - go and have dinner at boyfriend's house - A 'treat yourself' feeling ... works well!

In contrast to Astrid's experience, Sandie struggled with her doctorate and poor supervision for a number of years. She initially blamed herself in having "a very different approach to a lot of women". This resulted in motivation that was "so low". Feedback on her friend Lillie's positive study experience in America, and a change in supervisor who was knowledgeable and supportive, helped her refocus and achieve success. Her boy-friend, a doctoral student in engineering, and time for leisure time also helped.

Their stories emphasised the need for adaptive style of both women and the institution for gender justice in practice. The women's perseverance and other factors, too, in terms of shared responsibilities in the home, support from boyfriends/spouses, time for leisure, and women networking, made a difference to their academic achievement in the establishment stage of life-career.

Summary and Interpretation of Future Career - Academe and First Postings

In relation to Research Question 3 (RQ3), the women's lives, in Super's terms were both life-span and life-space, with older women playing an increasing range of salient roles and continuing to demonstrate career maturity and future-oriented career adaptability. They consciously chose to move along "one of a number of possible pathways" (Super, 1969b, p. 3), usually as a "paver of the way" (Josselson, 1987). Their careers at this stage supported my second and third domain assumptions about women redefining career concepts and healthily bringing positive dreams about gender relations into the reality of present careers (Chapter One, pp. 15-16).

The women intermittently experienced the "daughter of crisis" pathway (Josselson, 1987) mainly because of gender harassment in the workplace and in academe. This involved mini-cycles of appraisal to overcome self-doubt, to establish and re-establish status as women and to gain approval of "superiors and fellows" (Super, 1990) as effective learners and engineers. My findings, with some positive changes in the structural organisation and in good mentoring, reaffirmed previous findings about the progress of women in non-traditional areas of work (Carter & Kirkup, 1990b; Cockburn, 1991; Hacker, 1983, 1990; Robinson & McIlwee, 1989; Swarbrick, 1991); and postgraduate students (Allen, 1990; Armstrong, 1991; Atkinson & Delamont, 1990; Sandler & Hall, 1986; Women in Science, Engineering and Technology Advisory Group, September, 1994; Zinberg, 1994). Like other researchers (Hesketh, Elmslie, & Kaldor, 1990; Henderson, 1990; Sears & Barbee, 1977; McDaniels & Gysbers, 1992; Reis, 1987; Willinsky & Ellis, 1992), I found that when participants actively persevered, had caring and knowledgeable mentors, had support from family, spouses or special boyfriends, and had time for leisure, they were freed to be creative and passionate in their vocational life-work.

Themes Evolving from the Collective Concrete Other Subjective Career

The women's collective voice gave me an historical perspective on their career pathways in the gender regimes of each life-stage. Throughout the collective story, there was supporting evidence of commonalities, as well as differences in regard to the gender agenda, due to personal determinants and/or situational determinants each woman encountered. I became increasingly aware of the unique ways each older woman matched vocational choices with her own personality, special interests, knowledge, skills, and achievements (see Table E & Table F, Appendix G). I also began to identify the "interacting forces" that "determine[d] ... patterns" in each woman's construction of subjective career (Super, 1954, p. 17) and adjustments in their gender positioning in changing circumstances.

Four major themes emerged from the collective past, present and future life-career perspective**.** Theme One related to the range of personal and situational determinants that influenced, and at times created tensions for, non-traditional women in constructing and attaining a vocational identity. Theme Two indicated that the women's careers were influenced by: transformations towards gender inclusivity in school curricula; the organisation, content and skills taught, and process of thought encouraged in the undergraduate engineering curricula; the quality of postgraduate supervision, which was in a preliminary stage of transition; and the engineering work-place, which was for the most part traditional in its professional induction of women. Theme Three related to inter-personal obstacles, the lack of critical mass and non-traditional women's need for acceptance and approval of "superiors and fellows" to attain group and vocational identity as learners in the cultural milieux of upper school classrooms; and the gender regimes of engineering education and work situation(s) in engineering. Theme Four highlighted the value and process of self-evaluation by participants in identity formation and attainment, regarding how parents and friends, leisure-time, and other critical factors (personal and situational) had affected their personality development, achievements, career choices, and transitions to engineering education and to work. I

add depth and value to these themes from the collective story, by analysing Cecilia's quest for individual and group identity attainment as an engineer and a woman in Chapter Seven.

Jaggar/Super Propositions and Models and Women in Engineering

In regard to the methodological question, I found that Jaggar's/Super's fourteen propositions were a useful point of reference in establishing how the collective career had been affected by events at each career stage. By focussing on recurring themes, feelings and common experiences, I had used Super's nomothetic model where I described each participant in terms of personality and situational determinants shared by her group of women. In relation to my first domain assumption, I established that gender relations were a major determinant of participants' collective career and personality development at the level of the gender regime. In regard to my second domain assumption, there were a few intimations of valuing what they, as women, brought to engineering. Their stories supported my fourth domain assumption about work as a gendered concept and the close alignment of the development of self, identity and choice of career pathways in engineering as a non-traditional profession. I found Super's (1990) construct of the motivational hub of personality as "values, interests, and needs" and "aspirations" as forward-looking motivations enabled me to investigate the general health of these feminine ambivalents' careers.

In relation to my second domain assumption, my use of narrative and associated methods helped me to get to the heart of deeper issues of gender harassment, whilst exploring how (and if) women's special needs, interests and values were being met in their career development. Because of the participants' ability and willingness to reflect, and report back, I was increasingly confident that my narrative approach was highlighting gender "justice in practice" from their collective voice (Secada, 1989). Each of my domain assumptions about women in engineering education and first postings was helpful in my benchmarking task (see Chapter One, pp. 15-18). I recorded these events in my journal in preparation for the comparison of career perspectives in Chapter Eight.

By creating collective life-career rainbows of participants in Institution A and Institution B, I was able to represent the women's dialectical construction of non-traditional pathways as life-span and life-space at a glance (see Table C & Table D in Appendix G). My inclusion of remote situational determinants (in terms of concurrent policies and key reports) served to contextualise the participants' life-career at each stage. The ladder model (Figure 2. 6) represented for me the collective non-traditional career climb and the women's ways of resolving developmental tasks at each rung or status level in order to achieve a vocational, personal, and group identity as engineers. I saw the potential of the spider web model within the archway model (Figure 2. 3) in helping me to link theoretical segments and key elements in each woman's synthesising process of career decision-making and to bring into play Super/Jaggar's different "theaters" of interaction for the child, the adolescent, and young person (eg, the family, education, peer groups, work) in the quest to form and attain identity. In Chapter Seven, I apply Super's idiographic or life-history approach and evaluate the quality of my convergence of Jaggar's/Super's theories. The four themes evolving from the collective subjective career and the influence of Professor D, have guided my unfolding of Cecilia's life-story.

CHAPTER SEVEN

CECILIA'S QUEST FOR IDENTITY: WOMAN IN ENGINEERING IN POST-MODERN AUSTRALIA, USING JAGGAR/SUPER MODELS OF CAREER

PURPOSE AND OUTLINE OF THIS CHAPTER

In this chapter, I applied Jaggar's (1989)/Super's (1954) life-history (idiographic) method to gain insight into Cecilia's "crystallising life-style" from the "dawning" of her maturity to the "establishment" of her vocation (p. 17) and attainment of her embedded identity as an engineer (Josselson, 1987). Four themes that emerged from the collective (nomothetic) experience of the women participants' concrete other subjective life-career in Chapter Six guided the telling of Cecilia's story. My aim was to add depth and value to the collective stories, by analysing Cecilia's quest for self and group identity attainment as a bright Australian girl growing up between 1974 and 1991; as a woman in engineering education, from her first year in 1992, through all the organisational career transitions, to the end of her final year in 1996; and in her first posting between 1997 and 1999.

Methodologically, my aim was to continue to enhance my own understanding of the use of interpretive research paradigms. In the light of Cecilia's story, I continue to evaluate the quality of Jaggar's theory grafted into Super's segmental theory of career development, using Krumboltz's (1994) criteria (see Chapter One, p. 8). In regard to evaluating the power of my elaborated Super models as heuristics in my construction of Cecilia's life-history, I primarily focussed on how effectively the segments and elements of my combined archway model (see Figure 2.3) could be used to interpret and represent the dynamism of Cecilia's present career construction of identity as a maturing student engineer and, later, as a woman in engineering. I used my convergence ladder model (Figure 2.6) to represent the organisational career statuses and as a reference point for the developmental stage theory of personality, career, and identity. I was aware too of the power of the life-career rainbow to represent Jaggar's notion of the *historical dialog* of the nineties in which Cecilia's identity attainment was embedded (see Figure 2.4).

As narrator, I began with Research Question 1 (RQ1) and Cecilia's quest for identity in her past career in the 1970's and 1980's:

> RQ1. What are the key determinants of Cecilia's background and how are these events perceived as influencing her construction of her personal and professional identity as an Engineering student and her career development as an Engineer? (The "Past Career") [Linked to Jaggar's and to Super's Propositions 1-11, Collective Subjective Career Themes, and the Organisational Career (OCV)].

My aim, in relation to Theme 1, was to identify how personal and situational determinants helped her to begin to construct her early ideas of engineering and identity as an engineer. Theme 2 tackled her quest for identity as a learner, particularly in terms of her access and participation in studying non-traditional subjects. Theme 3 focussed on how she attained her group and vocational identity, especially in gaining acceptance and approval of "superiors and fellows" in the school milieux. I used Theme 4 to gain insight into the value of self reflection and how parents and friends, her leisure-time, and other critical factors had affected her personality development, achievements, career choices, and transition to engineering education.

Linking with Research Question 2, I continued to explore Cecilia's present subjective career, which was embedded in the concrete other organisational career standpoint of her professor (Professor D, see Chapter Five):

> RQ2. What events in the day-to-day interaction in the Engineering Degree course are critical to the development of Cecilia's personal and professional identity and competence as an engineering student? (The "Present Career") [Linked to Jaggar's and to Super's Propositions 1-14 and Organisational Career (OCI-OCVI)].

My intent with Theme 1 was to find which career determinants were critical in consolidating her identity as an electrical engineer and construction of electrical engineering as a vocation. I used Theme 2 to investigate how gender inclusive and adaptive she found the engineering curriculum and lecturers, in adapting to her special

learning needs, interests, values and learning style. In relation to Theme 3, my intent was to find what was uniquely critical to her attainment of group identity, particularly her acceptance and approval by superiors and fellows (Josselson, 1987; Super, 1990). I wanted to see whether there were events where she might be "floundering" (Super, 1969a, p. 20) in the cultural milieux of engineering. Using Theme 4, I focussed on her evaluation of academic success, career decisions, her ways of overcoming crises and/or choosing to do "the unexpected in personal life" (p.20), and making transitions. I, also, investigated how parents, friends and other key figures, part-time work, and her leisure activities supported her attainment of identity as a woman (Josselson, 1987) and future engineer.

I then progressed to the establishment stage of her career as a professional engineer in her first posting. I posed Research Question (RQ3), linked to the themes, to ascertain how her quest for a professional and personal identity as a woman in engineering progressed within her immediate work situation(s) with "superiors and fellows" (Super, 1990) and current remote situational determinants from 1997-1999:

> RQ3. What events in the day-to-day interaction in the Cecilia's Engineering work-place are critical to her development of personal and professional identity and competence as an engineer (and post-graduate student)? ("Future Career") [Linked to Jaggar's and to Super's Propositions 1-14 and Organisational Career (OCII-OCIII)].

In attempting to change conditions, I planned to use Cecilia's subjective career perspective as feedback to inform the organisational career of her professor(s); Super's (1990's) "superiors and fellows" in her "first postings" and postgraduate studies; and the research community in general.

CECILIA'S STORY

Who is Cecilia?

The first time I met Cecilia was at a luncheon for women in science and engineering on 24 March 1992 at Institution A. This tall, blond, vivacious woman enthusiastically volunteered to be part of my pilot study as a first year electrical engineering student. She soon proved to be an entertaining correspondent and has been part of my life for eight years.

Situational and Personal Determinants of Cecilia's Past Career (1974-91)

Remote Situational and Immediate Determinants of Family

Cecilia was born in Perth, Western Australia, in 1974, the year preceding the publication of the first definitive report on the education of girls in Australia, *Girls, School and Society (1975)*. She is the only child of a Russian/Polish-born mother and an Australian father, which created an unusual set of family dynamics for her (see Table A). Both parents, she said:

> ... definately (sic) enabled". Even in early school they encouraged me to do my best, however good that may be. They've also encouraged me to be positive towards life and learning ... (Cecilia, AQ, March 1992).

She described her parents' level of education and work patterns:

> Mum [has a] TAFE background. [She's been a] Secretary / Personal Assistant in Private Firms. [She gained] Levels 1-3 in the Public Service. Dad [has] tertiary [qualifications]. [He's been] Principal of 2 Colleges, Secondary Maths teacher, Maths tutor, Study Skills presenter. Both [were] involved in Home and work duties (15-20); Both [are in the] Workforce (21-40 & over). (Cecilia, AQ, March 1992).

and of their continuing studies:

> We are all studying at the moment, dad is going well, mum got 70% over all and I was all right, passed ... (Cecilia, TB, July 1994).

In common with most participants, the middle class life-career patterns of Cecilia's parents created a gender equitable image of "structures of opportunity" (Astin, 1984) in the family. Cecilia classified her upbringing as a "liberal feminine upbringing and orientation" (Cecilia, AQ, March 1992, p. 9) and revealed this in a number of events. Her value of life-span learning and belief in "career doubling" (Herr & Cramer, 1992) supported the collective career shift towards maternal influence, as well as paternal, on non-traditional young women. Nevertheless, it was "Dad, who recently completed his

master's degree" and "Mum, who is too busy working to study" (Cecilia, TB, March, 1999), in the maintenance stage of their careers. Such were the contradictions of the changing career patterns of her parents that were not discernible from the collective story (Chapter Six).

Cecilia's Identity Formation - Interests, Construct of Work, and Leisure

Cecilia's early interests were organised by parents with a number of outlets:

> Painting and drawing, dolls, going to the beach & and out in the bush with my family and their friends. At school we made up our own games (imagining and chasey, etc) (Cecilia, AQ, March 1992, p.1).

On the first growth rungs of my convergence ladder model (Figure 2. 6), her parents fostered her "special aptitudes" of drawing and painting towards creative "achievement" (Super, 1990). As an only child, her need for adventure and interaction with same-age friends and other family friends were satisfied. Cecilia's *joie de vivre* affirmed the importance of fun and play in her healthy attainment of developmental tasks (units of work) as Super (1976) and Bordin (1994) suggested. Her developing "self-concept" was positive and her move towards "internal [locus of] control" (Super, 1994, p. 71) and autonomy were encouraged in the vector archway space of her family and peers, as both "child" and "leisurite" in the late 1970's. Unlike other participants, she did not express an early interest in tinkering with construction toys.

Kindergarten and school provided theaters (Super, 1980) for the expansion of her major interest in art, from the late 1970's:

> ... one of the teachers told my Mum I was creative in my paintings (She had never told me that!). I remember disliking this teacher who constantly favoured one student (Cecilia, AQ, 1992, p. 3).

Her need for "exploration" in art, satisfying her "curiosity" and feelings of success (self efficacy) appeared to be better met in her home, than with her teacher in kindergarten.

On the next organisational rung, Cecilia's mid- to late-primary school interests included established and new leisure pursuits :

> Drawing, playing dolls with my best friend, computer games, going out with my family to the beach & bush riding my bike to parks & shops with my best friend. (as well as outside [music] lessons) (Cecilia, AQ March 1992, p.1).

She pursued vocational and "avocational" interests (Gottfredson, 1981) in aged-related freedom with friends. Her interest in computers began with "mostly games" and "Yes, for Word processing" too:

> ... some BASIC programming (not very sophisticated stuff though!). Mum [used it] for typing letters & word processing. Dad for writing software (for high schools) & for typing. (Cecilia, AQ, March 1992, p.5).

Unlike most participants (see Chapter Six), both parents modelled and mentored Cecilia in computing for leisure and as a key vocational competency.

In accord with *Girls and tomorrow: The challenge for schools* (Commonwealth Schools Commission 1985a), Cecilia's coeducational primary school (1980-1986) promoted gender equity by helping her develop:

> … computing skills and computer awareness for one year (Cecilia, AQ, March 1992, p. 3).

She linked her growth of interests in school subjects with the positive interaction she received from teachers:

> English, Reading and Art - I was better at these subjects ... Yrs 5 & 6 teachers ... encouraged me, let me know I was doing my work well and made me feel special (Cecilia, AQ, March 1992, p.3).

Teachers were now part of her positive structure of opportunity (Astin, 1984) helping her interests to flourish, and in constructing her concept of work (Astin, 1984) as "my work". Super (1990) emphasised the importance of emotional investment in work. In contrast to other participants, who were expressing an early love of science, science fiction, and/or mathematics, Cecilia continued to emphasise the arts as her key interest area. Also, her mid-childhood interest-based achievements, save for computing, were less characteristic of the "feminine ambivalent" in the technological age of the 1980's.

At a time when *The National Policy for the Education of Girls in Australian schools* (Commonwealth Schools Commission, 1987), Cecilia made the transition to high school (1987-1990). Now in Super's (1990) and Josselson's (1987) exploration stage of identity, she listed old and new avocational interests:

> Painting, listening to music (from dance & rap when I was younger to 'metal' music & baroque), going out & going to the movies with friends, and gardening (Cecilia, AQ, March 1992, p.1).

Her mainly artistic leisure interests were further cemented as a stable determinant of her adolescent personality and sense of group identity with peers. In her student role, Cecilia's study of the humanities, and arts subjects, added to her repertoire of formal achievements, based on earlier interests:

> ... I studied Art for 3 years; and Music for 2-3 years; Drama for 3 years English for 5 years; Social studies for 3 years & 2 years Economics [in Upper School] (Cecilia, AQ, March 1992, pp. 3 &4).

Provision of compulsory structures of opportunity in lower secondary school in "non-traditional" subjects helped her to develop competencies in:

> Computer studies, industrial arts, mathematics and science (Cecilia, AQ, March 1992).

These subjects provided necessary "resources" for her future needs in engineering (McIlwee & Robinson, 1992) and gave balance to her feminine (arts) interests. The latter probably provided the basis for "the creativity ... in handling the unseen" in electrical engineering (Professor D, Interview, 15 February, 1993). Interests were clearly identifiable as a personal determinant of Cecilia's personality and concomitant identity as a future worker, student and leisurite.

Cecilia's Vocational Identity Attainment in Upper School (1987-1991)

Structural Organisation of Cecilia's Upper Secondary School (Theme 3)

By 1990, Cecilia had attended three co-educational secondary schools:

> The first was a co-educational college in the Catholic sector, with a weak principal and a poor programme; the second was an innovative college but of short-lived existence; and the third was an "upmarket" Catholic co-educational school where the teachers were very good (Cecilia, TB, January, 1997).

The issue for Cecilia was the varying degrees to which her school principals had adopted "gender inclusive" policies for girls.

Cecilia's Choice of Subjects - Interest and Vocational Investment (Theme 2)

In 1990, Cecilia made her upper school subject choices:

> I wasn't sure what I wanted to do at the beginning of year 11, so I chose what subjects would most broaden my choices at Uni level (the hardest) (Cecilia, AQ, March, 1992).

Her father steered her specific academic focus:

> He helped me choose my upper school subjects ... If it weren't for him, I probably would've taken single maths and wouldn't have been doing Engineering now. (He always said I'd thank him for doing double maths one day, too !!!) (Cecilia, AQ, March, 1992, p.6).

She perceived her mother's role more as an "encourager":

> Mum always encouraged me to do my best and set very high standards. Beyond that, she basically went by what dad said (Cecilia, AQ, March, 1992).

She was pragmatic in her choice of "Mathematics II & III, Chemistry, Physics, Literature and Economics", as subjects that would "most broaden my career options" (Cecilia, March 1992), as Australian researchers were urging girls to do (Parker & Offer, 1989; Spender, 1986b). Her subject choices qualified her for a number of occupations, within higher paid scientific and engineering fields. Her pursuit of English literature countered her professor's belief that students were not being "sufficiently well prepared in English" although her other choices met his entry expectations for students (Professor D, Personal Interview, 15th February, 1993).

Critical Mass of Girls in Upper School Non-Traditional Areas (Themes 2 & 3)

Cecilia described the patterns of participation of females and males in Science and Mathematics in her "upmarket" school in 1990:

> ... we had more girls in Chem and about 50/50 in Maths and Physics, slightly more boys. So girls were as likely as boys [to study them] (Cecilia, AQ, March 1992, p.5).

Her experience supported some evidence of the adaptive style (Hesketh, 1985) of the organisational career, where teachers were putting policy into practice to promote gender equity with girls' access and in participation in non-traditional subjects. Cecilia's statement also conveyed her sense of group solidarity with other girls in their willingness to study these subjects.

Upper School Cultural Milieu: Cecilia's Relationships with Peers (Theme 3)

Cecilia valued and was influenced by a diversity of friendships:

> [I] ended up with a very broad group of friends, some of whom influenced me greatly ... (Cecilia, AQ, March 1992, pp 2&7).

Her friends shared leisure interests and hopes for the future. Being an only child may have been an added motivation to make and value friends. However, Cecilia found some self-styled high status groups of peers problematic:

> [I found] incredible status cliques in ... my upper school years. They gained high group status from their parents' prestigious occupations and ignored or deliberately excluded members of perceived "lower status" groups like me with a vengeance (Cecilia, Telephone Communication, April, 16th 1997).

The interweaving effects of socio-economic status and gender excluded Cecilia from this peer group, souring some social and learning interactions.
Cecilia's friends were ample compensation.

Transition - Cecilia's Preparedness For Entry To Engineering, February 1992

Late Choice Of Occupation - Do I Want to be an Engineer? (Theme 4)

> I think Dad was always encouraging me towards a scientific field, but he never directly said so (Cecilia, AQ, March 1992).

Cecilia's Dad was a strong influence in her choice of occupation. Although, her interests were in "painting and drawing" and "English", she did not consider an Arts degree as a valid basis for an occupation:

> [I] valued (as my parents do) a science degree above an Arts degree, as they are more useful and more highly regarded generally ... (Cecilia, AQ, March, 1992, p.6).

Cecilia reconstituted her vocational identity towards "real" work in a science-based occupation. The aspirations and expectations of adolescent friends in pursuing a profession *per se* were also "influential" (Cecilia, AQ, March, 1992).

Cecilia said her teachers were "really good and encouraging", but she did not "feel comfortable" in confiding about her "future career" possibilities. Her reluctance was based on her "embarrassment about attention-seeking". One teacher, however, did attract her towards science:

> Mr Hall, my Upper School Physics & Chem teacher. He had many interesting stories to do with science and because of that I was attracted the thought of a career in science (Cecilia, AQ, March 1992).

Her reasons gave me the first inkling about the importance of anecdotes shared by valued "superiors" in triggering her imagination and interest in science. She decided to "do engineering ... although Physics & Chem degree's (sic) did interest" her, because:

> ... it is more practical, tends to be more financially secure, it is useful to the community, and has incredibly diverse career opportunities ... (Cecilia, AQ, March, 1992, p.6).

Like other participants, she chose engineering because it was a useful, practical occupation filled with future possibilities, rather than her interest in it as a craft. The mismatch between "her characteristic pattern of abilities" (Super, 1990, p. 206), which were more arts-oriented, suggested that her choice was more an investment in an occupation than a vocation. Having made her decision, her "stable self-construct provided continuity" for taking on this new role as engineer (p. 206). She listened further to the anecdotes of university representatives about engineering:

> We had a career's night at my school, a counsellor ... kindly told me about his son's experience in engineering and gave me a book describing career opportunities in the field (Cecilia, AQ, March, 1992).

She considered that professional advice was crucial for girls:

> Incredibly. It helps to know what you are getting yourself into, all the good and bad points of a course, For some girls it may be a case of letting them know that they are capable of doing certain tertiary courses which they didn't have the confidence to try for without being told that (Cecilia, AQ, March, 1992).

Cecilia's choice reflected strong future-oriented career decision-making which was considered by Jaggar (1989) and by Super (1990) to be an important time perspective for success in her life-career pathway.

Success, Personality, Aspirations, Coping and Learning Styles (Theme 4)

Cecilia displayed both achievement and affiliative motivation, with positive attitudes towards hard work, life-long learning, and people. The motivational hub of her

personality as "values, interests, and needs" (Super, 1990) conveyed healthiness in her career development. In terms of her final school achievements, Cecilia confided much later:

> I wanted to go into Chemical [engineering] originally, but I didn't have the grades (Cecilia, TB, July 1995).

She may, by virtue of her enforced switch to electrical engineering, have been more "at risk" than her professor anticipated for women (Professor D, 15 February 1993).

In 1992, Cecilia's aspirations for her "next ten years" were anchored in her future occupation in engineering and tinged with humour and hope:

> I would hope that I had graduated and was employed, preferably overseas, with a company at the foremost of my field (but then again <u>any</u> company would be nice !!!) (Cecilia, AQ, March, 1992, p. 9).

In terms of "career adaptability", she focussed on the student engineer role as her most salient role for the next four years, and her worker role thereafter. The future domestic role of wife/mother was not salient for her, as with other participants. Cecilia in her expectations of success displayed what Super (1990) called "career maturity", which ought to have helped her to cope successfully with the next stage of life-career (p. 207). Like the other participants, voicing her aspirations and expectations helped her make connections to the "future" dimension of her life-career (Table E, Appendix G).

Fore-warned by the research (eg, Kvande, 1987; Thomas, 1990), and the experiences of older participants in gender regimes of engineering (see Chapter Six), I asked Cecilia about her coping strategies:

> For difficulties in assignments, I sit there and stew for a while, then I might ring up a friend or wait and ask somebody the next day ...
> For other sorts of problems mentioned, I use a journal. I can say whatever I want to without worrying that anyone will find out, which greatly relieves the pressure of a situation ...
> Or if I have a big decision to make, I can talk to myself in the journal and determine what my own priorities really are ...
> Sometimes personal problems get too depressing to record, so I use music for a relief - aggressive music if I'm angry & depressing music when I'm sad. I play it very loud to sort of "drown out" the problem. Crying relieves a lot of built up emotion, too.
> If I'm simply stressed or frazzled then I use a relaxation tape. They really help (Cecilia, AQ 1992, p.18).

Cecilia had a wide range of coping strategies to help her resolve potential intra-personal and interpersonal tensions and critical incidents. She also had a secure family base, a

range of good friends for support, and time for leisure as she made her transition to higher education.

Cecilia reflected on her learning style profile for engineering:

> [I agree with] Activist - very strong (14); Reflector - strong (15); Theorist - Moderate (12); Pragmatist low preference (10) - (Cecilia, TB, April 1992).

Comparing Cecilia's profile with her professor (Professor D) (see Table E, Appendix G), she identified herself as a *very strong* activist in contrast to his *moderate* preference. She was a *moderate* theorist, compared with her professor's *strong* preference. Both were *strong* reflectors. Her professor was a *strong* pragmatist and she had a *low* preference, "yet ...":

> ... I don't like "beating around the bush" and tend to be impatient about "ruminating and open ended discussions"... [I am] essentially practical, [I] respond to problems and opportunities as "a challenge", [it is] always a better way "if it works its good" (Cecilia, TB, April 1992).

More narrowly, with regard to information processing, there was some correspondence with her profile above:

> I prefer to perceive sensory (concrete) information; prefer the auditory channel to [get] my external information; [I] like the information to be organised deductively; to process information reflectively, and to progress towards understanding sequentially (Cecilia, TB, April 1992).

Her professor's preference for "intuitive" perceptions did not equate with Cecilia's preference for sensory "concrete" information. His preference for the visual channel to gain external information, was in contrast to Cecilia's preference for the auditory channel. Arguably, both preferences could be problematic for her in electrical engineering. Cecilia preferred information to be organised using a deductive approach, which linked with her professor's thinking. Her preference to process information through reflection, matched her professor. Cecilia's progress to understanding was sequential rather than global, although both modes of understanding, in Professor D's view, were required to progress to fuller understanding and creativity as an electrical engineer.

Overall, she displayed qualities of a "paver of the way" (Josselson, 1987), and was well-prepared to attain an identity as an engineering student (see Table G, Appendix H). Initially, I did not classify her as a typical "feminine ambivalent" (Douvan & Adelson,

1966), because of her early and persistent passion for the Arts. Yet, she fitted this category when I balanced these with her early zest to explore the world, her technological competencies, her later interests in biology and gardening, and belief that science-related work was "more highly regarded" and "more useful" to pursue as an occupation.

CECILIA'S EXPLORATION IN ENGINEERING EDUCATION FEBRUARY 1992-DECEMBER 1997

The Nature of the Archway Life-Space of Electrical Engineering (Theme 3)

As Cecilia climbed the organisational career ladder into first year electrical engineering education in 1992, electrical engineering showed one of the lowest female enrolment figures of 9.1% (Lewis and Harris, 1995). The high attrition rate soon after graduation (Department of the Prime Minister and Cabinet, 1994, January; Donald, 1991), also made Cecilia's venture into electrical engineering a rarity for a woman .

An issue from the collective career story was the lack of critical mass on the quality of women's learning experiences in fields other than chemical engineering (see Chapter Six). In Cecilia's year intake in 1992, there were eight (8) women, five of whom were in chemical engineering, and two (2) only in her field of electrical/electronic engineering. The other woman, Melanie, became her friend and confidante. Professor D's comment that "we don't have any women on staff" except a few "postgraduate women helping in the laboratory" (Professor D, Interview, 15th February, 1993) reinforced that she was entering a masculine gender regime. He was aware there might be a "slight hiccup", but assumed that his "females perform too well to say that we are putting some hidden obstacles in their way" (Professor D, Interview, February 1993). As his colleague, Professor A, flippantly remarked to me about a woman entering engineering "As I say to my daughter, I'll make a man of you yet" (Telephone Conversation, February, 1993), Cecilia's story tells of her five year progression through this course (see Table H, Appendix H).

Constructing Engineering And Identity As Engineer 1992-1997 (Theme 1)

Cecilia's first definition of engineering highlighted a number of general characteristics and relationships:

> ... it is more practical [than Chemistry and Physics, which I valued above an Arts degree], [it] tends to be more financially secure, is useful to the community, and has ... diverse career opportunities ... (Cecilia, AQ, March, 1992).

Cecilia's image of engineering equated with Super's (1983) concept of occupation, (Super, 1983), since she was conscious of engineering's meaning to society in regard to its prestige (value) and usefulness to society (p. 7). There were elements of vocation where she emphasised its pragmatic appeal and personal meaning for her in applying chemistry and physics to engineering. She also noted its promise of financial security and travel opportunities. Her construct lacked the finer discriminations of Professor D's vocational construct of electrical engineering as a craft (see Chapter Five). He spoke of his "application of ingenuity" (of what really are more or less the mathematical models in your mind) to the generation, utilisation, and distribution of electrical energy and in "the field of electronics and communication" where electrical engineers are a special sort of person "demanding clear thinking, ... and analytical ability, with clear perception of what ... you're after" (Professor D, Interview, 15 February 1993).

Climbing the organisation ladder to third year specialist studies in 1994, Cecilia's personal construct of electrical engineering developed more specificity, becoming more convergent with Professor D's construct:

> ... involves power generation, electrical controlling devices, also rectifying faults. I haven't talked about or picked it up [from] everyone else - all [they] talk about is their assignments. Some end up mucking you around (Cecilia, TB, July 1994).

She began to develop her identity as an effective electrical engineer:

> Electrical Engineering - [I need to be] well-organised, with aims, and expectations of the [role]. [I] can't be floppy anymore - [I'm] dealing with people's lives. [I] Heard [this] from friends on work experience (Cecilia, TB, July 1994).

This reflected her move towards personal meaning and her sense of vocation in electrical engineering. She identified a moral responsibility to others and her need to be well-skilled.

Cecilia extended her interest in ethics in her formal study:

> Ethics, [we're] responsible for a lot of money. Like if they give the 'go ahead' - [and its] faulty or [I'm] losing [the] firm a lot of money. I'd like to be popular! (Cecilia, TB, 1994).

Here the organisational career curriculum was adding cement to her vocational identity as an engineer. However, when asked how the curriculum *per se* in 1994 was stretching her horizons about engineering and becoming an engineer, she was somewhat contradictory:

> Through negatives, that has helped me, not hugely, [but given me] great shocks! [I] have not lost [my] romantic ideals ... about alternate energies (Cecilia, Electrical, Institution A, Telephone TB, February 1995).

As in earlier career stages, I found that Cecilia's interests were an essential source of motivation and in her understanding of the nature of work in engineering.

She satisfied her need for professional affiliation and achievement by becoming a student member of the Institution of Engineers:

> [I] receive Australian leaflets and a monthly paper have articles. [Like] Doctors, [we] have a board of registry, because [we're] responsible for more than one person's life. This girl (Mechanical engineering [in] Sydney) [has] real caring ethic. Sort of scary, people depending on me to be accurate and not making errors (Cecilia, TB, July 1994).

Subsequently, she became interested in the consultancy side of engineering:

> Consultancy side [is] (a newer work experience) [and] really broad. Work people have to devise where they are working and what they are doing. [The] IE mentor, I'm teaming up with [is] M from XXX. [It's] a turning point, [my] mentor is a woman, [a] trained electrical engineer. Not sure what she's there for. Taught [me] how versatile it can be and [so she's] not stuck in one field (Cecilia, TB, July 1994).

Cecilia was provided with early "anchoring", in Josselson's (1987) terms, to a valued woman mentor and to her future vocation in engineering. Unlike most participants, Cecilia was branching out in preparation for her future worker role (Super, 1990), with responsibility in a variety of sub-roles.

In 1995, Cecilia started planning for a future in Europe. With her usual enterprise she wrote that she was "training part-time as a bar-maid":

> ... some members of my family joke that this is a career move, but I only work an hour or two on weekends when it is slow at the bar, so [it] doesn't take up a great deal of time yet (Cecilia, TB, 21 March 1995).

This was the practical outworking of her 1992 occupational aspirations to give her an initial source of income when "I go overseas" to find work as an engineer (Cecilia, AQ, 1992). The following month she mulled over what Dr S had told her about higher degrees:

> I was talking to Dr. S in second year about the advantages of a Masters /PhD. He said "it really opens some door and closes others". For example, he said that "it intimidated the small companies". That's a really wacky attitude, "they say it shows them up". I want to go into a smaller company too. They have a friendly attitude (Cecilia, TB, April 1995).

She opted for her ideal "small company" and the chance of further study. Super (1990) applauded "planfulness" as a mark of career adaptability (p. 233).

Cecilia also expressed interest in visiting lecturer Fred's views on the essence of engineering and his underlying value system:

> Fred says "its all politics and money. [We] need to be more scientific, making something of quality, not cost-efficient". He wants to work with technology, and not be a "people mover" (manager). That's why he is an academic. They [managers] make a lot of money, I don't mind working with people. Engineering - I actually want to use it (Cecilia, TB, July 1995).

Ethically, she was in tune with Fred's concerns about what engineers do:

> Fred says solar still isn't used I feel sick, all that waste, [its] frightening! [With] no money [it] could be much worse than Chernobyl. Dad read no level of radiation is safe, it's waging war against mankind, [it's selfishness] - Yes, I'm going to make a difference. Help or change things ... (Cecilia, TB, July 1995).

Cecilia repeated a year of study, and found talking to Melanie about work experience helped refine her concept of "electrical engineering":

> The impression you get is that ti(sic) really depends what field you enter as to what you will do. I see engineering as problem solving in industry, and Electrical Engineering as problem solving power supply problems and motors needed in industry. (I'll let you know more when I get to 4th year) (Cecilia, TB, 21 March 1995).

By 1995, she had learned how her needs, values, interests and ethics might be satisfied in different positions in academe and the field (Super's 3rd proposition). Characteristically, she gravitated towards "superiors and fellows" who affirmed her current niche in engineering.

At the start of her own final year in 1996, she wrote optimistically about a new interest sparked by an engineer on work experience:

> R... who gave us, vac. students, a guided tour of A ... and it was EXCELLENT . I really want to work in Generation or Transmission. Its so exciting! - I can't believe I just said that ... I think I need to get out more! (Cecilia, TB, 22nd January 1996).

Through her active involvement, she now saw "generation" and ethical protection as her viable long term vocation. She linked her choice back to her lecturer's story and her aspiration to work in Europe:

> ... in both France and Germany, there is a great deal of interesting research being done in the fields of Power Generation and in particular, alternative energy ... I don't think I can get a job straight out of Uni overseas in the field [that] I want with my grades, so I shall have to crawl and beg my way into Western Power) ... Change of heart after a rejection letter or two?! They obviously aren't REALLY an equal opportunity employer ... !!! (Cecilia, TB, 22nd January 1996).

He had told her about the greater probability of getting into 'generation' in the Eastern States of Australia:

> There are a few private companies now the Victorian Govt. has given away some of its generating facilities. The larger population means more power stations than over here too. Besides, there is more to experience in Melbourne and Sydney. They get all the best international acts! (Cecilia, TB, 22nd January 1996).

As Super (1990) suggested, she exhibited an adaptive style in synthesising, observing and playing occupational roles in implementing her "self-concept", and testing the reality of future possibilities with two valued "superiors" (pp. 207-208). Satisfaction of her leisurite role and the performing arts was also on her mind.

In 1996, Cecilia began using leisure time to become a bilingual engineer:

> No job, no competitive sport or what-have-you ... this year. I have decided to take up German language studies at TAFE on the weekend. I want to work in Europe after I get some experience here. Maybe after 2-3 years experience (Cecilia, TB, 5 January 1996).

She wrote of its benefits from her professional reading:

> ... particularly since I see in the IEE Recruitment (Jobs advertised throughout the world through the Institution of Electrical Engineers UK) a few jobs in Europe ask for German speaking or French speaking Engineers based in the UK (Cecilia, TB, 5 January 1996).

She now internalised engineering as a global vocation, that linked to her travel aspirations and need to be proficient in German (Cecilia, AQ, 1992).

Cecilia recognised that she needed technological competence in using:

> ... the Internet far more than I do. Or at least use it for engineering purposes .... (Cecilia, TB, 21 March 1995).

Ten months later, she wrote:

> I [now] spend too much time on the Internet, but I read in the IE Aust magazine that the next generation of engineers (ie mine) are a goldmine for employers because they are so technologically skilled and familiar with the 'Net' ... (Cecilia, TB, 5 January 1996).

University technician Tom helped her with computer programming:

> He is really good in building my confidence and competence. I think they [my computer skills] are quite fair [now] ... He interacts with the class and jokes around, but we still learn what we need ... (Cecilia, TB, 5 January 1996).

She consolidated these skills on work experience:

> Everyone here at A ... has a computer and everything is computerised - all store information and plant information so everyone here can use one regardless of their age. (Cecilia, TB, 5 January 1996).

The technician helped build her self-efficacy, and colleagues on work experience affirmed her expectations of the *modus operandi* of the 21st century engineer.

Cecilia valued her role as a "woman", which she deliberately incorporated into her identity as an engineer. At her interview at A ... :

> Most importantly, BE FEMALE. You'll get the job no worries. I learned a few others [skills] too. Say yes, I'll do anything you ask me. Say yes, I love Engineering. Say no, I don't mind living away from home. Dad reckons we have to use this "female thing" ... to my advantage (Cecilia, TB, 5 January 1996).

She was impressed about a "woman in world war 2" who worked with "radio frequency" and "cracked [a] German code" and thought women today:

> ... [are still] invisibility rampant. Dad said Einstein's wife was not accredited ... [with] Maths. Dad's fair to everyone ... "funny [Einstein] 'didn't even wash himself", he said (Cecilia, TB, 8 May, 1996).

With her Dad's encouragement, Cecilia decided to use the image of a confident woman in engineering to her best advantage. Unlike other participants, she read about women's achievements as engineers. She was increasingly scathing of her friend Bron, who had become "one of the boys ... she smokes and drinks, goes to the pub" (Cecilia, TB, 23 April 1997).

Like her parents, Cecilia saw professional studies as essential for the establishment stage of her life-career:

> I want to get a job with WP ... they have a good graduate program from all accounts. For three years you work in ... different departments - Generation, Transmission, Distribution, Customer Services. Now all I need to do is get my foot in the door. I hope they are an equal opportunity employer (I'm shameless)! (Cecilia, TB, 5 January 1996).

This equal opportunity firm was ideal in Cecilia's sights, in terms of her vocational interest and her desire for professional development. Her greatest challenge was her current academic standing to bring these aspirations to reality:

> [Firm] A are trying to improve their intake of women to improve their statistics with respect to [Firm] C. C employs 12% women, A recently reached 10% I think ... believe me, it was something of a blow to the ego, although what did I expect with five F's on my academic record? (Cecilia, TB, 5 January 1996).

Despite the tendency of firms to employ "straight A" women students, she persevered academically:

> If I had not had that great experience at A ..., and I knew that I could work on my own and the benefit of that work experience, I would have given up ... (Cecilia, TB, 23 April 1997).

She remained single-minded in pursuing Engineering:

> My friend said 'Electrical engineering is a Vocation for you'. Vocation sounds religious! (Cecilia, TB, 8 May 1996).

When her confidence in her final project and belief in self was flagging, her lecturer "Super F was a Godsend":

> He congratulated me for my conclusions and my picking up the faulty results I had been trying to build on (Cecilia, TB, 23 April 1997).

At the end of 1996, "two guys interviewed" Cecilia:

> One says "I see you didn't do well in second year". I froze, thinking this is it. But he (Charles) turned to the other man, " just like me ... did you? ... it happens". I was offered the job (Cecilia, TB, April 23, 1997).

She talked to Charles about wanting to "work on protection":

> He thought that was great, he needed some one else to work in that field to help take the load from J's shoulders, who wanted to move into another area as well as protection (Cecilia, TB, April, 1997).

Fortunately, her success (career maturity) was not measured solely on high grades from her employer's "organisational" career perspective. In terms of career adaptability, she reminded me of the axiom, 'if you can dream it, you can achieve it'. Cecilia attained her professional identity as an electrical engineer in January, 1997. The question was now whether she would find the type of mentor support she valued and outlets to encourage and develop her initiative, forward looking motivation, ethical stance, practical abilities, interest in protection and other facets of her personality, as a woman in the work-place (Super's propositions 3, 10, 11, 12, 13 & 14).

Cecilia's Quality of Learning and the Curriculum 1992-1996 (Theme 2)

Remote and Immediate Situational Determinants of Curriculum (Theme 3)

By 1994, the curriculum review into Engineering education in Australia was complete (DEET, 1994). As discussed in Chapter Five, there was evidence of transition in curricula (Parr & Johnston, 1994) with an emphasis on the learner and learning. There was some dialogue between men and women engineering educators regarding the need to examine the masculine construction of engineering and self (Boman & Lewis, 1994; Ford & Ford, 1994). Lecturers elsewhere were making changes (eg, Lewis & Roberts, 1994; Trevelyan, 1994; Trigg, 1994), yet the collective story highlighted the participants' concerns with the "black hole" curriculum of their first year (see Chapter Six). Save for a final year issues unit, older participants had not experienced gender inclusive curricula.

As analysed in Chapter Five, Professor D held a curriculum conception in transition (OCVI). It emphasised subject content, fostering students' processes of analytical thought and ingenuity in the "practical laboratory" by making himself progressively "redundant". Competent use of computer was essential for these outcomes, but he conceded there was a lack of resources. He encouraged an "open door policy", informal student discussions about problems, but preferred them to work alone on projects. He said continuous assessment was like "the cattle prod" to get students to think about subject matter (Professor D, Interview, 15 February, 1993). As his student, Cecilia' story provided feedback on the organisational curriculum.

Cecilia Learning to be an Engineer and Curriculum (Theme 2)

Cecilia's Views on the Organisation of the Curriculum

Cecilia, like other participants, experienced the 'black hole' of the first year curriculum organisation:

> Lesley, I'm sorry for the delay ... I didn't realise how much work there actually is in the engineering course! (Lots!) ... So far [my journal] is mainly about tests & the work ... (Cecilia, Note attached to AQ, 23 April, 1992).

Her perception of the first year program in 1992 was clouded by a heavy workload and an alienating environment. In second year her black hole feelings intensified:

> No time, is this going to be like this for the rest of my life? ... [Its] really depressing - I looked around - nothing else suited, so back to old engineering (Cecilia, TB, 1993).

Her disillusionment with the reality of first year was associated with poor academic performance, motivation at a low ebb, resultant feelings of alienation, and a wish to cope by withdrawing. Cecilia had reservations about first year engineering and its consequences:

> They are trying to restructure the first year course ... Our first years are doing a year that leads nowhere, it's more management than business. It's not all that useful ... you can do a Master of Business in a year. Rather [they ought] to have a practical unit ... with more real problem-solving (Cecilia, TB, 29 July 1995).

Cecilia's views, echoing those of other participants, supported earlier feminist research (eg, Kolmos, 1991) and current Australian initiatives (eg, Parr & Johnston, 1994).

As she advanced in organisational status to third year studies, she confided:

> I'm still very interested in my course, particularly since reaching third year where everything is now especially applicable and more detailed (Cecilia, TB, 21 March 1995).

Curiously, it was electronics, her *bete noir*, that provided evidence of this:

> I believe I mentioned Electronics. I seem to be coping much better this year (our lecturer has a better command of English than German) (Cecilia, TB, 21 March 1995).

What interested her in "this great Electronics lab" was "building":

> ... our own audio amplifier. I have a great partner and we have lots of fun testing and building the bits (although I fear I am not as helpful to him as he is to me) (Cecilia, TB, 21 March 1995).

She wanted more linkage between the problems she faced on work set and those set in the formal curriculum:

> I wish that there were closer links with industry, and more realistic problems. Their set problems just end up as more theory, we're not using theory to solve real problems, not where we might encounter it at A... (Cecilia, TB, 29 July 1995).

At work, she had developed the notion of "design specification":

> AC/DC - What do we use these for [now]? Variable speed driven. Some things we don't know. They are not followed up by the lecturers. For example 'design specification' - we've never seen these. Stuff with A... should be part of the course (Cecilia, TB, 29 July 1995).

She was equally vitriolic about the outmoded content in a unit related to "instrumentation":

Instrumentation and temperature sensing is 'old hat' ... so limited ... no overflow, slow rates ... slow rates levels. [It] has few applications. This is not used at the A site, [it's a] radar, microwave, solar, focus. This is not learned [at uni], that unit is a waste of time (Cecilia, TB, 29 July 1995).

She chose "Alternative energies", her key vocational interest (see Theme 1), as the topic for her final year project (Cecilia, TB, May, 1996). Her work-place experience helped her modify concepts and learn electrical engineering jargon, which supported Cecilia's need for "connected knowing" (eg, Belenky et al, 1986). She was motivated to learn subject matter more deeply through practice, which matched her preferred learning style and personal construct of engineering. As she progressed through final year, the growing convergence between the organisational curriculum design and Cecilia's learning style preferences and vocational interests proved to be a definite 'theme of enablement' for her learning. Cecilia displayed higher levels of self-efficacy evidenced in her professional and personal commitment to electrical engineering, her persistence, and her reflective, often humorous, letters (see Theme 4). Both the affective and the cognitive influenced Cecilia's construction of knowledge and her personal making of work as a vocation, as Super (1990) had emphasised.

Cecilia's Lecturers as Teachers Creating Learning Opportunities (Theme 2)

In second year, a part-time "female" lecturer proved to be a life-line for Cecilia:

> Had Jane Brown for engineering analysis. Enjoyed this lecturer's support. She came from outside with high experience. I really enjoyed her account of engineering, and saw her as a role model, who raised my feelings of confidence in engineering education (Cecilia, TB, May 1993).

Characteristically, Cecilia appreciated Jane, both for her anecdotes and as a role model. Lecturer Des was also "the best":

> He told historical stories about engineers, [his] stories - gave me the idea of what happens when [you] graduated. I feel more hopeful ... (Cecilia, TB, May 1993).

In this way, Cecilia "anchored" (Josselson, 1987) with real engineers. Her "reality testing" (Super, 1990, p. 206) restored her interest, feelings of self-efficacy, and future possibilities as a woman in engineering. She described most of her other second year lecturers as "pretty good":

[We] keep getting external lecturers (Mr. R. TAFE) teaches, he doesn't lecture (It's like Yr 12 Physics) [and he's] easy to understand. [We] do problems, [we are] interactive in a small room, with small classes - He'll say "anybody got the answer ?" - [he's] more practical (Cecilia, TB, May 1993).

> Mr. S knows material really well. He explains, simple, not convoluted. He photocopies notes - mostly I don't use them ... I write and think [otherwise] I doze off (Cecilia, TB, 1993).

Cecilia valued the teaching style of lecturers that matched her preferred learning style. She was clearly enthused by lecturers with command of content, good explaining and questioning skills to assist her problem-solving and development of practical and technological skills (see Theme 1).

By February 1995, Cecilia was "happy" with her choice of electrical, but disappointed that lecturers were not keeping pace with innovations:

> ... fossilised from the neck up, seeing no new paradigms, no new questions. It frightens me, [they] assume no real protections [are needed]. [It is] scary and sick, not to care ... There [is] no new blood in the faculty ... (Cecilia, TB, February 1995).

She was also critical of lecturers with "no real commitment to labs":

> [They] take off. [The] Technicians have to help. I will stay [in electrical], it might be different. You don't grasp how hard it is. [I need] to work at it (Cecilia, TB, February 1995).

Linking with Theme 1, Cecilia needed the practical expertise of "superiors" to improve her skills to match her "romantic ideals" of becoming the ethical engineer in "alternative energies":

> [I want to go into] Industry for 5-8 years, and make a difference. Commercial research is ideal. I want to be a good engineer ... to protect people ... [and] no electrical hazards (Cecilia, TB, February 1995).

Her disillusion with lecturers, together with her propensity to learn more independently, prompted this comment:

> To tell you the truth ... I'm so used to having to supplement lecture notes with further reading that it doesn't matter whether the lectures are good or not ... (Cecilia, TB, 21 March 1995).

In her final year, she remained sceptical about her lecturers' ability to adapt:

> Those which aren't have left, are going to leave, or are due to retire in the next ten years anyway. Dead wood? Lets just say I wouldn't light a match in the Electrical Engineering building as there is a great deal of highly flammable material (Cecilia, TB, 5 January 1996).

She was "scared to complain" about a lecturer who "doesn't prepare" his lectures (Cecilia, TB, 23 April 1997):

> … we don't know what to study, he says "I'm not prepared for a lecture today" - "Read Chapter 12" you don't learn anything really that way (Cecilia, TB, June 1996).
>
> It's actually quite pitiful to see a lecturer who knows what he is talking about unable to communicate his knowledge (on other occasions they know nothing and communicate it quite well) (Cecilia, TB, 5 January 1996).

She worried too about a lecturer, who was also her supervisor, and talked "like a revolving door" in lectures:

> He's also helping me with my project on ... "alternative energies". My friend says he's ... really weird (Cecilia, TB, June 1996).

As a final year student, Cecilia's story revealed that lecturers were not meeting her learning needs in either the role of teacher or mentor.

Cecilia's Reaction to Lecturers Encouraging Collaborative Work (Theme 2)

Despite her enthusiasm for a collaborative project in electronics, Cecilia became increasingly wary of working with partners in labs:

> ... Sometimes you can choose a partner ([which is] excellent). Other times they are allotted and you know not to buy a lottery ticket in the near future ... (Cecilia, TB, 21 March 1995).

At one point, she had made a poor choice of partner (see Theme 4), which created a critical incident for her:

> I still don't work really [well] in groups. People end up chatting or one person reckons they are right and won't listen to anyone else although it doesn't ALWAYS happen that way (Cecilia, TB, 5 January 1996).

She tended to stick "mostly with Bron" and was irritated by male peers:

> I trust her and she doesn't make me feel stupid. Most of the other guys don't, but it does get a bit 'them and us' sometimes. The boys talk about boys things "you girls wouldn't understand". Yeah, okay ... the boys tend to take a lot of things too seriously, though it depends who you talk to (Cecilia, TB, 5 January 1996).

Informally, she was comfortable to "compare answers" with male friends:

> ... before lectures of during breaks in lectures (this is when the tone of M's voice becomes quite furtive: "Did you get 68.9% for the THD??? Is that too large???") (Cecilia, TB, 5 January 1996).

She also blamed herself for her lack of commitment to group work:

> If I were brutally honest with myself I would have to say that the reason ... is because before you turn up, people expect you to be organised and ... done something and I'm always doing something else or too lazy (Cecilia, TB, 5 January 1996).

Cecilia's preference to work collaboratively with others was soured by negative experiences with men in small group projects, which worked against her building epistemological truth and collegiality (eg, Belenky et al, 1986; Claxton & Murrell, 1987).

Cecilia's Evaluation of the Condition of Computer Resources (Theme 2)

In 1996, she reiterated the earlier concern of Professor D for the lack of, and age of, computer resources in the department:

> [Our university] does not have the financial facilities to buy new software packages ... the motors we are using are as old as the hills. The technicians (Bless their toes) are often asked to repair this equipment without being given the proper materials (or funding) to do it with (Cecilia, TB, 5 January 1996).

Tom agreed with her, saying that "the repair work he does are patch-it jobs and that it was "just shocking":

> A lot of old equipment is donated to [uni] from industry ... isn't particularly useful but it makes it look like they have a lot (Cecilia, TB, 5 January 1996).

This is an ongoing problem in her department, with inadequate resources to prepare electrical engineers for a technological age.

Lecturers' Choice and Cecilia's Use of Textbooks (Theme 2)

In 1996, the choice of textbooks by lecturers (with the exception of one) was a bone of contention for Cecilia, who liked to read to learn:

> I am [still] disappointed with the textbooks we have for some of our units. I'm beginning to wonder whether or not the lecturers are working on commission in this respect. Some of them are so difficult to read and appallingly sketchy (we'll just whip this formula from under our hat and *voila!*) (Cecilia, TB, 5 January 1996).

Other texts, she felt, presented theory as a *fait accompli* :

> The theory has been proved, no explanation of its origins, no explanation of why we picked that formula. Accept: IT IS SO... not that I usually question textbooks, but some of our lecturers say things which conflict with the text so you HAVE to check in order to discover the truth ... (Cecilia, TB, 5 January 1996).

She also questioned the choice of a book in terms of its frequency of use:

> ... Perhaps two weeks' work was included in the book, but I found a better one in the Library anyway (Cecilia TB, 5 January 1996)

She did not formally feed back her views on lecturers' poor choice of text-books or that she read avidly to learn (see Theme 1).

Cecilia's Views on Lecturers' Assessment Procedures (Theme 2)

Although, Cecilia preferred lecturers to tell her "what's next" rather than "other students", she was in favour of a final year assessment which was related:

> … to research, next year. [We] build [it], it looks like the real stuff. I felt much better! (Cecilia, TB, February 1995).

She was critical of anomalies with lecturers' assessment of students, some examples being:

> They are more strict on us than [them] ... Some [students] are not good enough, [they] should not be accredited, [they're] not practical enough (Cecilia, TB, February 1995).

> A Female was put up to 50% that stinks. A male friend [got] 49% [and] no conceded pass (Cecilia, TB, July 1995).

> S... was complaining that he gave M... most of the answers for the assignment but S... got 77% and M... got 93% and S... reckoned it was just because M ... was working with the lecturer over the holidays (Cecilia, TB, 5 January 1996).

She queried the irregularity of her appeal regarding a supplementary exam:

> ... the appeal process involved, [that] I write to Student Adviser. She rings lecturer querying the 50% result. He says I went off track that's why I did badly. He didn't even look at it, he "remembered". End of Appeal. Even if I pushed to have it re-marked it would cost me $20 and the same lecturer does it. Does this sound like an un-biased arrangement to you? (*SIGH!* I don't know why I bothered ... I should have KNOWN it was useless...) (Cecilia, TB, 5 January 1996).

Like some older participants, Cecilia valued fairness and consistency in formal assessment of all students. She was concerned about her right to a just appeal system, and the implications of poor assessment for engineering *per se*. Finally, she claimed the right of students to be heard on matters of quality in the curriculum:

> What do we think as students? [there's] no feedback. One lecturer got what he thought included our feedback. He wrote a big report in my second year, nothing was done about it. He was disillusioned (Cecilia, TB, 29 July 1995).

Cecilia's Group Identity and Niche in the Engineering Education (Theme 3)

Professor D was confident about his "open door" policy; the "quality approach from staff when dealing with a colleague in a laboratory male or female"; and "precisely zero harassment" of women by male students (Professor D, Interview, 15 February, 1993). In 1992, Cecilia combated her experience of the 'black hole', by "starting the journal". This became a key coping strategy in her quest for group identity with "superiors and fellows" in the "Spider Web" milieux of engineering education.

Cecilia and Lecturer Relationships as Anchors and Mentors

As a struggling student, one of Cecilia's yardsticks of academics was their personal approachability. She was unaware who the head of school was:

> I've got to think 'who?' [I] never see the head of school. D [is] head, don't quote me on that. [I] don't know the hierarchy. If I need any help I go to the lecturers (Cecilia, TB, July 1994).

She appreciated Dr L's advise and encouragement:

> [He] showed me third year stuff, and said 'come to me not your peers with questions'... [He's] real nice [and] cares about students, especially if they work (Cecilia, TB, 1993).

She was extra sensitive about her failures and an administrator's reaction:

> "Why [is it] out of order? " 'Cos I failed ...". [I] felt really snotty - just a guy doing the time table takes me as being very lazy, just 'cos [it's] late in the week [when] I approach him (Cecilia, TB, July, 1994).

By 1995, Cecilia was concerned by the poor quality of lecturers and the changing dynamics in the department:

> Lecturers are coming and going. They are ostracised from one another - political as far as I can see. Younger ones - [there are] only 2 or three. Weird too,[there are] increasing numbers of Indian lecturers, their qual[ifications] aren't all that good and with the massive pay drop, engineers here don't take up posts in the university (Cecilia, TB, 29 July 1995).

Each event supported her need for lecturers as "anchors" (Josselson, 1987), who were caring and knowledgeable, especially when she was failing.

In 1995, Cecilia repeated a year and had made friends with Bron:

> ... remember [her]? In the electrical lab, we get on very well. She has a sense of humour, her jokes keep me sane ... (Cecilia, TB, July 1995).

She told me of a lecturer's gender bias towards them:

> One lecturer [does] not like us, everyone but us. We're not allowed to use the circuit unless its checked ... He deliberately checks our work last. We laugh and joke about it (Cecilia, TB, July 1995).

The women held on to their "niche" (Young, 1984) in engineering, through the use of humour and self-talk as a counter-attack to gender harassment.

> ... I will stay, it might be different. [You] don't grasp how hard it is. I'll work at it ... I'll hang in, it's worth it. My friend who works in an engineering firm tells me to stick at it. We need you, she says (Cecilia, TB, July, 1995).

In second semester, Cecilia and Bron chose:

> ... another time slot [and another lecturer]. [We're] not [with him] in semester 2, it's really good (Cecilia, TB, July 1995).

Such a compromise on the women's part, did not challenge this lecturer's harassing behaviour or change the working conditions. Gender bias continued with another lecturer:

> ... there is always at least one per semester now, have you noticed? I must be getting more and more anti-social as I get older. Maybe I'm just not the doormat I should be (Cecilia, TB, 5 January 1996).

He gave her a lift home after a laboratory session and commented:

> ... how he wouldn't have his daughters (both getting good grades) do engineering or anything to do with the sciences as he doesn't think they would enjoy it (How does he know? He has never asked them. Doesn't he enjoy it? (Yes, he does so why shouldn't they?) (Cecilia, TB, 5 January 1996.

On another occasion, he was looking for a student to do work experience:

> First he asked S... who already had work, then M... so I asked if he could find me some work and he just wasn't interested AT ALL ... It all sounds so circumstantial, doesn't it? As I sit here typing this out, I realize that perhaps it's more of an attitude he had towards me than any specific action he perpetrated (suggestology... !) (Cecilia, TB, 5 January 1996).

Other women agreed with her about his gender bias:

> ... The thing is, I'm not the only one (woman), who feels the same way: Mel [does] (she had him last year) and so does Bron ... Mel's assignment for him was ... pretty good ... she only got 60% (Cecilia, TB, 5 January 1996).

She was also appalled by the way academics treated their male technician:

> The academics (that word is becoming increasingly despicable to me) - treat [Tom] as though he is inferior ... even though I found he had a better understanding of the workings of motors than other lecturers ... I am SO sorry he is leaving, but I think it will be better for him (Cecilia, TB, 5 January 1996).

Despite her experience of supportive lecturers, Cecilia's story revealed a climate of superiority created by other lecturers' interactions with women students, and with the male technician.

<u>Cecilia's Quest for Group Identity with Male Students (Theme 3)</u>

Early in 1992, Cecilia and Melanie had identified peers with superior attitudes towards them:

> … a select four ... we called them the Aerian Race, because they were so supremist ... and only really talked to you if you were useful to them (Cecilia, TB, 31 July 1994).

By 1994, she had categorised men into two types. "Know-alls" and "egoists", who were "in for the money", and/or "studying too much" (Cecilia, TB, 31 July 1994):

> A middle-aged student knows everything [about] machines and transformers! ... He's arrogant. It's like I'm annoying them, [they] say [to me] “What do **you** want?” (Cecilia, TB, 31 July 1994).

"Caring guys" were those who helped her and debated issues:

> M [works alongside me], a really nice guy. [He] really knows what he is doing. [Gives me] a head start. There is a need for enjoying yourself. Caring guys think that way too. We [share out] Water engine, no petrol anymore - caring for the world, for the young ... (Cecilia, TB, 31 July 1994).

Cecilia was treated by "egoists" as a stranger (eg, Pallota-Chiarolli, 1990); and from the few "caring guys" she experienced affirmation of her vocational identity (see Theme 1). She rapidly learned to estimate their worth as friends and as partners in projects:

> This semester [I] know one guy, I thought might be alright [to partner] for a project (Cecilia, TB, 31 July 1994).

By 1995, Cecilia was disillusioned by men's pseudo-support of women:

> Disappointed - They say "We support women's issues" - but no action ... Rick is that way. [Girl] friends thought the same - so I'm not alone. So relieved! (Cecilia, TB, 29 July 1995).

She and Bron alleviated the tensions with peers by supporting each other with humour and talking about future plans:

> Did we [female students] miss out on a unit last semester? Arrogance 295". R loves the sound of his own voice, "R with the silent p" - cracking up laughing eases the tension - [my] future oriented goals get me through (Cecilia, TB, July 1995).

Cecilia also reacted by criticising their lack of "inter-personal skills":

> ... but [they] don't get out socially - No personality. My girl-friend says they "All reckon we've got the hots for them if we stand close". She says that was also so, on her work experience. "Male charisma bipasses - all engineering students need them" - that's my father's saying. (Cecilia, TB 29 July 1995).

She found that their leisure activities were "limited":

> "What did you do on the week-end?" - I get responses like: "I put in an extra meg of ram" ... "[it's now] x5 faster" -really wicked! [An exception] M is really cool - he does labs with R - [he] takes the mickey and R takes it! Little wonder they can't relate (Elec/Electronic students) ... (Cecilia, TB, 29 July 1995).

She felt that engineers should be "well dressed, speak well, be straight forward confident" and criticised "all" her male peers for being "computer nerds":

> ... they dress that way - [they] don't care how they look - no clothes fit properly. "Super head" (only). Presentation is important (Cecilia, TB, 29 July, 1995).

Cecilia and Bron disapproved of their lack of respect for the technicians:

> They [male students] are pathetic. Bron and I are fed up - they are 'up themselves'. They treat 'sparkies' with disrespect and disdain. Bron says "we need to learn all that sparkies know". Only with that can the academic be used in real life (Cecilia, TB, 29 July 1995).

By the end of 1995, Cecilia had learned to use "new coping skills" with peers:

> … keep my mouth shut in order to not antagonise people ... and [give up] the rather painful habit of broadcasting my ignorance [since] everyone believes you without question ... or [saying] you are superintelligent (not that I have but I've witnessed these suicidal tendencies) ... people are derisive ... and don't usually seek out your company (Cecilia, TB, 5 January 1996).

With her indefatigable sense of humour, she mused:

> I am quite certain these skills will propel me up the corporate ladder (sly wink) (Cecilia, TB, 5 January 1996).

Despite Cecilia's assertion that the level of gender power play had lessened:

> ... this year [they are] far friendlier than the group I started with ... not as competitive (Cecilia, TB, 5 January 1996).

Her relationship with men was marred by a lecturer's unprofessionalism:

> [Doing my] Exam, the lecturer came up [and] said "Don't no, no". Intimidation I thought ... weird and arrogant, [he thinks the] only way to do it is 'my way'. The Guys said I got help doing [the] exam, [that] really sucks! (Cecilia, TB, 8 May, 1996).

She did not report the incident, but dealt with their chauvinism herself:

> You give back as good as you get. C [is a] chauvinist. [He said], with dual hand action, "[You] should have seen this girl, did she have big tits". [I] use his humour [back]. "I don't have the same wrist action you guys have. Screw up this connection ... (Cecilia, TB, May 1996).

She became aware of the increasing secretiveness of some male friends:

> Most guys [are] cool, not competitive really... [but] C ... 's getting secretive [with] lab reports (Cecilia, TB, May 1996).

Such behaviour was a hindrance to Cecilia's group identity attainment. She found in small groups that "dealing with power play by male students is critical ... if you do not stand up, it becomes worse":

> Gradually [it's] so demoralising. [They say] "Have you got good grades in this unit ?" before they will listen ... Got to stand up to it (in teamwork) not in a sniping or catty way ... it depends on being comfortable with yourself ... (Cecilia, TB, June 1996).

Cecilia's "major disappointment" with Bron was her lack of support when she was floundering and becoming "one of the boys" (see Themes 1 & 4).

In relation to Theme 3, some lecturers and peers displayed somewhat brutish masculinity towards Cecilia, her girl friends, and to the male technician. To counter the resistance of the men and her lack of group identity, Cecilia used humour, resorted to criticism, and adapted her coping strategies to maintain her position, "up against", what I deemed, the "hard edges of engineering". There were indications that there was a mismatch between her vibrant personality traits and those of male peers. As a stranger, she would not compromise her femininity as Bron did, to belong (see Themes 1 & 4). She flourished elsewhere, attaining her vocational identity and special interest with the support of a few like-minded others, including Melanie (Theme 1).

Cecilia's Holistic Assessment of Her Career Progress (Theme 4)

Cecilia's estimation of her "success" was holistic, being associated with academic progress and achievements, the health of her life-style, her level of affiliation with lecturers and peers, her resolution of critical incidents, and other factors influencing each status achieved on her climb up the organisational career ladder. Despite the "black hole" of first year (see Themes 2 & 3), Cecilia made academic progress:

> ... three distinctions - engineering, computer technology, and dynamics (Mechanical engineering) and 3 failed [exams], which required supps. (Cecilia, TB, June 1992).

She learned from her failures and the importance of reflection:

> I failed the ones I fell behind in: Physics, Electrical ([I] didn't know the concepts) & in Maths, I was nervous [I'm] working, - [I] gained 70% average in Semester 2. Computing [is] useful now. My diary? - yes, I still use it (Cecilia, TB, January 1993).

As a busy student, she found outlets:

> Recreation!?* Last semester a few bands. Need 12 hours sleep [in the holidays], [I'm] dead for a week. [I] Recover, [it's] a chain reaction. [I'm] taking a first aid certificate, after a certain level, [then, I can get into] free concerts (Cecilia, TB, May 1993).

Although her student role was the most salient, she combined her leisurite and voluntary worker roles to satisfy needs, interests and implementing other "aspects of self concept" (Super, 1990, p. 208).

In 1994, she was still finding the thought of assignment writing difficult to cope with:

> Every time I have an assignment due, [I think] does that count, probably not. [I] hand it in - get it back- and think phew! I am expecting a lot. Get a good mark and comment - [it's] enpowering. I'm better on assignments than exams, [because] time spent on this is greater (Cecilia, TB, 31 July 1994).

She learned to self-regulate her fear, and achieved competency with one lecturer's brand of "assignment feedback":

> ... He doesn't write a whole essay on the essay. He says 'see me if you've done really badly'. He goes over it in the next lecture (Cecilia, TB, July 1994).

Learning through mentoring and reflection was empowering for Cecilia. However, she continued to experience failure in her academic studies:

> I failed machines, in all I failed 4 units. Computer, I failed, I'm a bit embarrassed about that (Cecilia, TB, July 1994).

Mr L. counselled her on extending her course:

> Because [in] third year [there are] not as many [units], [I] have to wait another year - in second year. Mr L said, everytime [I'm] on 47%, I go through on the minimum. I have the potential, I need time to accomplish (Cecilia, TB, July 1994).

Cecilia thrived on positive feedback from examiners:

> Passed everything – much better and a little letter of congratulations from the Board of examiners! That letter of congratulations made me feel really positive (encouraged) - that I made good as a second year (Cecilia, TB, July 1994).

She admitted that self-talk and 'touching base' with me, was also helpful:

> Like when I failed, what have I to tell Lesley? No, [reporting back] is not a hassle it helps. Well, [it's a] bit of a blow to the self-esteem ... (Cecilia, TB, 1994).

For Cecilia, 1994 was the year that became a critical incident "story in itself".

She set the scene:

> I was only taking six units instead of the usual eight [where] 5 are at third year level and a 4th year unit ... (Cecilia, TB, 21 March 1995).

Her outlook influenced her approach to learning:

> This is going to sound silly, but I don't actually *have* a great deal of expectations from my course. Now I'm just concentrating on taking each semester one unit, one assignment at a time. If I think too much about the big picture I start to think "I'm NEVER GOING TO FINISH THIS DEGREE" and become disheartened. Silly lecturers don't help (Cecilia, TB, 21 March 1995).

She wrote on two occasions about lacking "time for leisure" and friends:

> I find quality time and recreation with friends is really hard. We go out occasionally and meet in town. Our holidays are so long, Paint, [I] leave till the holidays. Spend most [of the] time reading ... (Cecilia, TB, February 1995).

> MY SOCIAL LIFE is withering to say the least. I can't remember what boyfriends are used for. My friends try and understand... but not all of them do EVEN when I show them the things I have to do and explain that it doesn't necessarily come easily to me... BUT, I try to walk a bit every day (Cecilia, TB, 21 March 1995).

Cecilia struggled to find a healthy balanced adult life-style outside formal study (Josselson, 1987; McDaniels & Gysbers, 1992; Super, 1994).

Despite her competence with computers on work experience and on the Internet (Theme 1), her feelings of self-efficacy were negative "in the lab":

> Sometimes I hate sitting in the lab using the computers because everyone is down there and (Captain Paranoia rears his head) it feels like everyone can see when you make a mistake. I HATE MAKING MISTAKES. Character flaw from early childhood. Probably Freudian (I shouldn't be so sarcastic, I'm sorry). But there's only one way to learn, isn't there????? Doing it (Cecilia, TB, 21 March 1995).

During that year, with the technician's help, she competently learned "what we need" (Cecilia, TB, 5 January, 1996).

In terms of academic achievement in 1994:

> My marks were quite good I even scored my first 80% (Well, it thrilled me at the time, except when I looked at my electronics mark). Average 63%. 63% in technical design, 81% in the production electronics prac ... 69% both labs, electrical and electronics, 55% instrumentation, and 50% control (*SIGH* The bane of my existence...) (Cecilia, TB, 21 March 1995).

Her year had not been without a critical incident, due to ill-health:

> Critical Incident ... sitting my supplementary exam [at a Victorian uni] caused a great deal of hassle. I [then] underwent emergency surgery, spent one week in hospital, one week at home crawling around not to offend the wounded area and then I went back to Uni. I had a fair bit of work to catch up on - labs I missed still had to be performed. I didn't hand my assignment into "SwapBrain" when I promised and lo and behold! (have I mentioned my dramatic side?!!*).
>
> Mr N, who looks after the Power Engineering students, asks me into his office for a chat. He says that this lecturer thinks I'm having trouble in the unit and should withdraw (???? I hadn't handed anything in!! How would he know whether or not I'm having trouble???). I was quite shocked and hurt "swap for your own good". The man was telling me I was stupid (and I thanked him for it, which was worse??). What I don't understand is that people who have worse grades than I do and they *haven't* had the speech. I can't work it out. Mr N asked why I had failed in second year, I said it was my own fault. He said he couldn't help me there, with "lack of motivation". He said "One guy had got through 3rd year then quit". Mr N said to me "After getting that far it's a shame he hadn't gone to the end". I bet he didn't tell him he did so well to get there. [He] can't express feelings. Despite Mr N telling me "not to worry", SB told me electrical is harder than any other subject ... and he can't understand why students have the notion that Electrical is the easiest (I'm nodding sympathetically all the while). The other two (ie. Electronic and Computer systems) "follow a textbook format" he says, "and ... Electrical doesn't" (Perhaps I've noticed? Yes I had). Electrical engineers need to be "Jacks of all trades" (I neglect to correct him to "Jills"). Stupidly it may have been my pride ... I didn't defer [my exams] because I thought there might be a very *slim* chance that I'd pass. The closer I got to exams, the slimmer it became ... it was all worth it. I passed my supp... Getting up again (no failures) - [I] was starting to get panicky (Cecilia, TB, 21 March 1995).

"Oh Lesley, you have to laugh":

> ... Another crisis met and overcome by our electrical engineering heroine CECILIA!!!! Well sort of (Cecilia, TB, 21 March 1995).

Cecilia confided that without the support of her friends and family:

> I wouldn't be able to weather these (critical incidents) as well as I do (!!! Given that I weather them well ... !!!). Often I lack self confidence and they help to provide this. [which] increases motivation (Cecilia, TB, 21 March 1995).

With such 'circles of affirmation', her courage, tinged with humour, helped to keep her going.

Critical Incident of the Joint Project 1995 - "Character-building experience"

In 1995, Cecilia recounted to me how the progress of her joint project was marred by her male partner's gender harassment:

Awful partner, big prig. I thought I'd get along [with him] ... all of a sudden he had a lot of work to do. He said "you do the report", and I said "fair enough". Sunday, I finished that ... early, but [we were] not working together.

[It started with] "Do I get to read it, put it on a floppy for [my] computer". It came back ... one paragraph was mine, one just mine! He was grudging to the end, no changes [were made]. [There was] a definite change in his behaviour with women. [For] the 2nd module, I knew what to expect.

I confronted him. "You are worse than my wife, you write the final report". I'm missing information, [it's] hard, he's playing games with me. He came an hour late ... He had all the circuit information and everything. He rang me a touch smoothy. "You could have waited, [we] have to do it today, you come over, I can't get my wife's car" - a total power play. [Then] I start finding excuses!

He tried excluding me said he'd report me if I can't do it ... I wasn't strong ...
Dad said "you have to confront ... look at the bigger picture". Felt I had the 'fate of womankind' on my shoulders! [I] stood up to him, [I'm] really bitter. Quite oblivious later, [he] came up to me all friendly. It's a learning experience. Relieved when I [confronted] him. It was not my fault, [but] total power play.

I decided "That's it, Mate", and I went to the lecturer who leans back in his chair and says "It's a learning experience, other groups are far worse than [you] are". They seemed fine to me, I replied. "It's the way people make it look ... and better the devil you know" he replied. "that might be your boss". [What a] simulation of reality. Too painful, 66% in the end - [it was] an awful experience (Cecilia, TB, July 1995).

Cecilia resented this lecturer's acceptance of such harassing behaviour as a preparation for women in engineering. She felt that the male student had deliberately discounted her ways of seeing the world and devalued her contribution to the project and herself as a person. Fortunately, she had support from her schoolteacher father, who had experience in encouraging girls to deal with gender harassment. She was conscious of "learning by mistakes" in this oppressive culture:

> Can't wait to find out about engineering. Learn differently - I can't defer again anymore. I can't do things the easy way, ends up the hard way always ... Thanks for listening to me (Cecilia, TB, July 1995).

In preparation for semester two in 1995, Cecilia learned the importance of linking closely with a lecturer's teaching style to improve her grades. He taught by telling "a lot of stories with examples", which she enjoyed (see Theme 1):

> .. I wrote EVERYTHING down he said last semester and received 71% for that unit, which quite impressed me. In previous units with him, ... I never knew what was important and didn't do very well as I didn't have the correct notes to study (Cecilia, TB, 5 January 1996).

By improving her note-taking, she was jumping through organisational career status hoops. Over all, she wrote "I didn't do as well" in 1995 "as I would have liked":

> My lowest mark was 50% (which I have appealed - more on that later). I'm getting gutsier as I get further on in this course! and my highest 74%. I took seven subjects, most of my marks were in the mid 60's (Cecilia, TB, 5 January 1996).

She optimistically confided:

> I am hoping to do heaps better when I start again this year ... NO MORE ELECTRONICS LABS!! YAAAY!! (Cecilia, TB, 5 January 1996).

and added ruefully "if I fail any units ... ":

> ... I will throw myself under a train, or better still on the high voltage power lines supplying them. A suitable demise for a pathetic student in my field! (Cecilia, TB, 5 January 1996).

On the positive side, she wrote "its always helpful talking to people who have done the units before, so I guess I'll be calling Mel up a lot":

> In fourth year you have to know someone who has graduated ... Sometimes I only see lecturers for help so **they know** I'm working. S is one of those. I have him a bit next year (Cecilia, TB, 5 January 1996).

To conquer final year, she analysed academic tasks through gaining small incremental achievements:

> I have 5 units this semester, I've done two, and six next semester, [my project], then I've finished (Cecilia, TB, 8 May 1996).

There was a sense of Cecilia jumping through this final organisational status hoop with little sense of anticipation of joy or "fun" (Bordin, 1994) in her formal learning. She was jaundiced in her expectations of lecturers and male peers. In the milieu of engineering, she followed her own goal-directed plans to achieve. Cecilia passed all her final year units, and in second semester "has 6/7 units" and "passed them all, the lowest was 69%" (Cecilia, TB, November 1997), but not without the trauma of the final project!

Cecilia's Final Academic Hurdle - Critical Incident of Individual Project

Cecilia selected a topic "that really interested" her and a tutor she "liked" for her project:

> ... then his name was crossed off and Blinkey Bill's name replaced it (Cecilia, 23 April 1997)

Cecilia wrote in May 1996:

> Now into it! My project, [I'm] doing 'Alternative energies' (Cecilia, TB, 8 May 1996).

She recollected how she "could not figure out the circuit ... something was not right":

> ... I went to ask Blinky for the specifications? The results [were] derived from the Asian students last year ... he was very evasive and unhelpful. I mulled over it ... [I] went again ... all sorts of calculations were wrong .. he had marked their assignment ... over 80% ... (Cecilia, TB, 23 April 1997).

Her identification of the flaw in the calculations added to her sense that her supervisor was "really vague":

> ... "Have a low profile". I ask what that was? ... he laughed at me ... "power/time" ... no one mentioned that before. Talking to the guys later, they said "What's that?" ... (Cecilia, TB, 8 May 1996).

Cecilia had " learned a lesson":

> … even if the project subject is boring to you, the first priority is the tutor you choose (Cecilia, TB, 23 April 1997).

By June, 1996, she had no leisure time:

> ... [its] "really dumb, once a week I talk to my friends on the phone. I ask "oh, what was it like?" ... I said "I look forward to our weekly calls" - I don't have any other social life. ... I am getting really boring (Cecilia, TB, June 1996).

Cecilia " was stressed out":

> I broke out and all my skin peeled off my hands and elsewhere ... just like tinea between the toes. My eyes were so sore ... all red all over ... [they] hurt so much I could hardly work (Cecilia, TB, 23 April 1997)

In September, she went to her supervisor again:

> ... I had not really got going ... [I needed] some help ... He asked me the same questions I asked him in March ... "What are the aims of the project?" This time I had them because of "Super F" a great lecturer ... he went away to Germany and is now back ... he made helpful suggestions and helped with the aims of the project ... (Cecilia, TB, 23 April 1997).

She was persistent in "chasing the data" from her supervisor:

> In September, I asked again for the "details" I wanted. This time I had the list. I got a phone call ... vague... but gave me a number ... after three calls ... [I was] able to get the vital information I needed. I finished just before the exam. Blinky suggested I work on a new suggestion ... I tried, but I was so dead beat I gave in (Cecilia, TB, 23 April 1997).

"Super F" congratulated Cecilia on her "diligence in picking up the faulty results" she had been trying to build on and her "final conclusions". She regained her confidence and competence with his help, and with her memories of "successful completion of projects" on work experience (Cecilia, TB, 23 April 1997):

> I got through the project ... worth 75% ... finished up with 68% over all. I have appealed. My firm will pay for ... Post-graduate work. ... [but] it all hangs on getting my mark amended by at least 2% (Cecilia, TB, 23 April 1997).

Cecilia appealed because "the stress of the project" affected her "performance on the examinations", her health, and the "writing up of lab reports":

> I wrote 16-17 pages to you ... full of emotion ... that's why I did not send it.
> Yet I was able to use it in the appeal. Dad said not too heavy to win my case. I modified my words... (Cecilia, TB, 23 April 1997).

She related how she submitted her lab report at the appeal:

> [I] really worked on that to upgrade it, all this trauma affected all other parts of my work ... no wonder I was stressed (Cecilia, TB, 23 April 1997).

Cecilia's appeal was "overturned". She had a strong feeling that her tutor had not been a supportive mentor. He obstructed her "structure of opportunity" (Astin, 1984) and the fun (Bordin, 1994) of doing a project in her area of interest in 'alternative energies'. Her student role was very challenging, trying and at its most salient in 1996. Her worker role as an engineer was now on the ascendancy and served as a sustaining force during the most critical incident of her engineering education. However, having so little time for leisure was problematic, in terms of her emotional and physical health (McDaniels & Gysbers, 1992).

THE ESTABLISHMENT STAGE OF CECILIA'S LIFE-CAREER JANUARY 1997-NOVEMBER, 1998

Remote and Immediate Situational Determinant (Theme 3)

Under the umbrella of the recommendations made in the *National Position Paper for Women in Engineering, 1996* , Cecilia made her transition, via an encouraging interview with Charles, to her first posting, with a high level of career maturity and career adaptability (see RQ2, Theme 1). I analysed Cecilia's quest for identity, which was now embedded in Charles' organisational career, with reference to Research Question 3 (RQ3). Still the entertaining correspondent, she wrote:

> I start work at XXX. consultancy on the 6th January! I can't wait! (Cecilia, TB, December 1996).

Cecilia's Re-Assessment of Learning Style as a Personal Factor (Theme 4)

Cecilia compared her new information processing preferences as a graduate engineer with her 1992 profile as a first year student:

> I now prefer Sensory to Intuitive (Abstract) to organise information, considering possibilities, insights, and hunches. Auditory to Visual - as my sensory channel, getting external information through pictures, diagrams, graphs, demonstrations. As before, I prefer to start with principles and proceed to consequences and application. I still reflectively problem-solve through introspection and work best with one other person. As previously, I prefer to progress to understanding sequentially (Cecilia, TB, May 1998).

I found that her preferences matched Professor D's 'master' profile, other than his use of both sequential and global progress to understanding (see Table E, Appendix G). There was an even closer link with her new learning/managing style profile:

> As an Activist 14, I've remained the same. Post-site 1998, I am even more of an Activist! As a Reflector , I've moved from a strong 15 to an even stronger 17. As a Theorist I've moved from a moderate preference of 12 to a strong 16 and as a Pragmatist I've had moved from a low 10 to a strong 16 (Cecilia, May, 1998).

Being involved in engineering education, work experience, and her own initiatives, had made a difference. In addition to her achievements, skills, and good information strategies, she had an ideal learning/managing style profile for a professional engineer in her first posting (see also Table G & Table H Theme 4, Appendix H)

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Cecilia, Novice Engineer meets the Master Engineer (Themes 1 & 2)

When we talked over a celebratory lunch on 23 April 1997, she was agitated about a task she had been given:

> Briefly [it was about] a circuit and an instruction book ... I went through the instruction book twice -- at last I went to ask my older colleague and "mentor" ... he was a bit short with me, as though I hadn't tried, and I had ... I combed it twice ... I told him ... (Cecilia, TB, April 1997).

Cecilia carried "old tapes" of unreasonable demands of some "superiors and fellows" into her new work context. Her strength was her preparedness to talk through her first critical incident as a "worker" (Super, 1990) and to let it go. Super (1990) emphasised the importance of "development being aided by reality testing" (p. 207). Such was her introduction to her new consulting firm and the lack of mentoring.

Her "worker" role expanded to part-time "student" role (Super, 1990), when her firm encouraged her to enrol as an external post-graduate student at a Queensland university, specialising in "Protection":

> I received 75% on my first assignment", with affirming helpful feedback from the lecturer, not like [my old] university" (Cecilia, TB, 9 November 1997).

Such career success or maturity denoted her "readiness ... to cope with the demands" (p. 207) of both roles and the pursuit of her key interest in the context of study (see RQ2 Theme 1). She continued to have a secure home base with her parents. Cecilia "touched base" with me in April 1997:

> I haven't been very busy at all in the office (Cecilia, TB, April 1997).

Cecilia's remark about lack of busyness reflected that she was no longer gaining "work-satisfactions" in finding "adequate outlets for her abilities, needs, values, interests, personality traits, and self-concepts" in the office (Super, 1990, p. 208).

Cecilia Heading to On-Site Work "Up North" (Themes 1 & 3)

Characteristic of Cecilia, she wrote "I am excited about going up north to get some site work, because I enjoyed my work at A, when I was a vacation student" (TB, April, 1997). She re-established contact with her new boss:

> I had a reasonably amicable relationship with Dick before I went. I had been there for 3 days the year before and he was surprised that I wanted to come back. He would ring up and joke about 'reserving a pink hard hat' for me when I returned (Cecilia, TB, November 1998).

She now had a chance to explore her life more independently and to "implement occupational" self-concepts, as a woman and engineer, with "the approval of new "superiors and fellows" (Super, 1990, p. 207). Her opportunity for on-site work reflected a pro-active adjustment style (Hesketh, 1985; Dawis, 1994) in her firm's employment practices. Her "separation and individuation" (Josselson, 1987) from parents, also appeared to be a healthy life-style move for Cecilia, at this stage in her career. She wrote about her disappointment soon after her arrival:

> There are early indications of what I am to be in for. I was a bit bored at first because none of the electrical inspectors wanted to take someone in and teach them about site work. Some days I did very little other than walk around and read drawings, trying to familiarise myself with things (Cecilia, TB, November 1998).

In reality, there was no organised induction to work or "anchoring" (Josselson, 1987) for her as a novice on-site engineer (Theme 2).

Cultural Milieu - Cecilia and Lack of Critical Mass On Site (Theme 3)

Cecilia wrote of her general discomfort with all the men on the site and her concern for their "pack mentality":

> ... when I would walk past a group of guys and they were all staring at me ... its not the tattoos or hair styles ... it's their mannerisms. I knew if one of them did something to me, even if it was violent, the others would just watch ... I wonder if I were more petite and younger and on my own may be someone would have tried something (Cecilia, TB, November 1998).

The brutish masculine culture of engineering on this site in promoting a climate of harassment and intimidation, caused tension and unease in finding her identity as a engineer within this group.

Cecilia confided about an instance of sexual harassment with a fellow worker:

> Max put me with Brian ... to make sure that XX commissioned all their installations correctly. Brian ... a site person ... was wary of me at first since I was a female and he didn't know how to treat me (Cecilia, TB, November 1998)

She told me how "they'd swap stories and jokes" but "gradually":

> ... he started getting more and more personal with me, telling me how he and his wife were married but only for the sake of the kids and she doesn't have sex with him ..... After a while he'd say "Oh I'd really love to have sex this afternoon" and in reference to myself "You probably wash yourself in dettol after you have sex" ... (Cecilia, TB, November 1998).

Cecilia said she "tried to change the subject":

> "You don't like to talk about sex do you?" and I replied no, I thought it was very personal ... He lessened his comments and references to it for a while, but it started back up again later. I think he just decided I was a prude (Cecilia, TB, November 1998).

He began to call her "nerd and geek", simply because she did not "drink to excess". He seemed to think "he had some kind of control" over her:

> .... If I talked to J a great wit ... he [B] became angry with me and said I got him into trouble about being honest about our workload ... then he started slamming doors in my face and walking off when I was talking to him (Cecilia, TB, November 1998)

She went to Les, the lead mechanical engineer on the project:

> He said I could handle it and I was strong, go out there, give 'em hell etc. I did not go back to him ... because I didn't feel he understood, which is no fault of his ... he was very stressed with his own problems without bothering with mine (Cecilia, TB, November 1998).

She spoke to Brian's boss Paul:

> ... he made sure from then on he performed all commissioning and if Brian was around, then Paul was there too. Thank goodness for Paul ... but for his well developed interpersonal skills I think I would have left [the project] much earlier (Cecilia, TB, November 1998).

Brian's sexual harassment stunted Cecilia's ability to flourish as an engineer, and wounded her self-concept as a woman. Her "superior" Les covertly condoned such behaviour by not confronting him (RQ3 Theme 3).

Cecilia discovered that the site manager's daughter Jane was "quite manipulative":

> At the start I was relieved to go to share a chalet", rather than the caravan site. [but] she was... her behaviour added to ... my pain during the ordeal (Cecilia, TB, April 1999).

Jane would not tell her if the other girls from "doc control" were having dinner together:

> ... that sort of rot really upsets me. I like everything open and honest ... it wasn't like there were many women on site either! So when they all got together you could tell if someone was missing (Cecilia, TB, April 1999).

The women's marginalisation of Cecilia created a double identity crisis for her where she was neither accepted as an engineer or a professional woman. Her parents supported her at a distance:

> My mother thought it was cruel that I had to live with Jane, while I put up with everything else ... (Cecilia, TB, November 1998)

Each form of discrimination added to her lack of sense of community.

Cecilia's Work and Gender Harassment by "Superiors" (Themes 2 & 3)

After a couple of weeks, Dick placed her with Max:

> [He had] a reputation for being rude and bad tempered [and] yelling into his mobile phone and stamping his foot. I was to work with him on the Plant 2 electrical contract. Intimidating [yes], but I did not mind his mannerisms, because at least I was learning from him (Cecilia, TB, November 1998).

At first, he trained her and encouraged her to use his computer:

> ... because "He didn't have much use for the damn thing anyway" and I didn't have my own up there ... one night while I was typing an email to my Dad ... he exploded how his office was not his own and something about that "damn woman is always in there". I realise he must have been tired .. but I did not think his outburst was justified (Cecilia, TB, November 1998).

"Needless to say I didn't believe much he told me about what I could or couldn't use of his, or indeed any one else's, after that (Cecilia, TB, November 1998). After a few weeks, she found "he dropped his guard" and was "increasingly more abrupt and ... insulting":

> ... he'd often ring me and ask me what "the hell" was I doing ... but he had not told me where or when earlier. He said things that insinuated that I was stupid ... because I am female. Sometimes I'd make mistakes because I didn't know better, and I didn't know what questions to ask because I didn't know in the first place (Cecilia, TB, November 1998).

Cecilia found his supervisor Dick had the same attitude towards her:

> .... "Get your arse here now"... would be all he would say. ... they would both "shift the goal posts" on me without telling me, it just depended on their mood ... (Cecilia, TB, November 1998).

Cecilia felt intimidated but remained silent at this time because:

> ... they were all mates ... I was very conscious that sometimes they were needling me to see if I could hack it. In the end I earned their respect because I could hack it, but why should I have had to? (Cecilia, TB, November 1998).

What she found "irrational was that":

> Dick was saying to my boss [Charles in Perth] that I was doing very well, but it didn't feel like that to me. I totally lost my confidence in my ability as an engineer and, if I'd have stayed there much longer, in myself as a person... I've only mentioned a few incidents, but it was day in day out without relent (Cecilia, TB, November 1998).

The critical incident where they "eroded" Cecilia's confidence was "during the shutdown":

> "Get your sorry arse to Substation 2 right now or else". Neither Rod [site manager] nor Max, nor Dick told me that the guy was coming or that I was supposed to help him to calibrate a belt (Cecilia, TB, November 1998).

She felt the "behaviour of Dick and Max helped to erode his confidence in me, before I even had a chance to work with him":

> He gets stroppy with me and says in an irate, patronising tone ..." I mean have you tagged on to the conveyor yet?". It's a safety procedure ... [I] wasn't ... familiar with [actually doing it], I was a bit slow which irritated the belt guy even more (Cecilia, TB, November 1998).

All these things made her feel "incompetent, like I wasn't doing my job properly" (Cecilia, TB, November 1998). Cecilia said after that she was "never given more than a very limited amount of responsibility or asked to share the workload with the other guys":

> I was sent home early when everyone else was given extra hours. It made me feel like I was not part of the team ... because I'm a female. As far as I'm concerned that's outright discrimination. I didn't work for four years at Uni to be shuffled out of the way when it doesn't suit them to have me around because they want to be macho cowboys (Cecilia, TB, November 1998).

The day before Cecilia came back to Perth she "made a big mistake":

> that cost XXX ... money to fix. Max went ballistic at me. I was only given one day's notice - the higher managers had known for a bit over a week ... I could not wait to get out of there ... in May (Cecilia, TB, November 1998).

With such relentless harassment, she was "glad to get out of there":

> Everything I had has been taken from me. Pride, any little self confidence I had, my joy for engineering. I also have a tendency to dislike men before I like them. Before I went up north I was stupid enough to think I would be an engineer for the whole of my career. It had been something that I enjoyed. I don't any more. I don't like the people, I don't like the work ... I still am incredibly tired ... (Cecilia, TB, November 1998).

None of these men fulfilled their mentoring roles as Cecilia's supervisors (Super, 1990). Their systematic abuse and collusion in withholding information was unacceptable practice. Max and Dick's language was inappropriate towards a young professional engineer and woman. Max's behaviour reflected a classic cycle of gender violence, with his initial camaraderie followed by consistent anger and abuse towards her.

Cecilia and Repercussions in the City - September 1998 (Themes 2 & 3)

Knowing about her enforced return to Perth in May, Cecilia asked for a week off to recover. She did not get her "time off" until September:

> When I asked [again] in September he said to me "What? You haven't had a week off? EVERYONE should have some time off after site". Everyone except me obviously. (I think because I'm a female I'm supposed to work twice as hard sometimes) (Cecilia, TB, November 1998).

Cecilia, was not prepared to "give in to" this unsupportive management:

> In between my mental health worsened. I got so depressed pretending I enjoyed working there when I hated it. My dad told me to resign on the spot. I did not though (Cecilia, TB, November 1998)

She was professional and "helped with XXX's career night at this time":

> I hated XXX, resented my boss for ... not letting me have a holiday, but I still stood in front of these graduates and told them what a great place XXX is, because it is **if you are a bloke**. I had some of them come up to me later and say that it was only after listening to me that they wanted to apply to XXX, because I made it sound so good. Maybe I should try acting as a career ... (Cecilia, TB, November 1998).

She believed that you should have "some loyalty to the place you work for":

> - and while you are there you do the best work you can. And I have tried to do that all this time. That's no small feat, believe me (Cecilia, TB, November 1998).

Cecilia maintained her professional integrity, personal dignity, values and moral stand and a tinge of humour despite the continuing alienating conditions in her firm.

She again experienced male peers "behaving badly":

> I have three guys on the 9th floor who will not work with me. One is so arrogant he thinks I have some sort of stupid crush on him. A few others will work with me if they really have to, but will choose someone else if they can... There is one electrical engineer on another floor who only learned to look me in the eye earlier this year. I suppose I should be pleased that he is getting somewhere ... Another ... now I have earned my stripes ... up north ... has only started to talk to me ... he still won't work with me (Cecilia, TB, November 1998).

These men could not get beyond Cecilia's sexuality and treat her as a normal professional colleague (Carter & Kirkup, 1990a). Her boss was ineffectual:

> My boss can not understand why I have no work to do although [he] has heaps. He does not like problems (Cecilia, TB, November 1998).

Her contemporaries and her manager continued to hinder Cecilia's curiosity and exploration (Super, 1990, p. 231) in achieving vocational identity and success.

Promise Unfulfilled - Vocational Identity and Interests (Themes 1 & 2)

When Cecilia applied to XXX in 1996, she told the boss that she wanted to work in protection:

> He thought that was great, so far I have done three small jobs in protection. I have been here 2 years in early January. Frank arrived in February this year, and who I quite like, has been given heaps and heaps of protection work ... (Cecilia, TB, November 1998).

She was given "flimsy excuses", and said "take your pick":

> I have only been employed because I am a female; the other guys who work in protection don't want to work with me or I'm too stupid ..... I'm tired of trying to work it out because either way I come out a loser (Cecilia, TB, November 1998).

In the chilly "spider web" of this department, Cecilia's vocational interest was not being nurtured. This affected her productivity, created low feelings of self-worth, and a lack of "forward looking motivations" (Oeser, 1961; Super, 1984, 1990, 1994) to build her identity as an engineer. Cecilia had become a "daughter of crisis" (Josselson, 1987).

Cecilia submitted a gender harassment complaint, and she was moved:

> I am on another floor now, with people who actually have interpersonal skills and are genuinely nice and are not threatened by me (Cecilia, TB, November 1998).

As a consequence, her state of emotional health improved:

> My doctor has given me anti depressants but I'm trying not to take them because I want to believe things are getting better. I think they are (Cecilia, TB, November 1998).

Her new boss Luke shared "he'd suffered a similar sort of stuff" on site:

> ... finally Luke grabbed the guy by the throat and threatened to beat him up if he didn't stop the rot. It worked. Suddenly he had this new found respect. But as he pointed out it not something I can do in that situation (Cecilia, TB, November 1998).

Luke was an "absolute godsend":

> Luke gives me positive feedback all the time ... he is managing three big jobs at the moment and I think I have managed to take some heat off him ... Any way he is re-building my self-esteem whether he realises it or not (Cecilia, TB, November 1998).

He wanted Cecilia to work with him on a job for "another few months":

> I am perfectly happy to do that and I enjoy the work I'm doing here ... he suggested that instead of engineering that I should move into project management. That would be nice, but I can't see it happening. Not at my age and level of experience (Cecilia, TB, November 1998).

Luke was helping Cecilia to be an integral part of his team. In career development terms, his approach was transitional in adapting to meet her special needs and re-establishing of vocational identity. This was an oasis for Cecilia where the majority of men had actively used degrading and excluding strategies.

SUBSTANTIVE AND METHODOLOGICAL CONCLUSIONS

By using Jaggar's/Super's life-history (idiographic) approach, in conjunction with the collective (nomothetic) themes of other participants, I confirmed that gender was the major social construct affecting the lives of all participants, but lived out in some common and different ways by Cecilia. The theory segments and spider web elements of career decision-making of my combined archway model (Figure 2.3) helped me to analyse the four themes associated with the development of Cecilia's embedded identity, sense of self-efficacy, achievements, and choices of career pathways. I progressively summarised Cecilia's quest for identity in the form of her life-career rainbow to represent and link key socio-cultural and familial events to the four themes and developmental tasks in her construction of past career as child and school-girl (RQ1); present career with its tensions and transitions, as a non-traditional student (RQ2) and as a professional engineer (RQ3); and her aspirations related to each part of life-career (RQ 1, 2 & 3) (see Table G, Table H & Table I, Appendix H). I used my convergence of Super's (1976)/Astin (1984)/Josselson's (1987) theory of career, which emphasised work as the organising principle, to interpret how Cecilia developed her vocational identity and to probe her personality and self-construct development.

In terms of Theme 1, I found Cecilia's early conceptions of work were connected to successful resolution of age-related developmental tasks and acquisition of vocational and avocational interests. In adolescence, her work conceptions became more aligned to occupation, with the choice of prestigious useful work in engineering (as distinct from arts as leisure); and, as a student in engineering, to her internalised sense of engineering as a personal vocation. I also found that her special interests and avocational pursuits, became more congruent with her future profession as a woman in engineering. Cecilia's qualitative process of change in past career supported Jaggar's/Super's propositions about healthy personality development and career progression (pp. 206-8). Her self-concept was "positively constructed in a social context" (Super, 1990, p. 206), through exploration of the Arts and other interests in her family, in her leisure pursuits with peers, in primary school; and later with her high school teachers' early cultivation of girls' interests to broaden their work options. This aligned with Super's (1990) 1st, 5th, 9th, 10th and 11th propositions (pp. 206-7). She also gained competencies in, if not the passion for, mathematics, "hard" and "soft" sciences and technology. This supported Super's (1990) 2nd proposition (p. 206). In her choice of Engineering over an Arts degree, her "occupational self-concept" (Super, 1990) was strongly influenced by her father and mother, which she affirmed later through anecdotes of her science teacher, an engineer, and her own investigations of its opportunities and practical nature. This supported Super's 4th proposition regarding Cecilia's positive self construct providing "some continuity in choice and adjustment" (p. 206). She was a "paver of the way" (Josselson, 1987) and a "feminine ambivalent" (Douvan & Adelson, 1966) with a difference. Although "her characteristic pattern of abilities" (Super's (1990) 3rd proposition, p. 206) was more arts-oriented, she chose to pursue science and technology with the same zest to become an engineer. In terms of identity attainment (Josselson, 1987), she would have preferred chemical engineering but had to be content with electrical because of her lower than expected school grades (RQ1). Yet Cecilia's "Who am I?" revealed strong self-knowledge and personal agency to become the best she could. Like some of Carter and Kirkup's (1990) women, this was imbued with circles of affirmation from friends and parents; and teachers who created structures of opportunity

and encouraged. which aligned with Super's (1990) 5th, 6th and 9th propositions (pp. 206-7).

As a student of engineering, Cecilia progressively gained her vocational identity from early "anchoring", in Josselson's terms, with a women engineer and student membership with the Institution of Engineers. She actively created her own "webs of relatedness" (Josselson, 1987), in testing present and future reality through avid reading and anecdotes about women engineers and engineering by valued lecturers; and incidental mentoring by men who shared her special interest and cared about what they did as engineers (eg, Koch, 1990). She exhibited adaptive style by observing, playing out and synthesising her occupational roles in "implementing her self-concept" in practical projects on work experience with engineers in equal opportunity firms, her leisure/part-time work pursuits, and to a lesser extent in the engineering program. Her quest for identity supported Super's (1990) 10th and 11th propositions (p. 207-208), and his emphasis on the power of vicarious and interactive social learning with valued "key figures" in career decision-making (p. 212). Her career pathway also supported Super's (1990) 14th proposition where a variety of roles contributed to her career and personality development (p. 208). With her progressive self-enculturation into the engineering profession, Cecilia made an easy transition to the small consulting firm of her choice with the promise of postgraduate study and work in her area of interest (protection) at her interview (RQ2). Although Cecilia was a strong "socialised organiser of her own experience" (Super, 1990, p. 221), the dirth of mentors in the work-place to consolidate her special interest or foster her identity, and little work satisfaction and challenge, explain how she became an "adult underachiever" (Davis & Rimm, 1994) (RQ3). Nevertheless, although more cynical of others, she maintained her professional integrity and values.

In terms of Theme 2, Cecilia's needs and interests as a feminine ambivalent were satisfied in her school curricula. Her well-balanced achievements in the arts, science and technology generally supported transformative change towards gender equity (DEET, 1994) (RQ1). In the context of electrical engineering education, as a practical,

but theoretical and reflective, learner, she found the curriculum onerous, non-motivating, and unconnected to real-life problem-solving until her third and final years (RQ2). Her eventual academic success after five years was facilitated by counselling from a concerned lecturer assigned to this role, a small number of inspiring and supportive lecturers, the increasing practical nature of the course, and a technician who informally gave her confidence and competence in computer programming (RQ2). As a graduate electrical engineer, her learning /management style (Felder & Silverman, 1988; Honey & Mumford, 1982; Newhouse, 1989) had aligned with that of her professor (see Table E & Table H). However, Cecilia was concerned about the process and outcomes of mixed-gender projects; the quality of, and gender bias of, some lecturers; poor computer resources; selection and use of textbooks; and inequitable assessment with its implications for standards and duty of care in professional practice.

In relation to Cecilia's profession induction, Super's (1990) 9th, 10th and 11th propositions (pp. 207-208) were not met, because she lacked the needed support and "approval of superiors and fellows". As a consequence, Super's (1990) 12th and 13th propositions (p. 208) about an individual's need for "work-satisfactions" was diminished because of the lack of "adequate outlets" on site for her abilities and interests to flourish. Super's 14th proposition (p. 209) advocated the satisfaction of needs in roles of worker, leisurite, peer, student or woman, but Cecilia experienced alienation (Jaggar, 1983) from each of these roles (RQ3 Themes 1 & 3). As Connell (1987) suggested of professions "historically constructed as a form of masculinity", these engineers were actively excluding Cecilia as unfit to have their "specialised knowledge with technological expertise" (p. 181) (RQ2). As Jaggar (1983) contended, these men appeared to hold collusive ideologies that served to alienate Cecilia from her own "sexuality" and from her "intellectual capacities" (Tong, 1992, p. 187) as a public worker in 1998. Their behaviour equated with the culture of the traditional hegemonic engineering workplace of the 1970's and 1980's (Carter & Kirkup, 1990a; Cockburn, 1991, 1985; Hacker, 1983; Robinson & McIlwee, 1989). It was not a work-place in transition, as experienced by some of the 1993 graduate participants in their establishment stage (see Chapter Six).

In relation to Theme 3, these findings highlighted the importance of "superiors and fellows" as "anchors" creating "webs of relatedness" in Cecilia's construction of group identity and opportunities for achievement. As a young girl, Cecilia's special needs had been well met and she displayed the balance of "agency and communion" in her personality as a "paver of the way" (Josselson, 1987, p. 171). She had internalised the positive impact of the past events with key figures in her family, schools, leisure, and peer group, who were also her friends. There was only one instance of gender and social class discrimination by her upper school peers, but generally her schooling supported increasing transformative change towards gender equity in non-traditional subjects, in terms of her access, participation with a greater number of girls, and her achievements (DEET, 1994) (RQ1).

From present career events in the gender regime of electrical engineering education, she internalised her tenuous gendered identity as a woman and under-valued team membership in the chilly milieux created by some male lecturers and male peers (RQ2). At times, she displayed the low self esteem and anxiety that were characteristic of the "daughters of crisis" (p. 107). She was angry that some academics and male students treated the technician "as though he is inferior" (Cecilia, TB, 5 January 1996). This supported Connell's (1987) view that "hegemonic masculinity" in this regime was also constructed through "subordinated masculinities" (p. 183). Cecilia learned to cope by keeping her "mouth shut" and resisting becoming "one of the boys" to belong. As Super (1990) asserted in his 7th and 8th propositions, her ability to cope with the demands of unsupportive peers was an indication of her career maturity and adaptability (p. 207). She did not officially report the gender harassment, and these oppressive conditions remained unchanged.

In Cecilia's work-place, the men's gendered concept of work and gender power-over relations were central socio-cultural factors underpinning her non-attainment of group identity and sense of alienation, both intellectually and as a person (Jaggar, 1983; Josselson, 1987), Cecilia became the "stigmatised" woman (Marshall, 1985), where sexual and gender harassing events inhibited her opportunities for self expression, led to

her lack of self-efficacy and marred her dreams of her future. Engineering was a discouraging career for her in 1999, as it had been for some of the older women in 1993. It was time for men in engineering with such lack of "tolerance" for "some variety of individuals" (Super's (1990) 3rd proposition, p. 206), to "develop less stereotyped and personally realistic ideas about their possible roles in the occupational world" (Super, 1971, p. 189).

In relation to Theme 4, her reflections on past career revealed the strong "enabling" support of parents and friends (eg, Young, 1988). She was well-adjusted and single-minded, showed initiative, developed an internal locus of control, achievements and interests in science and arts and skills (including practical, technological, coping strategies, well-balanced learning / thinking /managing strategies) for access to engineering, with the potential to design, and pursue leisure interests. In electrical engineering education, her academic success and eventual attainment of professional identity was due to her perseverance, hard work, positive personality traits, and her own initiatives in developing a personal, ethical and interest-based vocational identity (RQ2, Theme 1). She used a range of coping strategies to counter, and problem-solving to resolve, critical incidents related to the engineering curriculum and associated interpersonal and intra-personal/health issues (RQ2, Themes 2 & 3). In times of stress as a student (RQ2, Themes 2 & 3) and as a worker (RQ3, Themes 1, 2, 3), the consistent support and encouragement of parents, outside friends (including Melanie) and the "chance" lecturers or mentors helped her to recall positive experiences, make occupational and leisure adjustments, inform her future decision-making, maintain her professional integrity, and renew her sense of vocation as a woman.

Theoretically, her career story supported my incorporation of Super's (1976, 1990) interactive life-span, life-space stage theory of personality and career development segment, with Jaggar's (1983, 1989), Josselson's (1987) and Astin's (1984) socio-psychological theory. Central to this theoretical convergence was my focus on the individual's embedded identity and its healthy construction and attainment. My use of

the gendered construct of work as a key organising principle enabled me to focus on a woman's accomplishment of developmental tasks/interests, probe her personality development, and her perceptions of others' affiliative support and structures of opportunity in a particular gender regime. For example, in terms of past career, Cecilia did not consider her choice of engineering was unusual for a girl, yet she was influenced by its prestige over the arts, its practical nature, and opportunity to travel. Neither Cecilia, nor "key figures", had compromised her non-traditional choice, self-concept or personality by internalising the femininity/cleverness dichotomy. Linking Theme 1 to Themes 2 & 3, I found that her past career was characterised by a healthy convergence of vocational and group identity. In contrast, her story of present career showed discontinuity between these two aspects of her identity due the internalised beliefs of some "superiors and fellows" that resulted in varying degrees of discrimination, ranging from the covert to overt acts of resistance. Her quest for identity supported Astin's (1984) premise of "differences - in degree - rather than kind by gender".

Methodologically, Cecilia's evaluation of her academic progress and general healthiness of self and the milieux, and the number of critical incidents (see Themes 2, 3, & 4) raised for me the issue of Super's conception of "decision" points in educational institutions as being "easily handled" (p. 291). These were largely represented in this context by, and juxtaposed with, transitions in organisational career statuses from one semester to the next (RQ2). This has implications for the way women in engineering are treated by Academe, and the frequency of women's feedback on their progress with trustworthy mentors. Cecilia affirmed that "touching base" at regular intervals with me had "helped". As Super's methodology had suggested (1980), my approach was a "counselling intervention" (p. 288). I found that it heightened her personal awareness of oppression, as well as a focus on what she, and other women in engineering had, and could achieve. This, as Jaggar's (1983) third principle of action suggested, enhanced her personal agency and integrity, and even in the darkest times 'up north', to move from her present oppressed positioning to effect positive change in herself, if not others.

I found the Combined Archway and Spider Web Model (Figure 2.3) provided a dynamic representation of Cecilia's life-stage interaction with "key figures" in constructing knowledge about self and actively exploring the world through work and play, as a child with parents and friends, a school-girl and leisurite, a maturing student engineer and, later, as a woman graduate in engineering. The inclusion of the spider web within the archway model facilitated my identification of Jaggar's/Super's (1990) propositions regarding the healthiness of her career decision-making and personality development. Its interconnecting links made it easy for me to identify intra-personal and inter-personal elements that were exemplary and/or 'found wanting' in Super's "theaters" of Cecilia's family and school education (RQ1), engineering education (RQ2), work (RQ3) and leisure (RQ1-3).

The elaborated Life-career rainbow (Figure 2.4) helped to represent "life-span" as continuity between her past, present and future career, reminding me of Cecilia's dialectical construction of career and identity in the changing gender order of Australia between 1974 and 1999. "Life-space" was represented by the saliency of her life-roles in different contexts at each stage. I imagined her career archway as 'Woman in Engineering' placed upon her life-career rainbow at each life-stage (see Table G, Table H & Table I, Appendix H). Likewise, the ladder model (Figure 2.6) provided me with the sense of Cecilia climbing the status rungs of the organisational career and confronting and resolving of "mini-cycle" hindrances and challenges within and between stages. The ladder also provided a reminder to check on the comparability between the subjective career of Cecilia and the organisational career of Professor D, and with the other participants' life-career. In this concluding section of the chapter, I used Cecilia's embedded quest for identity as a convergent construct to connect her story with segments of my theoretical version of the Archway (Figure 2.2), in preparation for the synthesis of theory and methodology in the final chapter. Overall, telling Cecilia's present career story supported my four domain assumptions about the value of using narrative to assess: current limitations in her engineering education and the work-place in accommodating to women's special needs, interests and values; deeper gender issues in practice (eg, Gallos, 1989; Hildebrand, 1989; Marshall, 1989); if/how the feminine is

valued by the woman and significant others (Alcoff, 1988; Branson, 1991; Greene, 1976, 1988; Heilbrun, 1979, 1988; Swarbrick, 1991); and how work as a gendered construct is used to position women in engineering as other and subordinate (Astin, 1987; Collin, 1986, 1990; Eveline, 1994; Josselson, 1987; Pallota-Chiarolli, 1990).

CHAPTER EIGHT

COMPLEMENTARITY OF PERSPECTIVES ON WOMEN IN ENGINEERING: BUILDING A CONVERGENCE MODEL OF CAREER AND DISMANTLING THE DIVIDE

> We think we are just O.K. We know that women successfully cope with and handle the education and job of an engineer. But we are not sure, whether we want to continue to do so, given the circumstances today. We have a vision of a different every-day life. To have this dream come true, we shall need some changes in our society.
>
> Hanne Lerstrup Kock, 1990

PURPOSE AND OUTLINE OF THIS CHAPTER

The major purpose of this chapter is to draw together the methodological and substantive findings from my analyses of first, the "generalised other" (GO) subjective perspective on women and girls in non-traditional career pathways (Chapter Two); second, the concrete other (CO) subjective collective (nomothetic) narratives of 53 women in engineering (Chapter Six); third, the individual (idiographic) life-history of one of the women, Cecilia (Chapter Seven); fourth, the generalised other organisational career (eg, Parr & Johnston, 1994) and fifth, the concrete other organisational career of 8 professors in which the women's career pathways are contextualised (Chapter Five).

Following a brief resume of my approach to this study, I use my three research questions to compare and contrast the four career perspectives on non-traditional women's past, present and future career (Figure 1. 1). My aim is to highlight apparent commonalities and contradictions, and to distil issues for women in engineering. I then progress to synthesise the evaluation of my Jaggar/Super convergence theory of career development, using Krumboltz's criteria of quality (see Chapter One, p. 8). Methodologically, my aim is to find out how well I have answered my question about the effectiveness of my elaborated models in representing life-career, in terms of accuracy and usefulness for my feminist construction and analysis of women's career narratives. Substantively, continuing to use his criteria, my aim is to evaluate the explanatory power of Super's propositions in relation to my three research questions; and how useful it was to apply both a nomothetic (collective) and an idiographic (life-history) narrative approach to build a more gender inclusive theory of career and

personality development. My interest also was in the capacity of my model to inform practice in this area, especially in the sense of empowering women and identifying conditions for change.

Thus, I focus finally on themes and associated issues emerging from my analyses which have practical significance. I suggest changes for adapting the concrete other organisational career to meet the special needs, interests and values of women in engineering education (in terms of a gender inclusive curriculum, and its structural organisation and cultural milieu); and in first postings. In presenting these findings and recommendations my overall purpose has been to give the participants' voices "social breath" (Rudduck, 1993).

SYNTHESIS OF CAREER PERSPECTIVES AND DISTILLATION OF ISSUES

Investigating the Contextualised Life-Careers of Women in Engineering

Over a two year period (1992-1994), I constructed the collective story of women's career in engineering from the experiences of fifty-three women in the engineering faculty of two Australian universities and in their first postings. During my analysis, I found that what was missing from this nomothetic investigation were important insights into each woman's crystallising life-style and her on-going career decision-making especially in engineering. As a result, I constructed Cecilia's life, spanning the years 1974-1999.

I framed my analyses in terms of three research questions related to past, present and future career. For both analyses, I interpreted the women's life-careers from the standpoint of a convergence of socialist feminist "unified systems" theory of social relations (Jaggar, 1983, 1989; Jaggar & et al, 1978, 1984, 1993) with Super's (1990) segmental theory of career and personality development. My aim was to provide a strong base for theory-building in relation to women's life-careers. My elaboration of Super's models of career development, where "career" was conceived as "life-span" and "life space" (Super, 1994), provided frameworks for the construction of, and analysis of, a collective women's narrative (Chapter Six), as well as Cecilia's life-career history (Chapter Seven). I accumulated the women's stories from a number of qualitative and

semi-quantitative data sources. I construed their stories as the concrete other collective "subjective" career (Barley, 1989; Benhabib, 1986b; Dale, 1978; Hughes, 1937), drawing out the key personal and situational determinants and four common themes that threaded through their lives (Chapter Six). Their collective story provided a valuable back-drop and the four themes to help me to construct Cecilia's unique life-career story (1974-1999). Cecilia's voice reinforced for me that life was a unique journey not a blueprint (Chapter Seven).

I contextualised the women's subjective careers within the "concrete other" (Benhabib, 1986b) "organisational" career narrative (Barley, 1989; Dale, 1978; Hughes, 1937), constructed from my interviews with the engineering, professors, all of whom were males. Like the women, the men were also prepared to debate gender issues in relation to women in engineering, and discuss their learning style profiles with me (Felder & Silverman, 1988; Honey & Mumford, 1982). My inclusion of the professors' voices provided a situation where I was able to compare the subjective and organisational career, and where the impetus for change in the present career context came, not only from the women, but also from some of their professors.

I constructed and interpreted these sets of data as the concrete other (CO) subjective and organisational career narratives, and I further contextualised both perspectives within the generalised other subjective (Chapter Three) and the current organisational practices in engineering education (Chapter Five). I synthesised the generalised other (GO) subjective perspective from the literature on non-traditional women's careers. The generalised other (GO) organisational perspective, I gleaned from my in-depth analysis of the conference papers written by educators representing Australian faculties of engineering and professionals in the workplace (Parr & Johnston, 1994). My construction of a hypothetical organisational change continuum helped me to compare and contrast the four career perspectives on education. For example, I was able to place the professors (and also the women participants) in positions from the traditional old order, through to transitional change positioning in "dismantling the divide" (DEET, 1991, June), thence towards a possible new order of transformational change for gender

inclusivity. Like-wise, I developed a continuum for the workplace, in regard to the structural organisation and inclusion of women as engineers and perceptions of gender social relations. Comparisons between perspectives also helped me to determine which situational and inter-/ intra-personal determinants had affected the women participants' career decision-making and their identity attainment as non-traditional girls, student engineers, and later as professionals in the workplace.

Answering My Research Questions

1. Career Perspectives on Past Career of Women in Engineering 1968-1992

> RQ1. What are the key determinants of an individual's background and how are these events perceived as influencing her construction of her personal and professional identity as an Engineering student and her career development as an Engineer? (The "Past Career").

The GO subjective perspective provided a foundational analysis of the changing gender order in Australia (eg, gender equity reports and policies). Both the GO and CO subjective perspectives had focussed on the associated effects of the gender regimes (family, school, leisure, peers) on the personality and career development of non-traditional girls in the historical time span (1967-1991).

In common with the GO and CO subjective perspectives, the life-career patterns of Cecilia's parents created a gender equitable image of the middle-class, professional family. In parallel, there were changes in mothers' professional career patterns (ie, career doublers or career break, with few full-time homemakers). The CO collective voice revealed how both fathers and mothers had provided opportunities, guidance, and 'circles of affirmation' that enabled them to explore, satisfy their curiosity, and cultivate an early gender-free balance of interests. Cecilia, in common with other participants, classified her upbringing as "liberal feminine" in orientation. None of the participants had been alienated from academic achievements, or restricted to leisure interests, stereotyped for their gender. The participants preferred a social model of vocational guidance, where both parents and older siblings (both sisters and brothers) actively supported their choice of a non-traditional occupation, whether their decision was made

early or in later adolescence. Family members also modelled a variety of professional worker, student and leisure roles for the participants as "pavers of the way". Cecilia, as an only child, also valued support from friends in making choices about each of these roles. Most participants had home computer facilities, yet there were variations in computer use by both parents. For participants, like Cecilia, who were encouraged in computer use, it became a necessary technological competency rather than a passionate interest.

It was rare for participants to recall any instances of poor role modelling within the family. Some professors, representing the CO organisational perspective, were fathers of daughters, whom they had encouraged to follow similar career patterns to themselves. In common with the collective story, Cecilia's recollections of her childhood and adolescence supported Super's (1990) 6th and 9th propositions for a healthy life-career progression, including direct professional influence of mothers (and sisters). I summarised these key family situational determinants of girls growing up as "feminine ambivalents" in Table A, Table, B, Table C and Table D (see Appendix G).

In contrast to the GO subjective career perspective, the CO subjective collective story told of schools which were actively promoting gender equity from kindergarten to high school, in terms of girls' access and participation in all subject areas. However, the participants, with varied experience and practice in computing at school, continued to display a collective lack of passion for computers. There was also an anomaly where participants from all-girls' high schools missed out on gaining technical drawing and/or woodwork/metalwork skills. Professors, representing the CO organisational perspective, adopted a deficit perspective of all young women's past education, where they blamed secondary schools for the women's lack of skills in geometry, technical drawing, computing, communication and literacy skills, "reproductive thinking and, especially all-girls' schools, for "not linking girls to engineering". The professors' overgeneralisation about women's prior knowledge and background was a concern if they were to build on these skills and address the women's dispositions to computing.

In common with the GO subjective and CO subjective collective story, Cecilia "positively constructed" her occupational self-concept in adolescence (Super, 1990, p. 206), through exploration of interests with her family, in her leisure pursuits with peers, in formal study in primary school; and later, capturing her high school teacher's passion for science, she actively investigated this "non-traditional" pathway and made her choice to become an engineer. Participants' qualitative process of change, enabled by "key figures", resulted in the positive development of interests and values, and the satisfaction of growth needs, affirming Super's (1990) 1st, 5th, 6th and 9th propositions (pp. 206-7).

With respect to Super's (1990) 1st, 2nd and 3rd propositions, the participants were well-qualified for the occupation of engineering, as indicated in the GO subjective perspective and from the generalised other (GO) organisational perspective (Parr & Johnstone, 1994). They chose engineering because of their love of mathematics, chemistry and physics and its practical nature. as indicated from the GO subjective perspective. From the CO organisational perspective, their achievements in physical and biological sciences and mathematics, equated with the essential list advocated by their professors. Unlike other participants, Cecilia's characteristic pattern of abilities began with the arts, and culminated in a conscious choice to work in a science related field, like engineering.

Feelings of 'aloneness' in upper school non-traditional subject areas pervaded the participants' collective story. From the CO organisational perspective, professors did not raise the issue of the lack of critical mass for girls in coeducational school settings or as a possible issue for women in engineering later. The CO collective story indicated some evidence of male teachers' discriminatory behaviour towards girls' achievements and aspirations in the milieux of non-traditional programs. There was, also, a vestige of masculine arrogance amongst Cecilia's upper school peers that was not evident in the collective narratives. A few CO stories equated with the professors' rather negative view of teachers as career counsellors in 1993. These participants felt pressured by the way over-zealous teachers pushed them towards an occupation (for which they were well-qualified for, but not interested in pursuing). Overall, the CO subjective career stories

indicated that high school teachers' roles were complex, and had influenced their lives in positive, often covert, ways.

As indicated by the GO subjective perspective, the CO participants exhibited positive intra-personal attributes (eg, well-adjusted, single-minded, internal locus of control, perseverance, work/avocational interests, social judgements and empathic). Additionally, participants displayed career maturity and individual differences with creativity in the arts, leisure, and sport. Further, their learning style profiles were an important attribute of their unique personalities, and for their practical problem-solving. However, the pragmatic dimension was generally low for first year participants, though more prevalent with those entering Institution B in 1993. In general, achievements served participants in their roles as students, leisurites, and future professionals. High levels of career adaptability were evident in their career aspirations, with realistic expectations of women in engineering, and coping strategies for the future as engineers. Additionally, participants (like Robbie and Christie) had drawn draw directly from their mothers' and older sister's experience of non-traditional professions. This supported Super's 4th proposition on their strong self construct providing "continuity in choice and adjustment". These additional "past career" personal qualities, as indicated in Super's 2nd and 5th propositions, more than matched the participants for the occupation of engineering in the 21st century (see Table E & Table F, Appendix G).

Contrary to the GO subjective, the CO narratives did not reveal the persistence of negative intra-personal determinants (such as fear of failure and success, over-striving for perfection, unfulfilled aspirations and lowered expectations) throughout women's careers. This would suggest the prevailing ideology of domesticity was lessening because the participants were not struggling with the femininity/cleverness dichotomy in either the family or schooling. Given the belief of the GO and CO organisational career perspectives that engineering was the "professional choice of the working class" (Professor F, Personal Communication, 9 February 1993), the participants' professional middle-class values served to challenge the values of, and relationships with, their professors and male peers, and then with male colleagues in engineering.

The participants' collective subjective stories of past career confirmed that, in general, they were secure as "pavers of the way" (Josselson, 1987), with the positive personality characteristics and capabilities of the "feminine ambivalent" group (Douvan & Adelson, 1966). Their positive structures of opportunity reflected transformative gender equitable change in the education system in Western Australia, that complemented their family regimes.

In regard to transition to engineering, the GO organisational perspective appeared to be moving towards a transitional view of valuing difference, by catering for diversity (ethnic, more than gender) with opportunities for remediation on entry. In contrast, the professors, whilst supporting the "Women in Engineering" projects in their respective institutions, tended to equate gender equity with access only. Some of the men baulked at Affirmative Action policies to attract more female students and saw that it was the role of the WISE coordinators (who operated on the fringes of the faculties) to assist women to make the transition, participate, and stay in the course. The older participants held a similar viewpoint to their professors and were "too busy" to be peer mentors. In contrast, a few younger women did value and seek help from the WISE coordinator which reflected a shift in their thinking about resolving transition and gender issues.

In summary, I considered that professors required a greater and more accurate knowledge of participants' past career. Transition practices, antagonism towards affirmative action, and resistance to change were other issues to be addressed by the CO organisational career (ie by the faculties).

2. Career Perspectives on Present Career of Women in Engineering 1993-1997

> RQ2. What events in the day-to-day interaction in the Engineering Degree course are critical to the development of the woman's personal and professional identity and competence as an engineering student? (The "Present Career").

As I proposed in Chapter One, the very entry of women to engineering education has challenged the *status quo* especially in regard to masculinity. Likewise, practices in engineering education have affected women's construction of self and identity. Six areas

of concern revealed in the GO subjective organisational career were the focus of my comparison of women's present career, namely, the structural organisation, the lack of gender inclusivity in the curriculum, the 'chilly climate' of the cultural milieux, tokenism and bias in interviews, the need for leisure, and personal determinants. I found evidence that associated policy initiatives were being implemented by the GO organisational career in 1994. From my analysis of CO organisational perspective there was an apparent lack of gender equity policies in action, evidence of men's resistance to change, and a paucity of women academics in the two engineering faculties.

I found that the structural organisation, from the GO organisational career perspective, was changing in relation to gender regimes, given that a limited number of women academics and researchers were working collaboratively with men, especially in introducing units related to gender equity in first year. There were also growing partnerships with industry, other faculties, and equity officers to recruit more students, indicating a change in the traditional image of engineering. Issues identified by the CO subjective collective and individual perspective were the masculine gender regimes in both institutions and the lack of women academics. In contrast, the CO organisational career of the professors did not see that the presence of women faculty would be an advantage in attracting more female students, and remarked that, in any case, women "didn't apply" for jobs in engineering faculties. Again, the professors expressed antagonism towards the implementation of Affirmative Action policies, this time in relation to attraction of more female staff. Their view was incompatible with the value the participants placed on the very few part-time female lecturers as mentors and models (Sandie & Cecilia), as inspirers for research and developing a special interest (Sandie, Astrid & Cecilia), and for teaching in academe (Astrid & Sara). Only Professor E spoke to me in these terms in "selecting" Astrid as a tutor in 1993. Notwithstanding, participants appreciated the qualities in their lecturers *per se,* who in Cecilia's story displayed the best of the traditional masculine and feminine.

The GO subjective career alone created a gender inclusive curriculum, undergirded by feminine values (ethic of care to balance the need for power and wealth) with

concomitant constructs of engineers and engineering; women's ways of connected knowing and preferred learning styles; resources related to women's contributions to content, research methodology and practice as professionals; and curriculum organisation that helped students to construct knowledge of engineering and self as engineers. There was evidence of transition in the GO organisational curriculum. The latter was outcomes-based and accommodated to the learning styles and special needs of students (particularly ethnic groups and to a lesser extent women), and to their initial constructs of engineering in their first year program. A transitional value of care was espoused, with the expansion of the collaborative roles of engineers and consideration of the needs of the industry (eg, cross-faculty international studies and negotiation skills). Generally, the participants' ideal program matched the outcome-based curriculum constructed from the GO organisational career perspective.

Consistent with the broader "generalised other" (GO) view of engineering education, the "concrete other" (CO) subjective career perspectives found the CO organisational curriculum model was lacking in its first year program, with its poor linkages to the women's prior knowledge, and with its "issues" unit in final year rather than first year. The participants referred to this event as the "black hole", with "bottley" and "physics and mathematics" driven units, which was characteristic of a masculine standpoint. Double majors had been introduced by one faculty, where the cross-fertilisation of concepts helped the learning of those participants involved. They were less affected, than other participants, by lack of motivation either during, or following, first year studies. Collectively, however, the satisfaction of learning needs, and to a lesser extent personal and vocational needs, tended to be sublimated. Cecilia's strategy in this masculinist regime of engineering education was to anchor herself to new relationships (Josselson, 1987), and to progressively build her own construct of vocational identity in parallel with the curriculum offerings. She, like others, was sustained by professional family members and the development of a vocational interest.

From third year, all participants found the CO organisational curriculum was more aligned to their preference for real-life problem-solving rather than simply applying a

formula or method, where lecturers emphasised research in designing and testing new methods. They found lecturers were interactive and approachable, which met their needs. Better learning in final year could also be ascribed to the women's astuteness in analysing what lecturers' valued in thinking and learning, and how their own learning styles could limit or enhance their achievements in different areas. In final years, participants appreciated that content and process were increasingly specialised and related to a particular branch of engineering. The women's preferences for authentic assessment were more aligned to the GO, than the CO, organisational career where fairness and consistency in assessment was an issue. Like their professors, the women recognised the need for modern computer resources. Unique to their CO subjective perspective, they wanted more formal input for enhancing professional skills before transferring to the work-place.

Many older women in 1993, and Cecilia in 1997, were sustained by the development of special interests in a specific aspect of engineering, by work-experiences, by good teaching practices with real-life problem-solving. This supported Professor C's career conception of the importance of "sandwich" courses, where theory and practice were melded in the making of a better engineer. Stories of those who struggled, like Cecilia, highlighted caring lecturers and technicians, who helped to refine the women's computer and generic skills and build self-efficacy. Cecilia's story told of "heroes", who helped in overcoming hindrances to her academic progress imposed by other lecturers or male peers. Her story also reinforced the women's need for lecturers' intellectual and emotional support to complete final year projects, and to foster vocational identity and self-efficacy as engineers.

The GO subjective perspective had focussed on women's vulnerability due to the lack of critical mass (other than chemical engineering) in their transition to, and participation in, the cultural milieux of engineering; and their alienation due to the persistence of the 'chilly climate'. Whilst some professors were aware of the chauvinism of some male students and the a "positive ambience" of the women, they denied that lecturers could be harassing. There was evidence from the CO collective story, however, that participants

experienced "daughters in crisis" episodes from first year. This was drawn out more deeply from Cecilia's story, where she and girl-friends experienced unwarranted harassment from some lecturers and "egoist" male peers in curriculum activities, and in informal milieux. Unlike, two of her contemporaries she did not officially report the gender harassment of the lecturers. She did report a male student's bullying behaviour to a lecturer, whose response indicated his tacit consent by his acceptance of its normality in her future workplace.

Somewhat of a contradiction, the participants enjoyed formal and informal interaction with male peers (who were also friends) and not always with the other women. Cecilia, like others, found that friendships, even with "caring guys" eclipsed at competitive times of examinations and job-seeking. These findings from the CO subjective perspectives supported the GO subjective perspective and my fourth domain assumption about work as a gendered construct and the adverse effects on participants of being positioned as "strangers" (Pallotta-Chariolli, 1990) and "broken truces" (Collin, 1986, 1990).

From the CO subjective collective and individual career, the women learned to cope, and adapt to, the lack of critical mass (except chemical) and 'chilly climate' in all fields of engineering. Increasingly, participants showed evidence of choosing to be "one of the boys" to gain group identity. This compromise was probably made because men were not ready to accept a "variety of individuals" (Super's 3rd proposition) at this stage of their career. Perhaps this was what Professor A meant when he jokingly said "I'll make a man of you yet"! In contrast, Cecilia's sense of group identity as a "feminine" woman made her position tenuous with the men. The older women participants in this study in 1993 (and Cecilia's friend Bron in 1996), by blending in, held tacit acceptance of the *status quo* at the structural organisational level, as did their professors. As indicated in Super's 3rd, 9th, 10th & 11th, the traditional intransigence of the CO organisational career on this issue was problematic as it served to alienate women from their intellectual growth and sexuality. It requires systematic and systemic change with adaptation by academe and students alike.

From the GO subjective perspective, the need for leisure was raised in relation to women's physical and emotional health. From the CO subjective perspectives, the participants' need to satisfy leisure needs, the pressure of time in effectively studying, and contingent inter-/intra-personal conflicts arising in engineering education, were predominant in their career decision-making. Cecilia's story reinforced that lack of leisure was an early indication that her life-style was out of kilter. Suggestions regarding the lecturer's role in vocational guidance for women (and men) in maintaining a healthy balanced career are discussed later in this chapter.

I identified contradictions in the GO perspective regarding an increasing recognition of positive personal determinants, and the persistence of negative intra-personal determinants, in women's present career. The participants in 1993, and Cecilia in 1997, carried strong resources into engineering education, and continued to develop for their transfer to the work-place of engineering. At the end of the course, their special skills and personal attributes corresponded with those highlighted for the modern engineer by the generalised other subjective perspective; the generalised other organisational career perspective; and some of the professors, including Professor J's belief about the need for caring in engineering (February, 1993). Success for the participants was a broad concept, which included a broad range of achievements and competencies (related to content, generic and computer programming skills), problem-solving and design methods. They had constructed a positive self-concept, acquired vocational interests, maintained strong personality characteristics, applied coping strategies for conflict resolution, matured their learning styles (which were more aligned to their professors as engineers), and made time for leisure Cecilia's story, also, displayed her feminine qualities for practical creativity, the ethic of care, and her future dreaming with high aspirations and realistic expectations as a woman in engineering (Domain assumption 3).

Despite their computer and generic competencies, both collective and individual stories conveyed vestiges of lack of confidence about their skill level in practice (aspect of self efficacy). This justified Professor H's view that it was an issue of "self-image" and

"confidence" for women, rather than absence of skill competencies with computing (Personal Communication, 27 May 93), and the need for interventions to alleviate the issue.

GO subjective perspective challenged tokenism and bias in interviews. From the CO organisational perspective, the professors did not refer to the issue of new women graduates' transition to the work-place, or the assistance new women graduates might require in combating tokenism, and interview bias. They considered that any gender harassment in the workplace was due to the "ignorance of a few". In their critical transition phase to the work, the older women in 1993 did not use the WISE coordinator's help as a possible "anchor" or affiliation with the Institution of Engineers. The participants, with their newly acquired status as engineers, were made in part to "prove" themselves in the interview and the context of work. Women graduates, in 1993, highlighted the need for women in academe and work to be models in engineering; and to sit on interview panels to break the irrelevance and sexist undertones of questions. Cecilia, in 1996, displayed an internal locus of control by taking the initiative to plan her transition to a small firm that would value her as an ethical, responsible and practical electrical engineer in 'protection', and help her to enrol in a higher degree**.** Whilst Cecilia's interview was encouraging, she then experienced both gender and sexual harassment in the workplace. Despite some "daughter of crisis" episodes, participants emerged from the course with high career adaptability as "pavers of the way" (Josselson, 1987) and as "feminine ambivalents" (Douvan & Adelson, 1966) with healthy personalities suggested by Super's 2nd, 3rd and 4th propositions (p. 206).

Suggestions regarding the value of vocational counselling for women in transition to the work-place and post-graduate studies will be discussed later.

3. Career Perspectives on Future Career of Women in Engineering 1993-1998

> **RQ3. What events in the day-to-day interaction in the woman's Engineering work-place are critical to her development of personal and professional identity and competence as an engineer (and post-graduate student)? ("Future Career").**

I found some convergence with the GO Subjective and GO Organisational people-oriented workplace paradigms and the CO Subjective career managerial style of Maggie. The professors, from the CO organisational career were aware of later challenges for women with families, but did not voice similar concerns for new women graduates in transition to work or academe. Women graduates in 1993 positioned themselves in different ways, in order to be accepted namely: become "one of the boys" (like Billie "My only revenge is success"); be strategic and seek out a male mentor to plan medium and long terms goals (like Sara); begin as a non-feminist optimist, learn the hard way through losing the credit for her project, and then become a cautious "feminist" (like Roberta). In terms of personal determinants, these participants' abilities to adjust and persevere were evident in stories of achievements, the acquisition of fresh interests, professional growth and personal integrity, tinged with a pervasive sense of humour (see Table E & Table F, Appendix G). I also noted that their dynamic self-acceptance and realistic evaluations of self-efficacy were having little effect on the structural organisation or cultural milieux of the work-place. In Cecilia's first posting in 1997, she was promised a career in "protection" which did not eventuate. She received no consistent supportive training, there were deliberate acts of managers withholding information, an incident of brutish sexual harassment and persistent dripping tap gendered (verbal and exclusion) harassment from male peers. Although the "by chance" hero, support from parents and friend "Mel", and her own romantic and ethical ideals helped to sustain her in 1998. As suggested from my domain assumptions and the generalised other subjective perspective, women in engineering continue to experience "broken truces" (Collin, 1986) and the "politics of advantage" for men in the workplace (Eveline, 1994, Autumn).

In academe, I found glimmers of transition in academe for postgraduates. Women's quality and success in study were strongly affected by their single-minded determination to succeed (Astrid, Hettie & Sandie). Their eventual success was affected by the quality of supervision and support of loved ones (Sandie), the lack of support from a spouse, balanced by the support of her professor (Astrid) and their concerted efforts to make

time for leisure interests or sport. Doctoral students flourished when they had supportive and knowledgeable mentors, and their needs, interests and values were being met in a variety of roles.

In the workplace and academe, the participants' narratives substantiated that "in neither the dominant nor the dominant gender codes do women escape from their subordinate and inferior roles" (Thomas (1990) [quoting Arnot (1982)] p. 181). The generalised other perspectives, especially feminist researchers and educators included a number of initiatives, which were being implemented to breakaway from the simplistic "pipeline" approach to career development which is an inappropriate model for women and to encourage institutions to be more adaptive. Their suggestions will be synthesised in a later section.

JAGGAR/SUPER CONVERGENCE THEORY OF CAREER DEVELOPMENT

Philosophical and Epistemological Congruity between Jaggar and Super

My methodological question was:

> **How robust is the Super/Jaggar convergence conceptualisation of life-span life-space career in representing and facilitating the construction and interpretation of women's subjective life-career in non-traditional occupations in Australia in the 1990's?**

As discussed at length in Chapter Two, my convergence of Super's segmental theory of career with Jaggar's socialist feminist "unified systems" theory of social relations on women's lives was fundamental to this study. The convergence was designed to overcome two major limitations: first that Super's theory was based on boys' and men's experience; and a second that Jaggar's socialist feminist standpoint was not really a theory of women's career development, but was more akin to an "ideology and a social movement", which could inspire and direct a certain methodology for social change in relation to "women's various interests" (Sargent 1994, p. 273).

I used four of Krumboltz' (1994) criteria as a benchmark of quality of my convergence theory of career in terms of its soundness and integrativeness; the explanatory power of

Super's propositions in generating questions; the practical applicability of this type of research to empower people; and its adaptiveness in responding to newly discovered anomalies (pp. 27-28).

I saw both positions (Jaggar and Super) as framed in terms of similar philosophical and ethical beliefs, assumptions and principles of action about the nature of humankind. Both also emphasised the uniqueness in the way an individual dialectically constructs self and knowledge about the world within the remote and immediate social contexts of a society. I saw this common foundation as a key strength of my convergence theory.

Like Super (1969a), I recognised the importance of using a developmental approach that was concerned with longitudinal expressions of career behaviour and its intimacy with personality development and the development and implementation of self-construct. His method, namely his idiographic (life-history) approach, which focused on the features peculiar to the person, fitted well with my desired feminist methodology of using subjective narratives to build and empower the individual (Chapter One, pp. 9-13). As emerged from Cecilia's story (Chapter Seven), she was indeed the "socialised organizer of her experience" (Super, 1990, p. 221) And yet, her active construction of self and knowledge was a dialectical process, because she was both contained and constrained by the inevitable tensions of relationships (both positive and negative) in particular contexts in institutional gender regimes (family, education and work) and within the broader Australian gender order (see Table G, Table H, & Table I, Appendix H).

Figure 1.1 (Chapter One, p. 6) shows the major perspectives of my model. Nomothetically, I was able to draw similarities as well as contradictions from the GO collective subjective career (my review of the literature on non-traditional girls and women in Australia and other Western societies in Chapter Three) and from the CO collective subjective story of the women participants (see Chapter Six). Taking another tangent, I was able to link general and specific emergent themes and issues to the CO collective organisational career of their professors (see Chapter Five), back to the GO organisational career for comparison (see Chapter Five), and back to my of Cecilia's

life-story of engineering from 1992-1999 (see Chapter Seven). My process of on-going analysis effectively ensured that I would not ignore the dialectical nature of Cecilia's construction of life-career within the community of experience of other participants and the remote/immediate organisational careers of superiors in engineering and feminist career/personality perspectives.

Range of Explanatory Theories to Explain Contextualised Career

The segmental nature of Super's theory linked well with my need to draw on a wide range of research to better explain the unique career and personality development of women, especially those choosing non-traditional vocations, like engineering. I was mindful of Holland's (1994) remark that in revising a theory, it would be "without spoiling its integrity" and would be used to explain a "broader set of career processes, behaviours and outcomes" (p. 50). I valued Super's elaboration of his segmental career theory into a set of propositions which helped me to generate a common set of research questions to construct narratives and organisational perspectives on key events affecting women's past, present and future career and to test my four domain assumptions about the careers of non-traditional women.

Super's (1969a, 1969b, 1980) original career theory was an integrative approach based on the interaction of personal and environmental variables in career development (after Buehler, 1933). My Jaggar/Super convergence was predominantly concerned with elaborating on his socio-cultural theory segments (historical change, social policy, employment practices, labour market, technology and the economy) to emphasise the embeddedness of people in the gender order and in gender regimes (family relations, education, leisure) and the way changes occur interdependently over time. By focussing on the stories of how women participants constructed the gendered self by investing in work and in social relationships with others, I was able to interpret how their careers had been affected by changes, and whether or not they had effected changes in these gender regimes at each life-stage. In terms of past career stories, the women participants, in common with Cecilia, had a secure base to develop a "sense of internal coherence and meaningful relatedness to the real world" (Josselson, 1987, pp 12-13). In contrast, there

was a common striving for person-environment fit in the women's stories of gender regimes of engineering in 1993. Such lack of webs of relatedness was destructive for Cecilia's progress as an engineer, and her physical and emotional health, in the exploration and establishment stages of her career between 1992-1999.

Super's incorporation of a multi-role personality theory segment in this life-stage developmental paradigm, enabled him to define career, in terms of a variety of roles and relationships to others (eg, daughter, student, leisurite, worker, citizen and homemaker), to discover where the investment of self in work was played out in different life-spaces and stages over the life-span. Participants in my study learned about these roles, their prescriptions and expectations of behaviour, by their progressive 'making' of self as 'engineers' and 'engineering' as an occupation. They were not limited in early roles (daughter, leisurite, student or worker) by the expectations and behaviours of others or of themselves. Difficulties arose at later stages due to the incongruity of being women and the stereotypical gendered expectations of the worker role of engineers held by "superiors and fellows" that resulted in their discriminatory practices. Cecilia's voice indicated that compromise, coincidence and chance encounters were pertinent factors which significantly affected the variety, and quality of her roles. Her intrinsic need to succeed, her connectedness to family and a trusted girl-friend, and leisure interests, sustained her vocational quest for identity. Using this segment, I also ascertained the healthiness of participants' career development in the growth, exploration and establishment stages by monitoring the saliency of particular roles (eg, student and worker), balance of roles (eg, leisurite role and time for recreation); the quality of reciprocal role relationships (eg, superior/over-competitive peers); and women's positioning, by self and others, in different "theaters" (eg, "one of the boys" in engineering).

Super (1990) included A. Adler's (1930) personality theory of individuality with his central focus on the importance of the concept of self, where fulfilling work and social interest might be constrained by superior/inferior social relations. My melding of Jaggar's (1983, 1989) and Josselson's (1987) standpoint with the Adler segment was

crucial for explaining the influences of men's self-interest and superior attitudes on Cecilia's self-development and how, as a woman, she choose to not fit in the "bloke's world" of engineering.

I found segments on self-construct theory (G. A. Kelly, 1955) and Bandura's (1982a) self efficacy theory helped to strengthen my convergence of Super's self-concept theory with Betz and Hackett's (1981) and K. R. Kelly's (1993, Spring) focus on the role of gender on women's achievement and confidence in interactive learning contexts. This standpoint, helped me to interpret the effort it took for Cecilia to achieve, how she was coping and/or gaining confidence, and how long she was able to sustain effort in the face of obstacles in engineering (eg, her computer programming skills).

In terms of constructing a socio-psychological stage theory of career, my convergence of Super's theory (1976) with Roe's (1956), Astin's (1984) and Josselson's (1987) emphasised the embedded gender identity, developmental tasks, and work as the organising principle. My incorporation of Josselson's (1987) four descriptors of women's career pathway choices helped me to classify the participants as "pavers of the way" by the way they achieved identity prior to entering university. This segment was the basis of my interpretation of how Cecilia progressively attained her vocational identity and special interests; and to probe the health of her personality and self-construct development at each stage. She, like all other participants, was affected by the gender construct at various stages, which affirmed, like Josselson (1987), that although males and females need to resolve all the developmental tasks within Super's growth and exploration stages, a woman's identity development was still "peculiarly female" and based upon:

> … an on-going balance between self in world and self in relation ... a theory of the separation-individuation process that underlies identity formation in women must appreciate that women never fully separate from their mothers (and) is crucially important to women at least through early adulthood (Josselson, 1987, pp. 190-191).

By monitoring the way women resolved crises and achieved developmental tasks in the exploration stage of university studies, I was able to predict how healthy their quest for vocational identity ought to be in successive stages. I was also able to corroborate

Cecilia's experiences with the older women's voices, like Sara and Sandie, noting that women in the establishment stage were unlikely to achieve status, in either the academic role or the work role of engineer, unless they were helped and advised by mentors. In telling Cecilia's story, there were indications that "chance encounters" (Bandura, 1982b), an aspect of accident theory (Herr & Cramer, 1992), had made a significant difference in her career path, when like-minded engineers fostered her quest for vocational identity and sense of belonging.

Super's trait/factor decision-making theory segment held that occupational choice was a developmental process based on a number of decisions over a period of years. This standpoint enabled me to test out how participants fitted the profile of the "feminine ambivalents" (Douvan & Adelson, 1976). Their recollections suggested that their earliest "needs, interests, values" (eg, Roe, 1953, 1956), their aptitudes and special aptitudes (eg, Gardner, 1993), their sense of "fun" (Bordin, 1994), courage (Adler, 1930), and forward looking motivations (Allport, 1961) were foundational to their secure growth in career maturity. Participants' were able to verbalise their aspirations and expectations (Astin, 1984; Gottfredson, 1981; Heilbrun, 1979; Savickas, 1990a & b); their ability to adjustment and take risks, in terms of coping strategies; to evaluate preferred learning styles; their courage to be and belong (Adler, 1930) as "pavers of the way" (Josselson, 1987); and to assess their own achievements in practical skills, requisite knowledge and relationships with others. This enabled me to determine the congruence of personality patterns, aptitudes and interests of the participants' with their choice of, and adjustment to, engineering. By Cecilia "touching base" with me, I interpreted how she had changed in response to educational and work experiences, in terms of: her aspirations and expectations; learning style profile; special interests; achievements; levels of intrinsic motivation, courage, sense of fun, feelings of self-efficacy, social interest and sense of belonging. Her value system, sense of personal vocation, ethic of care and professional integrity remained secure, but her sense of fun (Bordin, 1994) was atrophied.

Bricoleur - Feminist Research Methodology or Effective Social Research?

Like Griffiths (1995), Harding (1986, 1987, 1991), Marshall (1994), Olesen, 1994, Opie (1992) and Stivers (1993), I pondered whether my approach to career research had been a general social science type career research or essentially feminist in nature. My position was that, although my research was in the tradition of the mainstream (Erikson, 1970; Wright Mills, 1976), its central focus was on the origins of, and practices that served to perpetuate, women's oppression, and on ways to actively transform social relations in a caring way (Jaggar, 1983, 1989). Therefore, although I centred myself in the contextualised development of individuals' life-career, my focus on gender power relations was fundamental to my feminist epistemology. In "widen[ing] the feminist knowledge community" (Stivers, 1993, p. 425), I recognised that such knowledge concerning career and personality development must be built up "in a way that calls into question its own methods of building" (Griffiths, 1995, p. 81).

I believed in the power of my research of the 'case' to influence the social reconstruction of engineering education and the cultural milieu of first postings of women engineers. For example, my career narrative analysis of the participants did "entertain the notion that human beings and social structures mutually shape one another ..." (Stivers, 1993, p. 418). Nevertheless, from my feminist standpoint, I was able to verify the importance of the idiographic approach of a present lived life-history. Through Cecilia's voice, I gathered an explanation that was relevant to the way her construction of reality was uniquely affected by her interactions with "key figures" in particular contexts. I was able to see Cecilia in her own right, rather than just a group member. This type of methodology had been at the heart of Super's approach to his participants in his life-span, life-space study of boys and men's careers (Super. 1954, 1969a, 1969b, 1976, 1977, 1980, 1983).

My research methodology provided the opportunity to construct and compare the concrete other organisational and subjective career perspectives and the generalised other perspectives in which both were embedded. This process sets the stage for dialogue to effect transformations to improve "conditions" for women (Jaggar & Rothenberg, 1984). My approach was feminist in that I focused on the women as the least privileged stakeholders in engineering education and the work-place, with the aim, in part, of effecting changes that were in tune with the future needs of society as well as the individual needs of the women. I tried to interpret each woman's story with fidelity with the "hope of agreement" (Stivers, 1993), and also with the expectation of some contradictions (Marshall, 1994; Okley, 1992). Like Oakley (1981, 1984) and Super (1969a, 1969b), I valued the process of my research outcome, especially in regard to building equitable relationships with all participants, including the professors. Adhering to a principle of feminist practice, I listened, clarified, interpreted, and told the participants' stories. I now evaluate how effective I was as a narrator over the years.

The Use of a Personal-Professional Journal in Feminist Research

> Listen to their voices too and tell their subjective and organisational career stories, with fidelity - feminist methodology! (Lesley Journal, 13th October, 97).

I found that keeping my personal-professional journal (Abbs, 1974; Heilbrun, 1979, 1988; Holly, 1984) was a fundamental and invaluable technique for my feminist methodology. I believe this enhanced my research, enabling me to be a self-reflective researcher (Baxter Magolda, 1987, 1988, 1992; Kolmos, 1993; Super, 1983), which was especially important, given that I was adopting Jaggar's/Super's life-history approach over a long period of time. I used the journal for reflective writing, especially where it required a further degree of abstract and theoretical organisation. The result was, as Griffiths (1995) had found previously "a dialectic between abstract and theoretical reflection and [my] personal experience" (p. 81).

In traditional academic theorising, Griffiths observed that "no mention, let alone use ... is made of personal experience" (p. 77). In my study, by contrast, my reflections have enabled me to carry out more faithfully a feminist methodology. In this regard, I consciously attempted to make myself aware of the social and ideological roots of my self-understanding, as well as keeping myself out of the time warp of my own *past* career. This process empowered me to think and act in a more autonomous way, yet encouraged me to consciously record and reflect on the current thinking, feelings and behaviour of my women participants, and other researchers' methodologies and perceptions of influences on epistemological reconstruction (eg, Blumenfeld-Jones, 1995; Griffiths, 1995; Okely & Callaway, 1992). For example, I used to keep track of the progress of like-minded others in my journal to affirm my own methodology in action:

> There has been a wealth of development in qualitative methodology and the use of the narrative since I started this case study [eg, Boetcher Joeres & Laslett, 1993; Coffey & Atkinson, 1996; Cooper & Heck, 1995; Ely, Vinz, Anzul & Downing, 1997; Goodson, 1995; Griffiths, 1995; Heilbrun, 1988; Merriam, 1998; Packwood & Sykes, 1996; Polkinghorne, 1995; I. Wolcott, 1995; Zeller, 1995] (Lesley Journal, 11. 12. 98, p. 114).

My decision to include such extracts from the journal in the actual thesis has, hopefully, opened truths about myself and my methodology to others and enhanced the final product. Thus, the use and, importantly, the sharing of my journal was fundamental to my feminist methodology and my qualitative research practice.

Nomothetic Approach - Its Value in Constructing the Collective Career

As a critical feminist, my construction of the collective narrative of 53 women served to ground my own construction of knowledge about women in engineering. The women's voices provided a broad view from which to draw trends and themes about their gendered experiences of past and present career, and future expectations and aspirations of career. Their stories helped me to probe into their present position in the structural organisation and gender regimes of engineering education, work and private contexts. Their detailed perceptions of their own development and of the efficacy, appropriateness and effectiveness of first and final year engineering curricula, professional development in the work-place and postgraduate study were illuminating. I was then able to compare and contrast my construction of the collective concrete other

perspective with that of Cecilia, their professors and related generalised other perspectives, to better determine conditions for change.

Methods and Feminist Methodology

The autobiographical questionnaire, touching base forms, and the combined learning style inventory each contributed to the production of these special life-histories. With ongoing analyses, I gained insights into commonalities and some contradictions in the participants' backgrounds, needs, values, interests, self-beliefs, preferred information processing and management style, coping strategies, achievements and life-goals, culminating in profiles of career and personality development at the end of the growth and exploration stages and early phases of the establishment stage. I had no hesitation in adopting the basic format of the initial touching base forms to continue to study the life-span life-space construction of vocational identity, interests and achievements of individual students, like Cecilia.

Seeking women students' feedback through my clarification of methodology form was invaluable. Their feedback signalled to me their perception of the enormity and the seeming irrelevance of completing an autobiographical questionnaire and the combined learning style inventory. This was a real learning curve to me, as a bricoleur, trying to shake off my seeming "dip in dip out" approach when researching women's lives. I had assumed that my talk to potential participants at a lunch-time meeting and a letter of invitation was sufficient orientation to the purpose of my research. However, an unanticipated positive outcome in clarifying my methodology with women students was that several more women volunteered to participate. This was another learning curve and a reward for the bricoleur!

Idiographic Approach to Career - Value of Constructing the Individual Story

A worthwhile outcome of my investment in a longitudinal narrative inquiry was monitoring the way Cecilia, and other participants, felt encouraged to invest in themselves and envisage wider opportunities for their lives through regular touching-base. Cecilia's story indicated that this reflective process was particularly important for a woman in the almost totally male contexts of electrical engineering, since her progress depended so much on how consciously and conscientiously powerful "key figures" or superiors worked towards the goal of gender inclusivity. Like Belenky (1986), I observed from successive narratives that greater power over self was gained by each woman in finding a voice. For example, Cecilia's freedom to express feelings about her experiences as a "stranger" (Pallota-Chiarolli, 1990) was an outlet for her thwarted need to belong in engineering.

From my perspective, this longitudinal life-history approach had the potential to become a collaborative and mutually supportive enterprise for each participant, provided that there was a trusted conduit. For example, two women, with my help in resolving an harassment issue, built a trust in a WISE coordinator. As narrator, I found, like Chaplin (1988), that a significant outcome of the regular "touching base" was the avenue it created for personal counselling. Like Oakley (1984), I become a confidante and a counsellor at times. This narrative-based counselling outcome was evidenced particularly in the life-career progression of Cecilia remarked "its not a hassle it helps, even if its a bit of a blow to the self esteem". Although my research has ceased officially, I continue to hear from the women. Their news is mixed ranging from productive careers and well-balanced private lives of younger participants, to instances where some, like Cecilia, still experience and suffer from gender power relations in the work-place. In true dialectic accord, where past, present and future career are inextricably linked in both our minds and hearts, I remain an advocate for women in engineering.

Construction and Comparison of Perspectives - Analysing Along the Way

Using analytical techniques from a range of disciplines and my own ideological perspective, (namely using gender as my major social construct to interpret life-histories) provided a rich construction of the women's subjective career and the professors' organisational career. Sociologically, and in terms of the psychology of individuality, I analysed Cecilia's story (Chapter Seven) in relation to the immediate organisational career regime of her professor of engineering and the broader, more remote, socio-historical geographic context of engineering in Australia (Chapter Five). It was an iterative process and there was the hint of the anthropologist when I analysed subtleties of variance between participants' career narratives and the review of the literature, with its stories of women in engineering from other Western societies (Chapter Three). It was gratifying to note that Coffey and Atkinson (1996) observed that "one of the strengths of thinking about our data as narrative is that it opens up the possibilities for a variety of analytic strategies" (p. 80).

Most significantly, I employed Super's technique of using conceptual models of life career as heuristic devices for analysis (Super, 1980, 1984, 1990, 1994). Following Merriam's (1988) advice, I found that categorising data in computer files (using my elaborated Super models, and the formats provided by the autobiographical questionnaire, learning style inventories, clarification of methodology and touching base forms), helped me to construct, analyse, and systematically draw out and record themes along the way (pp. 124-125).

Disseminating Life-History Findings to Change Conditions Along the Way

From our feminist standpoint, it was important to my supervising professor and to me to disseminate findings, both methodological and substantive, as the women were composing their life-histories. This was our deliberate principle of action to create awareness of the need for change as a first step in the process towards transformative curricula and milieux in engineering and work-place. Consistently, we sent participants and WISE officers copies of abstracts and, if it was one woman's story, the complete paper was sent to this woman prior to a conference presentation. Participants frequently commented on this feedback as a courtesy, rather than their right. In writing up this

qualitative research I learned that when the women's voices were clearly the focus, it brought out the affective and the cognitive construction of their life-histories most effectively (Newhouse-Maiden & Parker, 1996a).

Discovering gaps between the subjective and organisational career perspectives helped point the way towards specific recommendations for change in conditions (Newhouse-Maiden & Parker, 1996b, 1997). At conferences, I found my use of role-play enriched the telling of a life-history (Newhouse-Maiden & Parker, 1996a), because some delegates empathically equated their own stories to the present conditions for women in non-traditional careers. As Merriam (1998) confirmed "research in education is important for extending the knowledge base of the field as well as improving practice" (p. 245). This had been a point well made by Jaggar and Rothenberg (1984) to improve conditions for women, and by Super (1980), where key figures as superiors (Super, 1994; Watts et al, 1981) were expected to take the major initiative as change agents in education and the professions.

Evaluating How I Initiated Change in Conditions as a Feminist Researcher

Commensurate with my feminist standpoint in changing conditions, and influenced by Super's (1980) propensity to link research back to his university classes, I have encouraged my student teachers to complete the learning style inventory and autobiographical questionnaire, as part of a self awareness strategy as learners and to understand their own unique career development. I have already conveyed findings on the career patterns of "feminine ambivalent" girls and women in engineering to create gender awareness in student teachers. Like Yates (1997) and Lather (1986, 1992, 1993), I have actively confronted my Honours and Masters students with the issue of methodology, especially in regard to key elements of sound narrative inquiry which is openly ideological. It is my hope that I shall have further opportunity to dialogue with engineering educators and men in engineering, who according to their own professional body, must take the responsibility for effecting changes in the culture and curriculum (Institution of Engineers, 1996).

In summary, my research was undergirded by critical feminist domain assumptions and principles of action. I believe my feminist research was effective research, because gender relations and the gendered construct of work were central in explaining women's embedded life-career development, and where fidelity to all participants (including the professors) guided my approach to educational reform (Noddings, 1986). It was also unashamedly a "liberatory methodology" for the women, because their voices were heard and valued, and conditions for change were established along the way.

JAGGAR/SUPER CAREER MODELS AS GRAPHIC HEURISTIC DEVICES

I have already touched on my commitment to using models as heuristic devices, and on how they have enhanced my way of conceptualising my iterative process of career research and facilitated my on-going analysis:

> Super's models and segmental theory (Super, 1990; Watts et al, 1981) help my imagery of women's life-career, as life-span and life-space. Constructed from within and from feedback from "key" figures (Lesley Journal, July, 17th, 1997, p. 103).

One of the limitations of adopting Jaggar's standpoint was the lack of models to represent career as a dialectical construction, which Super (1980) had so cleverly produced. My aim was to move towards a Jaggar/Super convergence model of career, but I accepted Super's (1994) premise that his other models were "needed to tell the complex story of career development" (p. 72). I adopted, adapted and used four of his models which were:

1. The Life-Career Rainbow: Six roles in schematic life-space (Figure 2.4);
2. Convergence Ladder Model of life-career stages, developmental tasks and behaviours Figure 2.6).
3. Woman in Engineering: Combined Archway and Spider Web Model (Figure 2.3);
4. Super's Archway of Career Determinants (Figure 2.2); A Segmental Archway Model of Women's Career development (Figure 2.2) modified to Figure 8.1.

Using Krumboltz' (1994) criteria, I now evaluate the "robustness" of my Jaggar/Super models in terms of: accurately representing career and the soundness and integrativeness of my convergence theory; their practical application to empower people; and adaptiveness in response to newly discovered anomalies (pp. 27-28).

The Life-Career Rainbow as a Subsidiary Model

My convergent Jaggar/Super life-career rainbow model (Figure 2.4) represented life-stage theory and personality role theory together to convey a comprehensive picture of non-traditional women's multiple role careers, along with key personal and remote-immediate determinants. The rainbow model facilitated my conceptualisation of career as an individual's dialectical construction of past, present and future, where what was, what is, and what could be, were inextricably linked (Jaggar, 1983, 1989; Super, 1990). Like Cecilia, each woman's career pathway represented to me a veritable yellow brick road, with some good (and not so good) companions along the way.

The life-career rainbow brought Australian society's gender order and gender regimes into prominence, when remote-immediate situational determinants were suspended above the model. I was able to ascertain nuances of historical change in the gender order and gender regimes by organising my literature review of the participants' generation (Chapter Three) to equate time periods with their growth (1968-1981), early exploration (1974-81), and mid-exploration (1981-1991) stages. This provided me an historical socio-cultural context for the generalised other and concrete other organisational career in Chapter Five, the participants' collective subjective life-career in Chapter Six, and Cecilia's individual life-history in Chapter Seven. I updated personal determinants set out below the career rainbow to represent those exhibited by participants as "feminine ambivalents" and "pavers of the way". These included Super's personal characteristics, plus my own additions in italics: awareness, attitudes *(self, others, objects),* needs *(growth and deficiency)* interests *(social interest, vocational/avocational),* values *(beliefs and attitudes),* general and specific aptitudes, achievements *(including affiliation)* and biological heritage *with aspirations and expectations, feelings, motivation (forward looking and intrinsic), traits (learning style,*

self-efficacy, coping strategies). Compromise, *coincidence* and *chance* encounters were also pertinent situational determinants factors affecting the roles Cecilia could effectively play as she progressed along her career rainbow.

To reinforce the dialectical construction of the women's career in socio-historical context, I created summative life-career rainbows, using EXCEL (see Appendices H & I). For example, I found it useful to see, at a glance, each participant's past career regarding family and immediate situational determinants (see Table A & Table B); and present career progress under the common social order of progressive educational policies in Australia and types of educational institutions each was enrolled (see Table C & Table D) and personal determinants (see Table E & Table F). Similarly, I created an individual set of life-stage rainbows (see Table G, Table H & Table I) for Cecilia, which helped me to track her quest for vocational identity and her changing commitment to engineering as a vocation, which was "person-oriented" (Super, 1983, p. 7), rather than simply an occupation (Super, 1976). I also summarised her quest for group identity in educational and work milieux; her evaluation of educational curricula to meet her needs; and her self-evaluation of academic success, her resolution of critical incidents, the waxing and waning of career roles, leisurite (general healthiness), and the roles of family/friends.

Subsidiary Model - Elaborated Ladder Model

My convergent ladder model of life-career stages, developmental tasks and behaviours (Super, 1990, p. 216), helped me to answer Super's question regarding the gender agenda "Is life-stage theory - the concept of developmental tasks - as valid for males as for females?" (p. 235). Initially, I used this model (Figure 2.6) to visualise organisational career rungs and the structure of age-related tasks set for the individual to achieve statuses of progression (Barley, 1989; Dale, 1972; Hughes, 1937). The ladder was useful in constructing the generalised other subjective career of non-traditional women and girls, with fidelity, from a variety of standpoints. In my construction of the generalised other organisational career, the rungs of the ladder model symbolised the statuses and transitions set by educators and other professionals in engineering in

Australia (Parr & Johnston, 1994). The concrete other organisational version was created from the collective voice of the professors as Super's "superiors" and another version was the participants' collective voice telling their stories of organisational career in 1993. In my "narrative criticism" (Cochran, 1990) of the participants' collective concrete other career, and Cecilia's quest for identity, the ladder model helped me to focus on meeting the ethical challenge of keeping trust with the organisational and subjective career voices to build a juxtaposed picture of career, as sequential stage events from their beginnings in early childhood to engineering education and transition to the work-force that "both individuals" and "staff as a whole" recognised (Rudduck, 1993, p. 8).

With regard to my construction of Cecilia's individual life-history in Super's growth, exploration and maintenance stages, the sub-division of these stages was indispensable in helping me to visualise her early construct of work, and how facets of her personality and identity were taking shape. Her sense of occupation emerged from high school as she completed "mini-cycle" transitions and progressed to engineering (Super, 1984). I found that she faced up to each critical incident, which triggered in her a "mini-cycle" of readjustment, where fresh "exploration" helped her to re-establish herself in a satisfying student, peer, part-time worker, or leisurite role and complete the stage-related tasks (Super, 1990, p. 215). Her story drew out the vast number of mini-cycle crises that occurred and needed to be resolved within, as well as between, each sub-stage.

Woman In Engineering : Archway and Spider Web Model

I was comfortable that Super's spider web model (Watts et al, 1981) fitted effectively in the vector space between the pillars of personal and external determinants of the "Archway model of career determinants" and enhanced "its synthetic, synthesising nature" (Super, 1990, p. 201). This model (Figure 2.3) has proved to be a dynamic and interactive model of decision-making, and in visualising the career of the individual woman.

Originally, the spider web had been used to represent "the early years of person-environment interaction" (Super, 1994), but I found it helpful to represent Cecilia's interactive learning process in each life-stage, where her attention to "time perspective, a sense of autonomy, and other elements" were still required for the "proper use of information" (p. 72). Thus, with its insertion in the archway I was able to identify and interpret the dynamic interplay of "the numerous determinants" of Cecilia's "decisions" (Super, 1980, p. 283) in her unique construction of vocational identity, and how she resolved any incongruence (Spokane, 1994) in fitting into various contexts.

"Key figures" were made visible in this decision-making model, which enabled me to more precisely identify the characteristics and qualities of Cecilia's parents, teachers, peers, lecturers and work colleagues from her subjective career voice. I was also able to interpret the nature of relationships and the tensions she felt, for example, Cecilia's on-site experiences as the lone female engineer trying to belong and the active resistance of other engineers or allied workers. Likewise, I used the model to spotlight the professors, as key figures and more incisively ascertain, from the institution's story of itself (Jaggar, 1989), their attitudes, values and beliefs about women in engineering, and their own competencies as engineers.

Segmental Archway Model of Women's Career Development

I had used Figure 2.1 as the original pictorial 'Archway' representation of the range of explanatory theories Super had included on career and personality development. I took this model and included extra theoretical segments that, from my feminist perspective, were crucial in better explaining women's lives (Figure 2.2). This was the theoretical model, but I found it was more visual, practical, and powerful, to use the combined Archway "spider web" model (Figure 2. 3) to test out Super's 14 propositions through my three research questions. For example, this version enabled me to envisage and test my domain assumptions through Super's propositions, regarding the health of relationships between Cecilia and her associated "superiors and fellows" (Super's (1990) 9th, 10th, 11th, 12th & 13th propositions); and how well she was able to explore, exercise curiosity, be approved of, build a positive sense of self and strong locus of

control as a healthy "paver of the way" in engineering (Super's 1-14 propositions). Ultimately, I used Super's 3rd proposition as a benchmark of undergirding values in this often tenuous, lopsided and potentially "explosive" masculine/feminine environment to ascertain whether engineering was an occupation, where there was tolerance for a diversity of people, as well as a choice of occupational roles and tasks for each individual to develop a personal vocation (Super, 1990, pp. 206-208).

I also drew out from the women's narratives how the lecturers and administrators had enhanced their "structure of opportunity" (Astin, 1984) by making a difference to their development of vocational interests and identity, by increasing their level of curiosity and exploration, and helping their moves towards an internal locus of control and well-planned decision-making. As a direct consequence of its use, I was able to identify the degree of adaptiveness shown by both the men and the women, what needed to be changed, and to provide more precise recommendations for the kinds of adaptive changes needed of key figures in Super's (1980) "theatres", in terms of the structural organisation, the curriculum and the cultural milieu; and similarly in the work-place setting of first postings. Family, peer groups, and to a lesser extent community groups, were identified by the women participants as important support groups and for leisure activities. Cecilia's story revealed that the absence of such immediate support groups was devastating for her in 1997-1998. I used this model to explain how she was "floundering or "choosing to do the unexpected in her personal life", especially in explaining later person-environment misfit so that appropriate vocational guidance could be provided (Super, 1954, 1969a).

Over the course of this study, I also updated the theoretical archway by including recent researchers and theorists, alongside a theory segment. By emulating Super (1994, p. 66) in this way, this process facilitated my theory-building (see Figure 8.1) to justify that my convergence of Jaggar/Super segmental theory of career, self, and personality development was not losing integrity (Holland, 1994). Rather that these theorists, with a melding of my own feminist standpoint, were reinforcing Super's fundamental premises that met Krumboltz's (1994) "qualities" of better theory.

In parallel with my amendments to the life-career rainbow, I injected the following theoretical segments to increase its robustness in explaining women's lives, as well as men's lives (Figure 8.1, page 350). At the apex of the archway, I had found that women's construction of self was better explained in terms of *self efficacy* in educational and work contexts (Bandura, 1971, 1982a; Betz & Hackett, 1981; G. A. Kelly, 1955; K. R. Kelly, 1993) in engineering. I found too that personality, portraying an amalgam of the women's determining qualities (Super, 1994), needed more facets to be included on the left side of the archway (Bolton, 1968). In particular, Super's needs segment (1990), required the differentiation of *deficiency* and *growth* needs, as discussed earlier (Maslow, 1968; Tauber, 1990). *Beliefs* and *attitudes* played out in interactive settings were clearly derived from the "values" segment and needed to be flagged (Allport, 1961; Bordin, 1994). In the interests segment, both *social* and *vocational* interests emerged in the construction of women's personality (A. Adler, 1964; Hesketh, Emslie & Kaldor, 1990). Additional segments were required and related to the effect of motivations and feelings, "that press [her] up or press [her] down" (Super, 1980, p. 296); as well as a segment of *aspirations* and expectations (Astin, 1984, Bolton, 1968; Gottfredson, 1981), that were so essential for future career (Super, 1990). Achievements of participants, represented by the left-hand capital, were found to be both academic and *affiliative*, to accommodate to their social interest and need to belong, especially as they were often positioned as strangers (A. Adler, 1964; Pallotta-Chiarolli, 1990) at, what I deemed as, the "hard edges of engineering".

On the right side of the archway, Super's "theatres" needed to correspond more precisely with my elaborated rainbow model and to the women participants' lives as they accessed via the historico-social-cultural doorstep of the archway. My amendment of School to *education* was justified to accommodate the concept of life-long learning. *Leisure* was a justified inclusion (McDaniels & Gysbers, 1992) between the peer group. Family and the community was also maintained since the "gendered nature of domestic work" (Walby, 1986, p. 51) was changing in a few of the women's families, with isolated instances of harassment by husbands in families, like Astrid's. The *labour market segment* now linked well with the concerns of women participant's careers and advances

in technology in realising their gifts and in making wise choices (Astin, 1984; Gottfredson, 1981; Rose, 1994). The segments of work and education in engineering continued to exhibit "male violence and sexuality" (Walby, 1986, p. 51) which alienated women, like Cecilia from her "intellectual capabilities" as a student (Jaggar 1983), and the lack of freedom to accomplish through work, as a new engineer. Women participants found they were required to respond and adapt to change (eg, Phillips, 1994). *Chance* played a significant role in Cecilia's life-story in engineering education (Bandura, 1982b; Herr & Cramer, 1992). In the vector space, I created three boxes: one was related to *interactive learning* (rather than simply social learning) to signify the woman's construction of embedded career (Cockburn, 1991; Hacker, 1983, 1990; Vondracek, et al. 1986); another to convey women's need for the enabling role of *Key figures and Niche* (Carter & Kirkup, 1990b; Pallotta-Chiarolli, 1990; Robinson &McIlwee, 1989; Young, 1984; Young et al, 1993); and a third signifying *Gender relations* (A. Alder, 1930, 1964; Connell, 1987; Matthews, 1983; Walby, 1990) as a major determinant of career. Finally, I included the *Historical-Biographical-Geographical* door-step to reinforce the embedded career and identity.

Creating a More Convergent Theory of Career Development

My methodological aim in this study has been to enhance the theoretical base and applied utility of Super's (1990) career theory for women, who as a group, have been traditionally overlooked. Super's emphasis, that no one theory domain was adequate enough to fully explain life-career development, made it easy for me to integrate my ideological standpoint as a socialist feminist (Jaggar, 1983, 1989, 1992; Josselson, 1987) to better explain women's lives in non-traditional vocations and related professional education.

In my convergence Jaggar/Super theory of career, I favoured Super's (1980) theoretical overlay of remote and situational determinants (eg, gender) because of my assumption that not all differences that women brought to the occupation of engineering were harmful (eg, ethic of care, equal valuing of feminine), but, rather, that women differ as a group in important ways from men (Domain Assumption 3). Notwithstanding, I

attributed gaps between non-traditional women's aptitudes and achievements to hindrances in the gender regimes of engineering education; and the downward spiral in Cecilia's self-esteem and aspirations to gender harassment in the work-place (Domain Assumption 1). The overlay of gender as a key social construct helped me to identify that work in engineering and in the allied work place was gendered because it hindered women's need for accomplishment and to belong (Domain assumption 4).
Super's 14 explanatory propositions guided my key questions about the past, present and future careers of women in engineering. His own practice gave me the opportunity to modify propositions "for clarity and parenthetical updating", such as adding a feminist perspective to his proposition about future career, where "dreaming the future" helped women to build collective self esteem and deal with the present in this light, rather than simply vocational socialisation (Super, 1990, p. 206). By incorporating feminist perspectives on "feminine ambivalents", gifted girls, and non-traditional women professionals into Super's segmental theory, I constructed the generalised other subjective perspective. In these ways, I have developed a more comprehensive theory, by providing a basis to address the full range of circumstances that could affect women's career satisfaction (both personal and situational determinants).

His allowance for a nomothetic more generalisable standpoint regarding the common determinants of the human condition provided the liberty for me to give social breath to the 53 participants. From my analysis of the collective narrative (Domain Assumption 2) I discovered common themes and issues in the present lives of women in engineering. This provided a picture of women's personal /professional characteristics as intending engineers and constraints/possibilities they discovered about engineering as a vocation. I corroborated their perspectives with the organisational career from professors' voices with the practical intention to effect adaptive change.

I integrated Super's idiographic theory of personality development into my Jaggar/Super convergence theory and used his preferred life-history approach to build theorising about vocational development. Using themes from the collective voice helped me to understand how one woman's quest for identity was progressively established, as well as explaining (even beginning to predict) her "floundering" at times, (which Super (1969a) also sought to do in his study (p. 20)). Such touching base, as part of my feminist methodology, enabled Cecilia to take responsibility for her own life. My study of her embedded identity became a convergent construct for me in integrating vocational counselling theory with socio-psychological theory as segments of both career and personality theory.

The nature of my convergence theory has remained essentially segmental, with the integration of these new theoretical segments into my Super/Jaggar convergence Archway Model (see Figure 8.1 below) which evolved in response to "newly discovered anomalies" (Krumboltz, 1994, pp. 27-28), interpreted from my life-career history narratives of women in engineering. I have used both substantive and methodological findings, including my gender inclusive models of career development for the purpose of educating future teachers and post-graduate students involved in qualitative research.

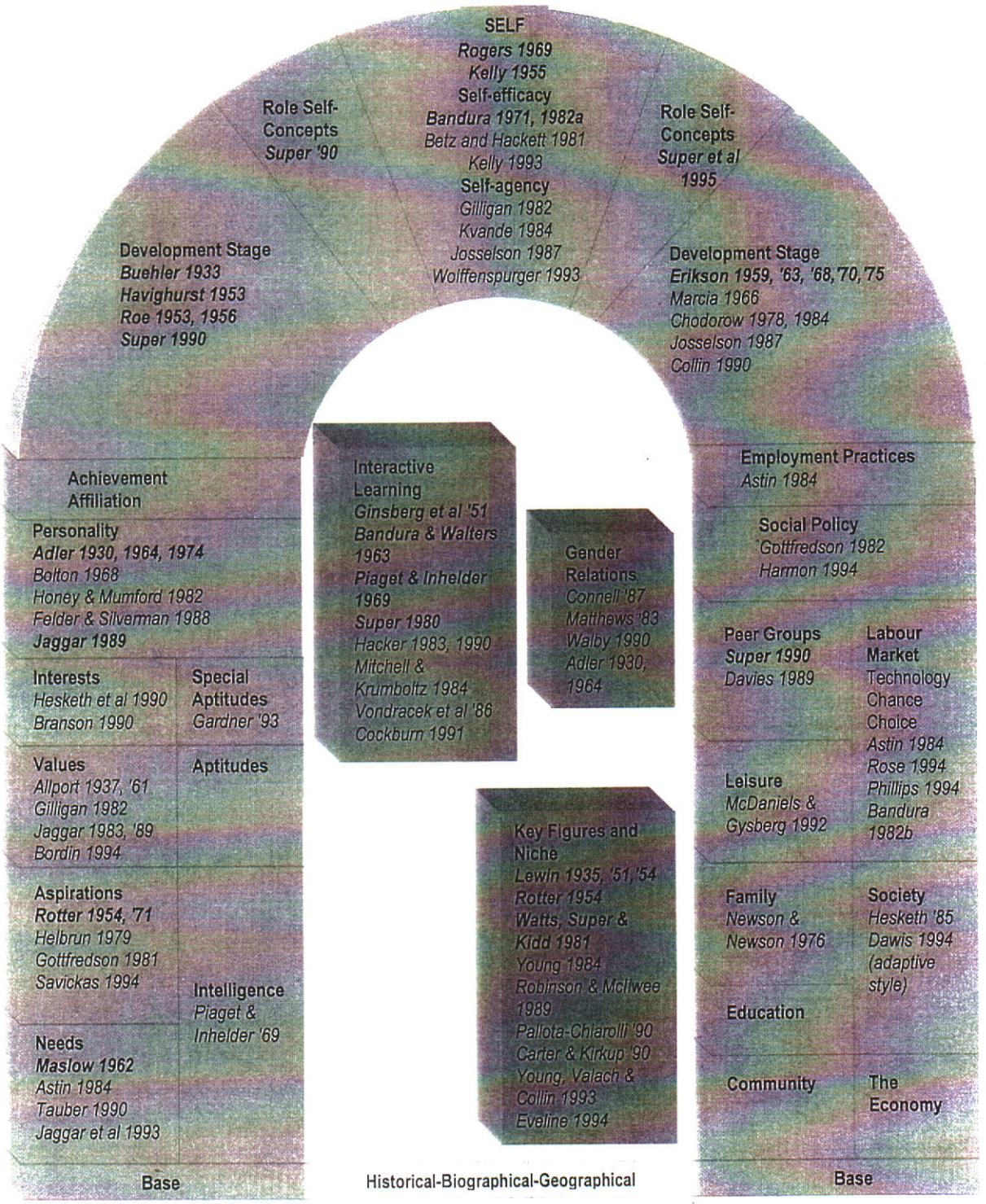

Figure 8.1: A Super/Jaggar Convergence Archway Model of Women's Career Development

(adapted from Super 1994)

IMPLICATIONS FOR ENGINEERING EDUCATION AND EMPLOYMENT

Issues that emerged from comparing and contrasting the four career perspectives on women in engineering (Figure 1.1) highlighted the need to enhance the participants' opportunity structure and to value personal determinants women brought to engineering as professional engineers. For ease of implementation, yet with a central concern for gender as a major structural and interactional determinant of non-traditional women's careers, I have clustered my suggestions for change to the "concrete other" organisational career in terms of: the curriculum; the cultural milieux; the structural organisation; and the vocational guidance that women require relative to transition from school to engineering education, in decisions made during the program of study, and in the transition to the work-place. I urge that the faculties effect inclusivity for women in engineering by making gender a central organising construct.

In terms of curriculum development, lecturers should have accurate knowledge of their women students' past career for better initial person-environment fit in engineering education. My suggestion would be to administer an autobiographical questionnaire and a learning style inventory to gain accurate knowledge of personal determinants in terms of special needs, values, interests, learning styles, coping strategies, informal and formal achievements, and situational determinants, related to their family, school, leisure, and part-time work. These determinants will help lecturers to know the woman as a learner, hopefully minimising any stereotypical reactions towards women in formal educational settings and in vocational guidance. In relation to vocational guidance, the lecturers would also be creating webs of connectedness for women as "pavers of the way" in their transition to first year engineering education.

Given the possible discriminatory behaviour of some lecturers and male students, it is vital that lecturers, through the formal curriculum, foster the attitude in all students that women are, and have been, as important to the engineering profession. I suggest that this could be effected by making the contributions of female engineers, past and present, visible by creating a data base from magazines, newspaper articles and journals. Women need same-gender heroes and attitudes from "superiors and fellows" that

promote quality in their every-day interactions. In addition, lecturers should provide students with reasons for any curriculum adaptations, such as collaborative projects for first years, to enhance cross-gender communication and management skills learning. I suggest that moving the "issues" unit from final year to first year, would serve to create a valuable dialogue on the need for gender equity in engineering. This would also be a healthy reminder to lecturers.

Although both faculties purported to adopt a problem-solving constructivist approach to learning to become an engineer, the women participants found first year a "black hole" experience. It is thus important for lecturers to make connections with the women's conceptions of engineer and engineering and expand on "what it means to be an engineer". For example, participants appreciated interaction with professional engineers and older students who demonstrated the integration of personal and work-related aspects of their lives. In parallel, it would be beneficial to encourage women students to use a reflective journal to build on prior knowledge about engineering and be motivated by goal-setting. They could voice their aspirations and expectations of the course, their values, and what interests them in engineering. Sharing such information with their lecturers would serve to create an opportunity structure within the curriculum that accommodated the women's subjective career constructs. The establishment of other communication links for busy people (such as e-mail, bulletin boards) would also encourage and satisfy women's need to seek expert advice from lecturers in "learning the ropes".

To alleviate the issue of women's lack of self-efficacy in the area of generic skills and computer programming, lecturers need to facilitate and monitor women's growing competence and confidence to further their engineering studies and employment prospects in a technological world.

To accommodate to participants' need for connected knowledge, it is important that lecturers link theory more with real-life experiences, and are more cognisant of the women's development of key interests and growing ethic of care, especially from their

work-experiences. Although the participants found final year projects challenging, the topic and the supervisor were often viewed as the "luck of the draw". Perhaps, lecturers might consider linking a topic to a student's key interest, which would serve three outcomes, specifically increasing motivation and involvement in the learning process; increased satisfaction with the final product, and the refinement of her vocational identity. Ideally, topic selection, tasks, processes, time-lines and assessment should be negotiated and clarified early in the year.

In regard to the vexed question of authentic assessment in a problem-solving approach to curriculum, lecturers need to pay due regard to "contexts" that might marginalise, exclude or hinder women's achievement in engineering. I found that an important aspect of this type of curriculum implementation and evaluation was encouraging participants to evaluate their own progress as learners and thinkers, (which could include a re-evaluation of preferred learning styles); and provide feedback on progress to lecturers and peers, their current concepts of "engineer" and "engineering" in attaining vocational identity. Such information shared with academe would also be helpful for vocational guidance for women transition to work. Since the issue of "juggling time" was an increasing dilemma for the women participants, I found it critical for them to self-monitor and make time for leisure to enhance learning, work and relationships.

In regard to the persistence of the masculine norm in the cultural milieux of engineering and the workplace, lecturers must address the discriminatory and marginalising behaviour of some men students and lecturers towards women in the cultural milieux. Effective strategies for such change should work in conjunction with the proposed changes for a gender inclusive curriculum. At the organisational level, it is important to provide a neutral person (perhaps the "Women in Science and Engineering" coordinator) with whom the women can discuss issues which are critical to their career progress and who can act as a kind of information broker between the students and the faculty. Also at an organisational level, pastoral care structures could be expanded to include encouragement for a network of women students (eg. dedicated space, time and clerical support). Although women may be reluctant about implementing affirmative action, it is

important to provide practical support for the setting up of mentoring arrangements essentially within the network of women students, but including where appropriate, the WISE coordinator, members of staff and practising women engineers. It is equally important to provide counselling for male students and any lecturers who show prejudice towards women, to help them to work through the unacceptability of such behaviour.

Other changes to the structural organisation are essential if the underlying masculine ethos of engineering is to be transformed. It is essential to foster the vocational commitment of women and men students in engineering and to do this ideally they need both women and men as occupational role models and mentors in Academe and on work-place practicums. Faculty, also, ought to respond to women students' need and value of women lecturers and to recommendations of recent gender equity policies written from women's perspectives. This may necessitate active recruitment and appointment of women academics. Benchmarks should be developed for monitoring the efficacy of engineering education and for increased gender equity in terms of women's achievements, the quality of participation and retention rates in all units of study. Likewise, progress in structural organisational change and innovations towards gender equity in engineering should be reported annually to the dean.

In relation to transition to work and vocational guidance, I have focussed on creating a more effective opportunity structure for establishing a woman's place in first postings and women's professional development. At the present time with the gender imbalance in Academe and the workplace, I consider that male lecturers must help women towards more effective access to the work-place. As vocational counsellors, lecturers need to be empathic towards women's special needs, values and interests, and their particular life-career stage situation (ie. transition to work, establishment stage, maintenance stage). I would suggest a number of strategies drawn from the literature and from the participants' stories.

Lecturers, working in close liaison with the WISE coordinator, representatives of the women's branch of the Institution of Engineers and managers in the workplace could serve to encourage structural organisational change. Such a range of mentors and perspectives should prepare women students realistically for their future career in their first postings and/or post-graduate studies where there is still evidence of gender harassment; and alert them to the continuing uneasy compromise with regard to women's family and career choices. To further enculturate students to the new gender order, lecturers might encourage student membership of the Institution of Engineers and provide opportunities for women and men to develop effective interview skills; and help women students to deal confidently with inappropriate attitudes and questions that are unrelated to the job specifications.

To alleviate women's concern for their career development, structures of opportunity should be in place in the establishment stage of development. For example, it may be helpful to develop a data base of mentors who have had professional development training to help, advise and monitor the progression of women in their first postings. Some managers in the work-place and supervisors in postgraduate studies may need professional development in actively combating any type of "put down", or more serious sexual and gender harassment, towards women. As women move through the "establishment" stage into the "maintenance" stage of life-career, the profession and the women will need to adapt to meet the changing needs, values orientation, and interest focus of women, and often the extension of "life-roles" (eg, wife, mother).

I anticipate that if lecturers (in partnership with those in the workplace, including academe) are prepared to expand their role to include vocational guidance along with their lecturing and research roles, they will collectively enhance the probability of gender equity as the norm of engineering in the 21st century.

Conditions in Universities in 2000 - Implementation of Recommendations

In voicing the urgency for the two faculties to move towards transformative change, I have contextualised the participants' "subjective" careers and associated "organisational" careers within the changing culture of Western Australian universities regimes, the changing "generalised other" of engineering in Australia, and the current gender order of the global village.

In Western Australian universities, there are women in top management who have the potential to "reflect and shape social change" ((Thornton, 1999, January, p. 4). This would include their potential to initiate change in the "organisational" career context of engineering faculties and departments and in consequence the "immediate" situational determinants of women's "subjective" careers, as indicated by Hewitt (2000). Four Western Australian universities are already jointly "scaffolding the careers of women" by mentoring junior academic women to effect change (Goldflam, 1996, January). On the down-side, the stories of women at the top suggest that they too are vulnerable and still subject to discrimination in their work contexts (Castleman, Allen, Bastalich & Wright, 1995; Gale, 1995; Hammons-Bryner, 1995; Poole, Nielsen & Skoien, 1995). Although they are "through the glass ceiling", networking support has been encouraged (King, 1997).

Within the "generalised other" of engineering in Australia 2000, the major theme is change, with the common aim of advancing women's careers in engineering and transforming the culture (Commonwealth of Australia, 1995; Institution of Engineers, 1996; Roberts & Lewis, 1996). Under-girding such change is valuing diversity in engineering education (Parfitt, Copeland & Lewis, 1996), yet being mindful of the vulnerability of women in engineering (Copeland, 1995; Mares, Lewis, Lambert, Simpson, Copeland & Griffith, 1996). Gender inclusive models of curriculum have been implemented in engineering (Lewis, 1995; Moxham & Roberts, 1995), in parallel with professional development for university lecturers (Baillie, 1995; Henes, Bland, Darby & McDonald, 1995; Hildebrand, Cooper, Allard & Wealands, 1995). Women researchers are currently debating how change ought to occur (Copeland, 1995; Lewis &

Copeland, 1998, August; Stonyer, 1997a, 1997b); Lee and Taylor (1996) have focussed on women's personal determinants and the "dilemma of disobedience" in their construction as engineers; and McLean, Lewis, Copeland, O'Neill and Lintern (1997) are refocussing on the issue of masculinity and the culture of engineering. Other researchers are benchmarking changes in engineering education and the profession by monitoring the increases in percentages of Australian women (Cobbin, 1995; Lewis & Harris, 1995). Despite some residual barriers, women students in engineering gain higher percentage aggregates compared to their male peers in Western Australian universities (Thornton, 1998, p.4).

Within the current gender order of the global village, there has been continued interest in the career development and life-style patterns of women (Claes, Martin, Coetsier, & Super, 1995: Nevill, 1995; Super, Sverko, & Super, C. M., 1995); and the monitoring of the careers and degree of visibility of women, especially the gifted (Kitano & Perkins, 1996; Reis, 1995a, 1995b) and those in engineering and science (Ashby & Gore Ohrm, 1995; Benchart & Staberg, 2000; Davis, Ginorio, Hollenshead, Lazarus & Rayman, 1996; Henwood, 1996; Nobles & McDonald, 1996; Rosser, 1997; Tonso, 1996). Again, women are reminded that they cannot afford to be complacent about the glass ceiling, the invisible barrier that stops women from getting to the top. "It is cracked but still in place", and we live in a society where "sexism, racism, glass ceilings and xenophobia live side by side with unemployment, underemployment and poverty" (McDonald, 1996, November).

Such contextualisation of the recommendations emanating from the women participants' voices, within these higher levels of situational determinants, puts into sharper relief the need for the two faculties to adapt significantly if more women are to be encouraged to become engineers, and then to participate equitably with men in engineering education and in the work-place. Equally important are changes in conditions that enable graduate women in engineering to be well mentored and be retained and/or retrained to attain leadership positions in both academe and the workplace. Transformation towards gender inclusivity will depend on the goodwill of faculty members, and their willingness to

effect this cycle of change in partnership and mutual dialogue with teachers in the local schools; their women (and men) students; and with professional men and women in engineering.

CONCLUSION

In this chapter, I have summarised my study and distilled from it issues pertaining to women's careers in engineering. I have evaluated the quality of my convergence theory of career and personality development, based on Jaggar's critical unified systems feminist theory (Jaggar, 1983, 1989; Jaggar & Rothenberg, 1984) and Super's (1990, 1994) segmental theory of career determinants. I have explained how, to me, my narrative approach was an effective way to weave and interpret women's biographies for their own personal empowerment, and in gaining a sense of the degree of gender equity in practice over three stages of career. By naming and conceptualising 'gender power relations' as the key social construct underpinning my four domain assumptions, I have been able to trace, in the women's stories, the significance of gender as a dynamic social value that shifts as each institution (family, education, work) changes its positioning of woman as 'other'. Work, similarly, is a dynamic gendered construct, especially obvious in a non-traditional profession like engineering. I found the nature of work was closely aligned to the amount of recognition and support "superiors and fellows" gave women in valorising the feminine and valuing them as colleagues in their construction of self, identity and choice of career pathway. My Jaggar/Super elaborated models, especially the combined archway of career determinants, provided useful frameworks when testing out Super's 14 propositions on the healthy career development of the women in engineering, in theory building, in identifying conditions of enablement and restriction, and conditions for change.

Methodologically, by determining the degree of complementarity between the different career perspectives (Figure 1.1), I was able to precisely identify the gaps between the concrete other subjective and organisational careers and to make recommendations for change in the two faculties. I suggest that to facilitate the transformation of the curriculum and the cultural milieux of engineering education and first postings, it would

be more effectively implemented by situating these within the context of the present "organisational" career adaptations in 2000, because new policy formulations and practices had been implemented since 1992, when this study first began.

Substantively, while many of the issues raised by my women participants are probably common to many students in many university faculties, they are thrown into sharper relief by the alienation of these women (intellectually and in terms of sexuality) from the organisational concept of "engineering" as a masculinist gender regime. Even some of the women who survived their experiences within these faculties of engineering have scars on the memory. At best, they see their experience as something of an ordeal which they had to endure and they can look back on it and laugh. This is a sad reflection on what should be some of the best years of a person's life. Participants would do well to adopt Billie's motto 'my only revenge is success' in engineering education and in the workplace.

Most significantly, I believe my study has shown that these women, collectively and individually, have provided engineering education with an alternative philosophical, moral and ideological basis for a transformed, inclusive curriculum – not only by simply being there, but by being pro-active in their respective educational settings. Having completed this life-history approach to career, and used their voices to lay out the basic parameters for change, the words of Freire (1973) impel me to ask this question of their professors, "Gentleman, are you listening?", because if you are "unable to perceive critically the themes" of your time, and "thus to intervene actively in reality", you will be "carried away in the wake of change" (pp. 7-8). It is your responsibility to attract and retain more women in engineering, it is hoped that you will graciously listen to the participants' voices, and consider ways to re-vision and transform engineering education towards gender inclusivity, and also reflect on your own professional development for the next millennium.

EPILOGUE

One of the most satisfying outcomes of my life-career research is that several women have continued to "touch base" with me, as Oakley's (1981) participants had done. I have become a trusted confidante, distant and objective enough not to criticise but rather to listen to their hopes, fears and achievements. I had thought that Cecilia had found her niche in "project management on the 7th floor" (Cecilia, Personal Communication, November 1998). In March 1999, however, she rang to arrange a meeting with me and to break the news:

> I don't want to be an engineer any more. I used to enjoy engineering but I hate it now. There is no way I will ever go back to any stupid site run by XXX. Not ever I don't ever want to go back to the 9th floor. It's just too oppressive. I have nothing left. Mum told me one night that she was afraid I would never function normally again. I queried "What as a engineer? and she replied "No, just as a person" That shocked me. This 7th floor job won't last for ever, then I'll have to go back to the 9th floor if I stay in XXX. I won't work somewhere where money is more important than people. I want to look after myself now (Cecilia, Personal Communication, 17 March 1999).

When we met for lunch, she said she had dyed her hair black to cover her self-image of being a "bimbo blond". She had "no time for leisure" with "few contacts with friends" and was "just surviving" (Cecilia, Personal Communication, March 24th, 1999):

> I shouldn't let one bad experience influence my decision but its not one bad thing that's happened. I've spent the last 7 years struggling in this field only to be kicked again and again! I think leaving is the sensible thing to do and I'm looking forward to a new career and a new beginning! (Cecilia, Hand Written Note 24/3/99).

Sexist attitudes, coupled with sexual and gender harassment, had served to wear away at her self concept and progressively sabotaged her hopes of a successful career in engineering. I noted that gender discrimination was also wearing away at the community of engineering to which she had strived to belong. As my convergence Jaggar/Super theory explained, without hope in the future, and the support of "superiors and fellows" in the present, even a successful past career appeared bleak to Cecilia's shattered self. Cecilia has made decisions to study psychology part-time and to enter the public service. Josselson (1987) would have interpreted her career pathway decision now, as a "daughter of crisis": was it a comfort to be just like her mum in the public service at this crisis time? (see Cecilia, Autobiographical questionnaire, March 1992, p. 2). Nevertheless, her career move demonstrated some "psychological continuity"

(Super, 1994, p. 69) in relation to her prevailing interest in people, even if it was a forced decision of withdrawal from engineering.

Changing Conditions - Did Cecilia Make a Difference?

The engineering department at her university has also changed. It has initiated a mentor-mentee program (Lawrance, Hullet & Goodell, 1998); and also enhanced the physical environment aesthetically. One of the lecturers has indicated to me that he has become more empathetic towards the isolated position of women in engineering as a direct result of my life-career research. Further, Cecilia's former company XXX has extended its equal opportunity policy to include sub-contractors in a bid to promote gender inclusive practices. In view of Cecilia's experience, it seems timely that in December 1999, the Federal Parliament passed *The Equal Opportunity for Women in the Workplace Amendment Act,* which came into operation in January 2000. This requires firms to implement strategies for better gender social relations. Recent benchmarking indicates that "5 WA companies are among 29 companies nation-wide", who have failed to comply (Tickner, 2001, November). Neither are professional women, according to Sex Discrimination Commissioner Goward, really any closer to "breaking down glass ceiling barriers" than a decade ago (James, 2001).

If my research had a mission, it was to try to highlight that, in order for practices to change in higher education, the issue of "equality/inequality" must be "central to ... debates" (Weiner, 1993, p. xi) about women's level of recruitment, the curriculum and women's educational achievements, and the quality of participation and progression into engineering. The engineering industry must adapt to a world in which, increasingly, women are part of its professional and management scenario. Given the tight institutional rein put on these token women, I can understand the career compromise of women like Billie, Bron (Cecilia's friend), and Christie (Newhouse-Maiden & Parker, 2001) who positioned themselves as "one of the boys" in first postings. In contrast, Cecilia tried to change the culture and the structural organisation of her work-place by valuing her femininity and her role as a professional ethical engineer. I have taken the liberty to reiterate:

> ... Another crisis met and overcome by our electrical engineering heroine CECILIA!!!! Well sort of (Cecilia, TB, 21 March 1995).

On a note of hope, it is gratifying to find a 1992 woman graduate who enjoys the "camaraderie and team-work" of men as a drilling engineer (Wilson-Clark, 2001). Such reports confirm the gossamer thread running through some participants' stories (Astrid, Sandie, Sara, Cecilia): some men are prepared to be mentors and to "perceive critically the themes" of their time, and "thus to intervene actively in reality", rather than be "carried away in the wake of change" (Freire, 1973, pp. 7-8). The future of women in engineering may well depend on such pioneers.

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APPENDICES

APPENDIX A

CONFIDENTIAL: AUTOBIOGRAPHICAL QUESTIONNAIRE
(A reflection on socialization effects, education and career choice).

Please complete the questionnaire and comment where appropriate:

PERSONAL DATA.

1. Name Number _____
(Office Use Only to preserve confidentiality)

2. Year of birth

3. Place of birth 4. Ethnicity

5. Year arrived in Australia

6. Branch of Engineering:

7. Year of Study in Engineering 1st ____ Final ____ Graduate ____

Family and Socialization

8. List Brothers/ sisters and self in birth order (use symbols m, f, and s) and age

9. Early play activities you enjoyed most and/or were encouraged to play

10. Mid-childhood interests / activities

11. Adolescent hobbies / interests / sports

12. Adult interests / activities / sports

13. Friendships

(Reference items 9,10,11,12)

How influential is / was your peer group in terms of interests, dress, sex role stereotyping and career path?

EDUCATIONAL BACKGROUNDS, WORK / CAREER PATHS

PARENTS

14. Schooling (Tick appropriate levels for each parent)

	Primary	Secondary	TAFE	Apprenticeship	Tertiary	Other
Mother						
Father						

15. Workforce and/or Home duties

Mother

Indicate stages of life in terms of a) the workforce and/or b) home duties

(15 - 20)	(21 - 25)	(26 - 30)	(31 - 35)	(36 - 40)	(41 & over)
(a b)	(a b)	(a b)	(a b)	(a b)	(a b)

Occupation(s)_____

_____

Father

Indicate stages of life in terms of a)the workforce and/or b) home duties

(15 - 20)	(21 - 25)	(26 - 30)	(31 -35)	(36 - 40)	(41 & over)
(a b)	(a b)	(a b)	(a b)	(a b)	(a b)

Occupation(s)_____

_____

SELF

16. Formal Education

a) Kindergarten / Play school / Preschool.

Early memories

b) Primary school

i) Single sex / Co-educational

ii) Favourite subjects - give reasons why

iii) Favourite teachers - give reasons why

c) Secondary school

c) i) Single sex / Co-educational

c) ii) Did you study non-traditional subjects for your gender?

(e.g. Industrial Arts, Physics, Computer Studies - girls)

Yes / No

If so, please list and indicate number of years of study

Subject(s) _____ _____ _____

number of

years of study _____ _____ _____

c) iii) List Subjects studied in Upper school, with reasons for your choice

_____

_____

_____

_____

_____

YEARS OF STUDY - SELF

c) iv) HUMANITIES / ARTS

	English/English Literature	Social Studies	Drama	Art	Music
Years of study	_____	_____	_____	___	___

c) v) MATHEMATICS / SCIENCE

Mathematics - number of years of study?

Lower School _____ Upper School ___

Please indicate which level of Mathematics in Upper School

Mathematics I _____ Mathematics II , III _____ Other ____

Physical Sciences - number of years of study?

Lower School ____ Upper School *____

* Circle Chemistry/ Physics/ Physical Science/ Geology as appropriate

Biological Sciences - number of years of study?

Lower School _____ Upper School _____

List other subject areas you studied, that you consider pertinent to your career choice and personal development. Please indicate number of years of study

Subject:	_____	_____	_____	_____
Years of study:	_____	_____	_____	_____

c) vi) COMPUTING AND COMPUTER STUDIES

Number of years of study:	Primary	Secondary	TAFE	Tertiary
a) Computing (skills)	_____	_____	____	_____
b) Computer Studies (Awareness)	_____	_____	____	_____

Home Computer

- Do / did your parents own a personal computer?

- Did / do both parents use the computer?
  Mother_____ Father_____ Both_____

- If so, for what purposes did she / he use the computer?
  Please list :

-If your parents owned a computer, were you encouraged to use the computer ? Yes / No.

If yes, please comment on the uses you made of the personal computer
(e.g. games, word processing, programming)

In your experience, were girls less likely to study the Physical Sciences, Mathematics and Computer Studies than boys in Upper School? Please comment :

17. SIBLINGS- EDUCATION , CAREER / CAREER INTENSIONS

	Highest level of education achieved	Chosen intended career
Sibling 1		
2		
3		

18. CAREER PATHWAYS - SELF

a) Choice of a career in engineering - Why did you want to become an engineering:

b) Parents' level of interest in your schooling and aspirations/expectations of your future career(s)/ adult roles. Circle the best description for her or him:

b) i) Mother

Non-interest	Marginal	Involved -advice and discouragement	Involved -advice and encouragement	Highly directive

Comments:

_____
_____
_____

b) ii) Father

Non-interest	Marginal	Involved -advice and discouragement	Involved advice and encouragement	Highly -directed

Comments:

_____
_____
_____

b) iii) Did/do you perceive differences in your parents' level of interest in and/or expectations of your brother's/sister's schooling and future career/ adult role?

_____
_____
_____

c) Siblings' aspirations and expectations

How influential were your siblings in your choice of future career?

d) Peer group's aspirations and expectations

How influential were/are friends in your making of career choice?

1	2	3	4	5
Crucial	influential	important	some influence	unimportant

e) The influence of Teachers' (at all levels of schooling) aspirations and expectations of you and your life chances and future career paths.

Please comment :

e) i) Did any teacher/ lecturer display bias in their behaviour and/or advice to you because of your gender? Yes / No
Please comment :

e) ii) Did any teacher/ lecturer act as a role model in your choice of study and/or future career choice? Yes / No
Please comment :

e) iii) Did you seek advice from a teacher/ lecturer on your career path or future career? Yes / No
Please comment :

Formal guidance

f) i) Guidance Officers' / Counsellor's Advice :
Did / do you seek professional advice? Yes / No
Please comment :

f) ii) How crucial do you think such advice is for the adolescent girl and women in tertiary study?
Please comment :

19. CRITICAL INCIDENTS / EVENTS – SELF

What sort of coping mechanisms do you use (e.g. keeping a journal, talking it through with friends) when critical incidents / events (eg. difficulties / frustrations in assignment work, personal problems, social and work relationships, choices, professional and personal identity resolutions) occur ?

20. ASPIRATIONS AND EXPECTATIONS - SELF
What do you think you would you like to be doing in the next ten years? (this may include academic, professional and personal hopes for the future).

21. a) SUMMARISE THE ABOVE INFORMATION AND PLACE YOURSELF ALONG THE CONTINUUM :

1	2	3
Androgynous (sex-role liberated) upbringing and orientation to life	Liberal feminine upbringing and orientation to life	Predominantly Feminine upbringing and orientation to life

21. b) Do you consider that you upbringing, education and orientation to life has <u>enabled</u> or <u>hindered</u> your career path or future life chances?

Please comment :

Thank you for completing this questionnaire. I hope to provide you with feedback in the foreseeable future.

Lesley Newhouse-Maiden.

[An amendment sent to Institution B students - special section for 4th years/graduate and critical incidents extended for purposes of 'in-depth interview schedules'. This extension later served as a foundation of 'touching base' forms.]

REFLECTIONS - **4th year and graduates' evaluation particularly.**
Reflecting on your progress thorough the university course in science and engineering at university, try to evaluate **both the strengths and weaknesses** of your :

a) knowledge base - in Mathematics, Arts and Science

b) requisite skills base (including drawing, practical and computer skills)

c) personality disposition for engineering (e.g. flexibility, perseverance, out-going, reflective, intuitive, caring, innovative, happy, sense of humour)

d) social and work skills

e) support from:
i) family

ii) friends

iii) other engineering students

iv) Faculty - academic and administrative

v) Co-ordinator for women in science and engineering

CRITICAL INCIDENTS

What types of 'critical incidents' did you encounter during your secondary schooling, and may be encountering during your tertiary studies in engineering? [For Graduates this question will be extended to the workplace, or pure / applied research setting] (may include aspects of the perceived relevance of course content and practices; the marginality of women in interactions in the classroom / lab, fieldwork or in the literature related to engineering; differential treatment and/or interactions between males and females, particularly in traditionally masculine knowledge areas; lecturer / student roles; peer / peer relationships; evaluation procedures and practices; advise / decisions about career paths; differences in male / female interviews; work experience; and the relative absence of female scientific, technological and engineering role models and lack of 'critical mass' in women students in the course.)

APPENDIX B

NAME ***(For researcher's use only).***

PREFERRED LEARNING STYLE,

This questionnaire is designed to find out your preferred learning style(s). Over the years you have probably developed 'habits' that help you benefit more from some experiences than from others. Since you are probably unaware of this, this questionnaire will help you pinpoint your learning preferences so that you are in a better position to select learning preferences to suit your style.

There is no time limit to this questionnaire which is in two parts. It will probably take you 10 - 15 minutes. The accuracy of the results depends on how honest you are prepared to be. Remember, there are no right or wrong answers.

PART A:

According to Felder and Silverman there are five major dimensions to a preferred learning style: perception, input, organisation, processing, and understanding. Questions relevant to these five dimensions are listed below, with their descriptions given to assist you in your answer choice.

For each question tick *either* a) *or* b).

1. What type of information do you preferentially perceive?

a) Sensory (concrete) - sights, sounds, physical sensations - gathering data through the senses. Sensors like facts, data, experimentation, solving problems by standard methods - dislike surprises; good at memorising facts; careful, but slow, like details without complications.

b) Intuitive (abstract) - possibilities, insights, hunches - indirect perception by way of unconscious. Intuitors prefer principles and theories, innovation - dislike repetition, good at grasping new concepts; quick, but often careless; bored with detail, but like complications.

2. Through what sensory channel do you like to get your external information?

a) Visual - pictures, diagrams, graphs, demonstrations - probably forget what is simply said to them.

b) Auditory - words and sounds - learn much of what they hear and say - get a lot out of discussion - prefer verbal explanation to demonstration - learn by explaining things to others.

3. How do you like your information organised?

a) Inductively - start with facts and observations and then infer principles - from the particular to the general.

b) Deductively - start with the principles and proceed to the consequences and application - from the general to the particular.

4. How do you prefer to process information?

a) Actively - through engagement in physical activity - doing something with the information - discussing, explaining it, testing it - don't learn much in passive situations, work well in group (tend to be experimentalists).

b) Reflectively - through introspection - work better alone or with at most one other person (tend to be theoreticians).

5. How do you progress toward understanding?

a) Sequentially - in continual steps, mastering material more or less as is presented. Follow linear reasoning processes; can work with material when they understand it partially or superficially. Strong in convergent thinking.

b) Globally - in large lumps, holistically, in fits and starts; sometimes lost for days, unable to solve - even the simplest problem until they suddenly 'get it'. Then they leave the sequential learners baffled. Unable to explain how they came up with the solution. Strong in divergent thinking and synthesis.

PART B:

Read each statement carefully, and if you agree more than you disagree with the statement put a tick by it. If you disagree more than you agree put a cross by it. Be sure to mark each item with either a tick or a cross. It will assist you in this section if you respond with your "gut level" reaction rather than with a considered opinion.

_____ 1. I have strong beliefs about what is right and wrong, good and bad.

_____ 2. I often "throw caution to the winds".

_____ 3. I tend to solve problems using a step-by-step approach, avoiding any 'flights of fancy.

_____ 4. I believe that formal procedures and policies tend to cramp people's style.

_____ *5.* I have a reputation for having a no-nonsense, 'call a spade a spade' style.

_____ 6. I often find that actions based on 'gut level' are as sound as those based on careful thought and analysis.

_____ 7. I like to do the sort of work where I have time to 'leave no stone unturned'.

_____ 8. 1 regularly question people about their basic assumptions.

_____ 9. What matters most is whether something works in practice.

_____ 10. I actively seek out new experiences.

_____ 12. I am keen on self discipline, such as watching my diet, taking regular exercise, sticking to a fixed routine, etc.

_____ 13. 1 take pride in doing a thorough job.

_____ 14. I get on best with logical, analytical people and less well with spontaneous, irrational people.

_____15. I take care over the interpretation of data available to me and avoid jumping to conclusions.

_____16. I like to reach a decision carefully after weighing up many alternatives.

_____ 17. I'm attracted more to novel, unusual ideas than to practical ones.

_____ 18. I don't like 'loose ends' and prefer to fit things into a coherent pattern.

_____ 19. I accept and stick to laid down procedures and policies so long as I regard them as an efficient way of getting the job done.

_____ 20. I like to relate my actions to a general principle.

_____ 21. In discussions I like to get straight to the point.

_____ 22. I tend to have distant, rather formal relationships with people at work.

_____ 23. I thrive on the challenge of tackling something new and different.

_____ 24. I enjoy fun-loving, spontaneous people.

_____ 25. I pay meticulous attention to detail before coming to a conclusion.

_____ 26. I find it difficult to come up with wild, off-the-top-of-the-head ideas.

_____ 27. I don't believe in wasting time by beating around the bush.

_____ 28. I am careful not to jump to conclusions too quickly

_____29. I prefer to have as many sources of information as possible - the more data to mull over the better.

_____ 30. Flippant people who don't take things seriously enough usually irritate me.

_____ 31. I listen to other people's point of view before putting my own forward.

_____ 32. I tend to be open about how I'm feeling.

_____ 33. In discussions I enjoy watching the manoeuverings of other participants;

_____ 34. I prefer to respond to events on a spontaneous, flexible basis rather than plan things out in advance.

_____ 35. I tend to be attracted to techniques such as network analysis, flow charts, branching programs, contingency planning, etc.

_____ 36. It worries me if I have to rush out a piece of work to meet a deadline.

_____ 37. I tend to judge people's ideas on their practical merits.

_____ 38. Quiet, thoughtful people tend to make me feet uneasy.

_____ 39. I often get irritated by people who want to rush headlong into things.

_____ 40. It is more important to enjoy the present moment than to think about the past or future.

_____ 41. I think that decisions based on a thorough analysis of al the information are sounder than those based on intuition.

_____ 42. I tend to be a perfectionist.

_____ 43. In discussions I usually pitch in with lots of off-the-top-of-the-head ideas.

_____ 44. In meetings, I put forward practical realistic ideas.

_____ 45. More often than not, rules are there to be broken.

_____ 46. I prefer to stand back from a situation and consider all the perspectives.

_____ 47. I can often see inconsistencies and weaknesses in other people's arguments.

_____ 48. On balance I talk more than I listen.

_____ 49. I can often see better, more practical ways to get things done.

_____ 50. I think written reports should be short, punchy and to the point.

_____ 51. I believe that rational, logical thinking should win the day.

_____ 52. I tend to discuss specific things with people rather than engaging in 'small talk'.

_____ 53. I like people who have both feet firmly on the ground.

_____ 54. In discussions I get impatient with irrelevancies and 'red herrings'.

_____ 55. If I have a report to write I tend to produce lots of drafts before settling on the final version.

_____ 56. I am keen to try things out to see if they work in practice.

_____ 57. I am keen to reach answers via a logical approach.

_____ 58. I enjoy being the one who talks a lot.

_____ 59. I discussions I often find I am the realist, keeping people to the point and avoiding 'cloud nine' speculations.

_____ 60. I like to ponder many alternatives before making up my mind.

_____ 61. In discussions with people I often find I am the most dispassionate and objective.

_____ 62. In discussions I'm more likely to adopt a 'low profile' than to take the lead and do most of the talking.

_____ 63. I like to be able to relate current issues to a longer term bigger picture.

_____ 64. When things go wrong I am happy to shrug it off and 'put it down to experience'.

_____ *65.* I tend to reject wild, off-the-top-of-the-head ideas as being impractical.

_____ 66. It's best to 'look before you leap'.

_____ 67. On balance I do the listening rather than the talking.

_____ 68. I tend to be tough on people who find it difficult to adopt a logical approach.

_____ 69. Most times I believe the end justifies the means.

_____ 70. I don't mind hurting people so long as the job gets done.

_____ 71. I find the formality of having specific objectives and plans stifling.

_____ 72. I'm usually the 'life and soul' of the party.

_____ 73. I do whatever is expedient to get the job done.

_____ 74. I quickly get bored with methodical detailed work.

_____ 75. I am keen on exploring the basic assumptions, principles and theories underpinning things and events.

_____ 76. I'm always interested to find out what other people think.

_____ 77. I like meetings to run on methodical lines, sticking to laid down agenda, etc.

_____ 78. I steer clear of subjective or ambiguous topics.

_____ 79. I enjoy the drama and excitement of a crisis situation.

_____ 80. People often find me insensitive to their feelings.

Peter Honey, 1982

LEARNING STYLES - GENERAL DESCRIPTIONS

ACTIVISTS: Involve themselves fully and without bias in new experiences. They enjoy the here and now and are happy to be dominated by immediate experiences. They are open minded, not sceptical, and this tends to make them enthusiastic about anything new. Their philosophy is, "I'll try anything once!" They dash in where angels fear to tread. They tend to throw caution to the wind. Their days are filled with activity. They revel in short term crisis fire fighting. They tackle problems by brainstorming. As soon as the excitement from one activity has died down they are busy looking for the next. They tend to thrive on the challenge of new experiences but are bored with implementation and longer term consolidation. They are gregarious people constantly involving themselves with others but, in doing so, they hog the limelight. They are the life and soul of the party and seek to centre all activities around themselves.

REFLECTORS: Like to stand back and ponder experiences and observe them from many different perspectives. They collect data, both first hand and from others, and prefer to chew it over thoroughly before coming to any conclusion. The thorough collection and analysis of data about experiences and events is what counts so they tend to postpone reaching definitive conclusions for as long as possible. Their philosophy is to leave no stone upturned. "Look before you leap!" "Sleep on it!" They are thoughtful people who like to consider all possible angles and implications before making a move. They prefer to take a back seat in meetings and discussions. They enjoy observing other people in action. They listen to others and get the drift of the discussion before making their own points. They tend to adopt a low profile and have a slightly distant, tolerant, unruffled air about them. When they act it is part of a wide picture which includes the past as well as the present, and others' observations as well as their own.

THEORISTS: Adapt and integrate observations into complex but logically sound theories. They think problems through in a vertical, step by step, logical way. They assimilate disparate facts into coherent theories. They tend to be perfectionists who won't rest easy until things are tidy and fit into their rational scheme. They like to analyse and synthesise. They are keen on basic assumptions, principles, theories, models, and systems thinking. Their philosophy prizes rationality and logic. "If it's logical, it's good!" Questions they frequently ask are, "Does it make sense?" "How does this fit that?" "What are the basic assumptions?" They tend to be detached, analytical, and dedicated to rational objectivity rather than anything subjective or ambiguous. Their approach to problems is consistently logical. This is their 'mental set' ands they rigidly reject anything that doesn't fit with it. They prefer to maximise certainty and feel uncomfortable with subjective judgements, lateral thinking, and anything flippant.

PRAGMATISTS: Are keen on trying out new ideas, theories, and techniques to see if they work in practice. They positively search out new ideas and take the first opportunity to experiment with applications. They are the sort of people who return from management courses brimming with new ideas that they want to try out in practice. They like to get on with things, and act quickly and confidently on ideas that attract them. They don't like 'beating around the bush' and tend to be impatient with ruminating and open-ended discussions. They are essentially practical, down-to-earth people who like making practical decisions and solving problems. They respond to problems and opportunities as "a challenge." Their philosophy is, "There is always a better way," and "If it works it's good."

APPENDIX C

41 Aster Avenue,
Willetton, W.A.6155,
November 26th 1992.

Dear *Professor,*

I have recently had my Ph.D. proposal accepted by *University A*. My research focuses on the past, present, and future perceptions of the learning experiences of the women students, particularly in the traditionally "masculine" subjects associated with the discipline of Engineering. The subjects of my research are first and fourth year women in Engineering at both *University A* and the *University B*. I have been given approval for my research by the Head of Engineering in both institutions. On their recommendation, I have worked in conjunction with the *WISE coordinators at University A and University B* during the past year.

Having been a lecturer in teacher education for the past twenty years, I am well aware that the perceptions of reality of educational situations can be interpreted from multiple perspectives. I should very much appreciate interviewing you, as a departmental head, to gain insight into your perception of the learning environment in which these women develop their skills and capabilities as engineers.

Anticipating your willingness to help, I enclose a number of key questions that will form the basis of our discussion. I will phone your secretary in the new year in the hope that a mutually convenient time can be arranged.

Yours sincerely,

Lesley Newhouse-Maiden

Questions for proposed discussion with the Head of Engineering Departments at University A and University B

1) Do you think that the Equal Opportunity and Affirmative Action policies of the University per se have established a 'climate for change' with regard to educating and valuing women's contributions at university, particularly in traditionally "masculine" disciplines?
2) How far in your opinion have these policies:
   a) been adopted by your Department of Engineering;
   b) influenced changes in the structure of your Department of Engineering; and
   c) influenced changes in the traditional teaching and assessment practices?
3) a) What is the prevailing philosophy of your department with regard to the role of engineering in the 1990's?
   b) How does this philosophy relate to the perceived roles of men and women in their career paths, counselling and caring for students, and prospects of future work in your field of engineering?
4) How far have the structures within the Department changed in relation to women lecturers' positions? (e.g. Is there a clear differentiation in the roles of men and women lecturers in the department?)
5) To what extent does your department recognise and act upon the problems and concerns of, and for, women to enable their talent and potential to flourish in the field of Engineering?
6) How does your department promote engineering as a career path for women ?
7) How emancipatory do you perceive the pursuit of engineering to be for women?
8) Do the teaching styles and strategies of lecturers, when teaching technology, take into account the feminine perspective ?
9) Are women who withdraw from engineering courses followed-up to ascertain reasons why?
10) In your opinion are there any other factors, either internal or external, that may affect the career path of women in your branch of engineering?

APPENDIX D

41, Aster Avenue,
Willetton, W.A. 6155.
January 31st. 1992

Dear Sara,

Thankyou for helping me to set up the first stage in my qualitative research study, under the auspices of University A, which is specifically related to the experiences of women in engineering. I hope that you will also help by providing me with a retrospective account of your academic life and career path, from the viewpoint of a successful woman graduate in engineering, who is now actively seeking employment. I also intend to engage both first and final year women engineering students in the keeping of a journal to record "critical experiences" in their study of the field of engineering. This, according to the research, is a purportedly masculine discipline, which does not easily accommodate to the needs and experience of women.

I enclose an autobiographical questionnaire, which I hope you will complete, since it will provide me with useful background information about your early socialisation and influences on your choice of career. Such information is **completely confidential.**

Since retrospective journalling often clarifies which were the important perennial issues and which, in hindsight, were the relatively unimportant issues I would also ask you to reflect in "journal form" your responses to the following points:

a) What are your impressions of being a female who has successfully completed a degree in a traditionally masculine field of endeavour?

b) i) What types of "critical incidents" did you encounter during your engineering degree course? (for example, with regard to advice/decisions about career paths; relative absence of female engineering role models; difficulties with aspects of the course content and practices; "marginality" of women in interaction in the classroom/fieldwork or in the literature of engineering; differential treatment and/or

interactions between males and females in a traditionally masculine knowledge area; evaluation procedures).
b) ii) How did you resolve these issues personally and professionally?

c) What sort of "coping mechanisms" did you utilize and how effective were these? (e.g. humour, 'opting out for a while', challenging sexist remarks, networking with other females).

d) Are you now seeking employment in engineering? or using your degree to pursue another career?

e) If engineering, are your preferences for deskwork, fieldwork/practical or a combination of both?

f) Would the physical conditions and / or your own physique be a limiting factor in the particular job specifications in this field?

g) How do you feel about working predominantly with male engineers?

h) What as a female do you think you can contribute to the field of engineering?

i) Are there any other pertinent points you wish to add?

As you can see some of these questions are presuming key gender differences, but my task is to either affirm the current research findings and/or most importantly to find out how the women engineers perceived /perceive their particular situation as a minority group working in a male dominated field of study and work.

May I emphasise again that should you respond, and I hope you do, that there will be **complete confidentiality of information**.

Yours sincerely

36, Hackney Way,
Yanchep, W.A. 6035.
July, 31st. 1995

Dear Sara,

I enjoyed talking with you face to face yesterday, and I congratulate you on your new appointment - how exciting after three years in the electronic engineering industry to move to pastures new, in Brisbane. Thankyou for agreeing to reflect on this phase of your career path, your expectations of your new position, your current aspirations, and vision of your future aspirations. All this now from the perspective of a **successful** engineer with **three** years of professional experience.

Thankyou for agreeing to be an extended case-study 'voice' of a woman called **Sara**. My research shows that Engineering education continues to be a masculine discipline in both theory and day to day practice, through the perceptions of the participants in my case study in two tertiary institutions in Perth. Such a 'masculine model of curriculum' has not accommodated to the needs and experiences of women, despite the reforms in the formal curriculum.

I have included in this letter a special section for women, who are qualified and currently in Engineering in the field, rather than academia. Such information will be **completely confidential.** Since **retrospective** journalling often clarifies which are the **important perennial issues** and which, in hindsight, were the relatively unimportant issues, you faced. I would also ask you to reflect in "journal form" your responses to the following specific points:

a) What are your over all impressions of being a woman who has successfully completed her first three years in a traditionally masculine field of endeavour?

b) i) What types of "critical incidents" have you encountered since we last 'touched base'? (for example, with regard to advice / decisions about career paths; relative absence of female engineering role models; difficulties with aspects of the content, skills and practices; "marginality" of women in interaction in work-interaction or in the literature of engineering; differential treatment; use of your time (in and out of hours))

b) ii) How did you resolve these issues personally and professionally?

c) What sort of "coping mechanisms" did you utilise and how effective were these? (e.g. humour, 'opting out for a while', challenging sexist remarks, networking with other females).

d) i) When did the idea about seeking a **new** job begin to formulate?
ii) what sort of a position were you hoping for ?
iii) Was it a different type of work/research/design within engineering?
iv) are your preferences for deskwork, fieldwork/ practical, research/design, and/or management ? Please state.
v) Do you aspirations ever to include academia and become an engineering lecturer?

g) Have the physical conditions and / or your own physique been a limiting factor in the particular job specifications in electronic engineering?

h) i) How have you felt about working predominantly with male engineers and men in the workplace?
ii) How effective and helpful were the 'mentors' in your firm, has the scheme continued over the three years for you?
iii) Are there any other women engineers in your current position?
iv) Will there be any women engineers in the new position?
v) Is it a promotional position for you in the new job?

i) Has the nature of the task in engineering changed as your life circumstances have changed? or as the level of your confidence and competency has increased?

j) What, as a female, do you believe you **have** contributed to electronic engineering, and **hope** to contribute in your new job?

k) Have you ever been experienced any harassment / discrimination in your present workplace because you are a woman?

l) i) Has your family continued to enhance your expectations for life, work and being uniquely you? In what ways?
ii) How comfortable do you feel about leaving your parents and other family members by going inter-state?

m) i) Do you have a special male friend (out of work)?
ii) If so, how has he affected your selfhood, your attitude to life-enhancing work, self image and relationships towards others?

n) Have your friends enhanced your perceptions of selfhood, work and growth in confidence and worth?

o) How reciprocal are these facets of your relationships with friends?

p) How has formal study and this three year position in electronic engineering helped in the development and understanding of self, purpose, personal satisfaction and relationships with others?

q) How helpful are the organisational structures in your work-place in promoting fulfilment, creativity and a sense of worth in each individual?

r) What about interests out of work? (Type(s) and Time availability)

s) What about leisure? (Type and Time availability)

t) i) What about leaving the community (Church fellowship)?
ii) In what ways have you outreached to the community?
iii) Does your firm encouraged an involvement with the schools to promote engineering? What do you think about this as a form of education for young people?

u) i) How has your perception of being an engineer changed with this engineering position, and your perception of electronic engineering?
ii) Are you still comfortable with 'software' as your particular niche?
iii) What aspects have become a 'passion' or special interest to you?

iv) Are you concerned about the ethics and moral issues in electronic engineering? (say need for censorship in 'software? Is this important to you?)

v) Are there any other pertinent points / or general observations you wish to add?

As you can see these questions are **presuming** key gender differences and experiences in engineering education and work. My task has been both to affirm the current aspects of research findings related to women in engineering, and most importantly to find out how women engineers perceived / perceive their particular situation as a minority group working in a male dominated field of study and work in Western Australia in the 1990's.

May I emphasise again that there will be **complete confidentiality in the source of the information**.

All the very best in your new venture, I do hope it fulfils your expectations do keep in touch.

Lesley Newhouse-Maiden

APPENDIX E

CLARIFICATION OF METHODOLOGY FORM

41, Aster Avenue,
Willetton W.A. 6155
May 18th 1993

Reference Ph.D. research related to Women in Engineering, with a particular focus on first year and final year women

It would be helpful to me to find out the reasons why it was not possible for you to complete the Autobiographical Questionnaire and Learning Style Inventory
For example:
A) Invasion of privacy? Y / N Too busy? Y / N Forgot about it? Y / N
Anonymous researcher was irritating? Y / N Too time-consuming? Y / N
Please add any other reasons or comments about " being researched"

B) Issue of being a "woman in engineering" perceived by you as unimportant or as a non-issue Y / N

No differences if you are a man or a woman studying engineering? Y / N

Very "comfortable" as a woman studying engineering? Y / N
Any other reasons? Y / N
Please comment :

NAME or 'nom de plume' (if you wish to) :
Branch of Engineering :
Would you be willing to complete the learning style inventory at this time? Y/N
Would you be willing to complete the questionnaire at a later date? Y/N

Would you be prepared to discuss your experiences in engineering with me later in the semester / year? Y / N.
If yes, would you either give a contact telephone number _____ or phone me on 457 1497 (H) 3706527 (ECU)? Y / N
Please return to me in the stamped addressed envelope enclosed.

Thank you for your help. Lesley (Newhouse-Maiden)

APPENDIX F

ENGINEERING WOMEN - 'TOUCHING BASE' WITH FORMER FIRST YEARS (1994) - feed back on 1993

1. Exam success this Year *[Repeats some]

2. Were your horizons stretched in your identification as ‘an engineer’ and 'the nature of engineering'? How?

3. Do you have any comments on the quality aspects of the teaching strategies provided by your lecturers?

4. Have you still motivated and interested in engineering? What new knowledge, skills, projects have you learned this semester?

5. Are you struggling with any aspects of the course at present?

6. How are your computer skills and competence developing?

7.What aspect of engineering is really interesting you at present?

8. Do you work in groups formally on tasks, projects, lab work?

9. Do you work informally on projects, assignments?

10. Do you have a buddy if so who?

11. Did you receive any help in ‘learning the ropes about engineering from:
a) Lecturers, Heads of Department, tutors?
b) Other students, same year, other years?

12. a) Any ‘crises’ or ‘critical incidents’, last year?
b) If so, What was the nature of the crisis? (Public or private?)
c) If so, how did you resolve the situation, problem?

13. Are you a ‘buddy’ to any first years?

14. Are you getting continued support from your family?

15. Are you having quality time with family?

16. Support from friends outside faculty?

17. Are you having quality time with friends?

18. Have you time for leisure interests (including sport)?

19. Have you time for other activities (community, church, coaching)?

20. Have you a part-time job?

Any other comments about the coming year?

Thank you again

Lesley

ENGINEERING WOMEN - 'TOUCHING BASE' WITH FORMER FIRST YEARS

Please comment on:

1. Exam success in Second Year

2. To what extent were your expectations of the Engineering Course (your branch) met in second year?

3. Were your horizons stretched in understanding what it is like to be 'an engineer' and 'what the nature of engineering' is? How?

4. Do you have any comments on the quality aspects of the teaching strategies provided by your lecturers?

5. Are you still motivated and interested in engineering? What new knowledge, skills did you learn in second year?

6. a. Did you struggle with any aspects of the course last year?
   b. Are you struggling with orienting to any aspects of the course at present?

7. How are your computer skills and competence developing?

8. What aspect of engineering is really **interesting** you at present?

9. Do you work in groups **formally** on tasks, projects, lab work?

10. Do you work in groups **informally** on projects, assignments?

11. Do you have a 'buddy' to work formally/informally alongside? If so whom?

12. Did you receive any help in 'learning the ropes' about engineering from:

    a. Lecturers, Heads of Departments, tutors?
    b. Other students, same year or other years?

13. a. Any 'crises' or 'critical incidents' this semester?
    b. If so, what was the nature or the crisis (public or private)?
    c. If so, how did you resolve the situation, problem?

14. Are you a 'buddy' to any first years?
15. Are you getting continued support from your family?

16. Are you having quality time with family?

17. Support from friends outside the faculty?

18. Are you having quality time with friends?

19. Have you time for leisure interests (including sport)?

20. Have you time for other activities (community, church, coaching)?

21. Do you have a part-time job?

Any other comments about the coming year?

Thank you again

Lesley

ENGINEERING WOMEN - 'TOUCHING BASE' WITH FORMER FIRST YEARS (1996)

Please comment on:

1. Exam success this Year:

2. To what extent were your expectations of the Engineering Course (your branch) met this year?

3. Were your horizons stretched in your identification as 'an engineer' and 'the nature of engineering'? How?

4. Do you have any comments on the quality aspects of the teaching strategies provided by your lecturers, particularly the way(s) they facilitated your learning?

5. Have you continued to maintain your motivation and interest in engineering? What new knowledge, skills, projects were you engaged in this year? How successful were you? Do you think these learning experiences will help later in the work-place?

6. a. Did you struggle with any aspects of the course this year (eg content, skills, projects, your own feelings)?
   b. What were the most exciting aspects of the course this year?

7. How did the computer aid your work? How high are your feelings of confidence, and actual competence in computer-assisted work and education in engineering now?

8. What aspect of engineering is really **interesting** you at present?
   Any changes in type of work aspirations for the future (eg Research, Design, Management, Tertiary lecturing)?

9. Did you work individually and/or in small groups **formally** on tasks, projects, lab work, this year?

10. Do you still work in groups **informally** on projects, assignments, or is it more competitive as the course progresses?

11. Do you have a 'buddy' to work formally/informally alongside? If so whom?

12. How helpful have the following people been to you this year in engineering:
    a. Lecturers, Heads of Departments, Tutors? How?
    b. Other students, same year or other years? How?
    c. Institute of Engineers? (eg Mentors, Women's Branch)

13. a. Any 'crises' or 'critical incidents' this year?
    b. If so, what was the nature of the crisis (public or private)?
    c. If so, how did you resolve the situation, problem, challenge?

14. Are you a 'buddy' to any first years? Is it important to help them?

15. Did your family support you well this year? In what ways?

16. Are you having quality time with family?

17. What type of support from friends outside the faculty?

18. Are you having quality time with friends?

19. Have you time for your leisure interests (including sport)?

20. Have you time for other activities (community, church, coaching)?

21. Do you have part-time work in the engineering field or other?

22. **Graduating students** - did you have any interviews for first postings? How did you find the interviewing process? Any biases, fair, equitable?

Any other comments about your life next year?

Thank you again,

Lesley LNM11/96

FORMER FIRST YEARS (December, 1997)

Please answer the following questions on your life-career development :

1. What were your Academic and/or work-place **achievements** this year?:

2. To what extent were your **expectations** of the Engineering Course (your branch)/or new posting/ or higher degree/ met this year?

3. Are your horizons continuing to be stretched in your **identity** achievement as 'an engineer', and in your **construction** of 'the nature of engineering'? How?

4. What quality aspects of **mentoring** are provided by your lecturers/supervisors, particularly in the way(s) they have facilitated the progress of your project?

5. What **new** knowledge, skills, or problem-solving capabilities have you achieved this year? How successful have you been? How have your university learning experiences related to the work-place/or vice versa?

6. a. How have you maintained your **motivation** and **interest** in engineering? Did you struggle with any aspects of your course this year (eg content, skills, difficulty with projects, your own feelings of confidence)?

6. b. What were the **most exciting aspects** of engineering education/work-place experiences, this year?

7. How is the **computer helping** your work/ creativity/ problem-solving? How high are your feelings of confidence, and actual competence in computer-assisted work in engineering education/work-place?

8. Which aspect of engineering is really **interesting** you now?
Any changes in your aspirations for the type of work? (eg Research, Design, Management, Tertiary lecturing)?

9. How you like the more **individual** nature of your engineering education project this year? Are there are opportunities for small group interaction?

10. Is it more **competitive** in your final year/PhD/Masters studies/work situation? Do you still work with peers **informally**?

11. Do you have a **special 'buddy'** to work alongside? If so whom?

12. How helpful have the following people been to you this year in engineering? (eg. educationally, counselling, encouragement, 'learning the ropes'):

a. Lecturers, Heads of Department, Tutors? How?
b. Other students, same year or other years? How?
c. Institute of Engineers? (eg Mentors, Women's Branch, journals)
d. Work place sites? (Mentors/supervisors/others)?

13. a. Any **'crises' or 'critical incidents'** this year?
b. If yes, what was the nature of the crisis (public or private)?
c. If yes, how did you resolve the situation/ problem/challenge?

14. In your opinion, is it important to be a **'buddy' to younger students**?

15. Do your **family of origin** still support you well? In what ways?

16. Are you having any **quality time** with your family of origin?

17. Is there mutual support with **friends outside** the faculty/work-place?

18. Are you having **quality time** with friends/special friend?

19. Have you time for your **leisure** interests (including sport/hobbies)?

20. Have you time for **other** activities (community, church, coaching)?

21. Do you have work in the engineering field/other work/ or part-time study?

22. **Graduating women** - have you had any **interviews** for first postings?
If so, how did you find the interviewing process? Any biases, fair, equitable?

23. What about **job prospects** for next year? Any **other comments** about your life-career plans/ other issues?

Thank you again

Lesley
LNM12/97

APPENDIX G

METHODS AND PHASES OF COLLECTION OF PROFESSORS' AND WOMEN PARTICIPANTS' DATA

Phase One – Professors (Institution A)

Institution A Letter to Professors November 92	**Phase 1 Taped Individual Interview**	**Transcribed**	**Phase 1 Level 1 Learning Style Inventory**	**Analysis and Feedback of Professors' Learning Style**
Professor A	Telephone only	✓		
Professor B	9.2.93	✓	✓	28.9.93 Link to 4th Yr Women 16.9.93
Professor C	1.3.93	✓	On LSL 10.93 – 1.94	
Professor D	15.2.93	✓	✓	7.10.93
Professor E	9.2.93	✓	7.10.93	8.10.93 Link to Astrid PhD

Phase One – Professors (Institution B)

Institution B Letter to Professors January 93	**Phase 1 Taped Individual Interview**	**Transcribed**	**Phase 1 Level 1 Learning Style Inventory**	**Analysis and Feedback of Professors' Learning Style**
Professor F	9.2.93	✓	✓	15.2.94 Link to Sandie PhD
Professor G	9.2.93	✓	X	
Professor H	11.2.93	✓	X	Additional Interview 27.5.93 (Engineering tasks)
Professor J	3.2.93	✓	✓	7.2.94 Touched Base 95 Link Christie

PHASE ONE – EARLY 1992

Institution A – Pilot Study

	Autobiographical Questionnaire	Learning Style Inventory and Feedback	Touching Base
Cecilia **1st Year 1992**	Completed 23.4 1992 Kept a journal	LS Inventory sent Sept 1992 Learning style feedback 30.9.1992	April 1992 June 1992 December 1992 January 1993 May 1993 *Telephone each time*
Carolyn **1st Year 1992**	Completed 29.3.1992 Kept a journal	Learning style feedback 21.6.1992	June 1992 December 1992 July 1993 *Telephone each time*
Zumei **4th Year 1992**	Completed 24.1.1992 Kept a journal	Learning style feedback 24.7.1992	January 1992 July 1992 November 1992 Graduated 1993 *Telephone each time*

Phase One - Graduate Women Who Became Part of Study

	Autobiographical Questionnaire	Learning Style Inventory and Feedback	Touching Base
Sara **Graduated from Inst. B** **Dec 1991** ***(See Appendix D)***	Sent out January 31st 1992 Completed & returned	Sent LS Inventory 19.10.93	December 1991 May 1993 19.10.93 7.3.94 31.5.95 17.12.97 *Telephone each time*
Beth **Graduated from Inst. B** **Dec 1991**	Completed December 1992	Feedback 3.3.92	3.3.92 *(Letter)* 14.5.93 *(Telephone)* 15.10.93 *(Letter)*
Hettie **Graduated from Inst. B** **Dec 1991**	Completed 3.2.92	X	Dec 1992 *(Letter)*
Maggie **Graduated from Inst. B**	Completed 15.3.93	X	15.3.93 *(Letter)*

Dec 1980			

INSTITUTION B – PhD & Final Year Women

Name	Instruments	Phase Two Later in 1993 to Phase Three 1994-98
Sandie PhD	AQ LSI 18.10.93	TB – Taped interview November 93 29.8.95 – Telephone & feedback from sister
Haylia *(Final)*	AQ LSI 3.2.93	TB – 15.7.93 – Feedback on LSI – Telephone Interview 20.8.93 and assistance with essay on equity 1994 – after graduation - Telephone
Penny *(Final)*	AQ LSI 22.9.93	TB – Feedback 17.11.93 on AQ & LSI – Telephone December 93 - Telephone
Sue *(Final)*	AQ LSI Clarification of methodology	TB – Feedback on AQ & LSI 30.9.93 - Telephone 17.11.93 - Telephone
Tammy *(Final)*	AQ LSI 22.9.93	TB – Feedback on AQ & LSI 3.11.93 - Written December 93- Telephone
Robbie *(Final)*	AQ LSI Clarification of methodology	TB – Returned LSI 30.9.93 15.11.93 – Written analysis of LSI and progress during year December 94 – Telephoned talking about a job
Wendy *(Final)*	AQ LSI Clarification of methodology	TB – Feedback on LSI 8.2.94 Interview 28.7.93 & completed AQ & feedback on course & asked for assistance on essay on equity. Work 94 - Telephone
Ivonne *(Final)*	AQ LSI	TB – 9.93 – Completed AQ & LSI

INSTITUTION B – First Year Women 1993

Name	Instruments	Phase Two Later in 1993 to Phase Three 1994-98
Nichole	AQ LSI Clarification of methodology 18.5.93	TB – 20.9.93 Feedback on LSI – Written Jan 94 – Feedback on 1st year – Telephone Written – Dec 96 and 97.
Chantelle	AQ LSI	TB – Written on feedback of AQ & LSI 93 Feb/March 95 Feedback on 2nd year 23.7.96 - Written feedback on 3rd year progress.
Christie	AQ LSI	TB – 10.5.93 Feedback on AQ – Written 12.11.93 – Feedback on LSI – Written & follow-up telephone call Feb/March – Telephone Written 18.12.96 Telephone 14.7.97 Phone 9.8.97 Written 12.11.97 & follow-up LSI Written Dec 97. Written – 19.7.98 – affirmed inclusion in paper
Lois	AQ LSI	TB – 30.9.93 Completion of LSI Feb 94 – Completion of AQ with phone interview Dec 94 – Telephone Jan 95 – Phone. Dec 96 – Phone feedback on Year. 2.2.97 – Phoned to say she was offered honours.
Shelley	AQ LSI	TB – 2.94 Feedback on LSI. 12.94 Telephone feedback. Jan 1995; Dec 1996 – Written feedback on the year.
Anna	AQ LSI 30.9.93	TB – Oct 93 – Feedback on AQ and LSI. 11.93 – Written feedback on the year. Feb/March, 1995 – telephoned.
Angela	AQ LSI Clarification of methodology May 18th 1993	TB – 14.2.94 – Feedback on AQ and the year. Feedback on LSI part 2. Jan 95 – Telephone feedback. March 1997 – Written feedback on 1996.
Caren	AQ LSI 30.9.93	TB – Oct 93 – Feedback on AQ and LSI. Written – Dec 94;March 95; Dec 1997.
Emily	AQ LSI Clarification of methodology May 18th 1993	TB – May 93 feedback on LSI and telephone on progress. Telephone (July 94). Written 17th Dec 1996 – One year to go.
Jane	AQ LSI 30.9.93	TB – Feed back on LSI and program (10.93). Telephone Feb/March 95.
Kate	AQ LSI 30.9.93	TB – Feed back on LSI and program –Feb 94. Telephone – July 95. Written – Dec 95, Dec 96 and 14th Feb 98.
Louise	AQ LSI Clarification of methodology May 18th 1993	TB – Feedback on LSI and the year (2.94). Written feedback – Jan 96; 18.12.96; 3.8.97.
Lee Min	AQ LSI	TB – Feedback on LSI. Written feedback - May 93 and Nov 93.
Sylvia	AQ LSI 30.9.93	TB – Feedback on LSI (10.93). Telephone – July 94. Written feedback – Feb 96; Jan 97; and Dec 97.
Patricia	AQ LSI 30.9.93	TB – Feedback on AQ, LSI, and feedback on the year (Feb 94). Written feedback – 3.1.96; 10.1.97; 12.97.
Rebecca	AQ LSI 30.9.93	TB – Feedback on LSI (10.93). Telephone feedback – July 94; Dec 1995
Rosemary	AQ LSI 30.9.93	TB – 23.11.93 feedback on LSI and telephoned on the year. Written feedback – July 1995; 24.7.96; 23.9.97.
Sharon	AQ LSI Clarification of methodology May 18th 1993	TB – Feedback on LSI – 30.7.93. Telephone – early 94; Jan 95. Written – Dec 96 and Jan 97.
Vivienne	AQ LSI Clarification of methodology May 18th 1993	TB – Feedback on LSI and AQ, plus programme – early 94. Jan 1995 – telephone (move from Institution B). Institution A – Written feedback – Feb 96; 30.11.96; 12.96.
Katelyn	AQ LSI Clarification of methodology May 18th 1993	TB – Feedback on LSI and AQ, plus programme – 14.2.94. Telephone and written – Feb 1995. Telephone – Mother. Withdrew program after completing year.
Colleen	AQ LSI Clarification of methodology May 18th 1993	TB – LSI and AQ completed. Telephone – September 93. Withdrawal – September 93.

Table A: Collective Subjective Past Life-Career Rainbow – Institution A

INSTITUTION A							
	Mothers' Ed	**Mothers' Career**	**Fathers' Ed**	**Fathers' Career**	**Birth Order**	**Home Computer**	**Girls' Education**
Astrid	Secondary	Clerical	Secondary	Manager	B G S	No	K/Coed/Coed
Billie	Secondary	Pr. Sch. Librarian	Tertiary	Metallurgist	S G	No	K/Coed/Coed
Lin - (Malaysia)	Secondary	Self Employed	Secondary	Self Employed	G S B	Yes - Both	K/Coed/Coed
Zumei - (Malaysia)	Tertiary	Teacher	Tertiary	Civil Engineer	S B B	Yes - Both	K/Coed/SS
Aggie - (Malaysia)	Secondary	Clerical	Secondary	Manager	S B G B	No	K/SS/SS
Anita	Tertiary	Pr. Teacher	Tertiary	Sen. Mast. Phys Ed	S B B	Yes - Both	K/SS/SS
Jenny	Secondary	Secretary/h.m	Teriary	Engineer	B S G	Yes (No)	Coed/Coed
Mandy	Primary	Business Owner	Primary	Retired/Divorced	S	No	K/Coed/SS
Sally	Tertiary	Nurse Manager	Technical	Wkshop Manager	S G	No	K/Coed/SS
Steve	Secondary	Career Doubler	Secondary	In Workforce	S B B	Yes - Dad	K/Coed/Coed
Valerie	Secondary	Newsagent Owner	Secondary	Newsagent Owner	S G G	Yes - Mum	K/Coed/SS+Coed
Beverley - (Kenya)	Technical	Secretary	Technical	Tea Research	B G G S	Yes - Dad	K/Coed/Coed
Carolyn	Technical	Secretary	Technical	Sales Executive	G B G B S	Yes - Both	K/Coed/Coed
Cecilia	**Technical**	**Pers'l Assistant**	**Tertiary**	**Educ. Principal**	**S**	**Yes - Both**	**K/Coed/Coed**
Michelle	Tertiary	Maths Teacher	Tertiary	In Workforce	G S G	Yes - Both	K/Coed/Coed
Charlotte	Technical	Dental Nurse	Technical	Managerial	G S B	Yes - Mum	K/Coed/Coed
Helen	Secondary	Secretary	Technical	Westrail Foreman	G S B	Yes - Both	Coed/Coed
Lola	Tertiary	Nurse	Technical	Draftsman	B S G B G	Yes - Both	K/Coed/Coed
Marie	Secondary	Cook	Tertiary	Architect	S G	No	K/Coed/Coed
Terry	Tertiary	Librarian	Technical	Plumber	B S G	Yes - Both	K/Coed/Coed
Vivienne	Secondary	Home Maker	Tertiary	Engineer	B S	Yes (No)	Coed/Coed

Table B: Collective Subjective Past Life-Career Rainbow – Institution B

INSTITUTION B							
	Mo. Ed.	**Mo. Career**	**Fa. Ed.**	**Fa. Career**	**Birth Order**	**Home Comp**	**Girls' Education**
Maggie	Secondary	Own Business	Tertiary	Professor Eng.	S B G	No	K/Coed/SS
Haylia (Rumania)	Tertiary	Engineering*	Tertiary	Engineering	S	No	K/Coed/Coed
Beth	Secondary	Home Maker	Secondary	Sales	B S B G	Yes (No)	K/Coed/SS
Hettie	Tertiary	Research Officer	Tertiary	Accountant	S	Yes - Both	K/Coed/Coed
Penny - (UK)	Tertiary	Medical Doctor	Tertiary	Home Maker/Dr	B B S	Yes - Both	K/Coed/SS
Sandie	Tertiary	Home Maker	Tertiary	Metallurgy/Eng	G S	Yes - Dad	Coed/SS-Coed
Sara - (India)	Tertiary	Eng/Home Maker	Tertiary	Engineer	B S B	No	K/Coed/Coed
Sue	Tertiary	Architect	Tertiary	Architect	B S G	No	K/Coed/Coed
Tammy - (Zambia)	Tertiary	Nurse/H.Maker	Tertiary	Computer Cons.	S B G B	Yes - Dad	K/Coed/SS
Mars	Tertiary	Educator	Absent	Absent	S G	No	K/Coed/Coed
Robbie	TAFE	Draftswoman	Tertiary	Accountant	S G B	No	Coed/Coed
Wendy	Tertiary	Nurse	Tertiary	Computer Cons.	S G	Yes - Dad	K/Coed/Coed
Ivonne	Tertiary	Teacher	Tertiary	Ph D	S G G G	Yes - Both	K/Coed/Coed
Nichole	Tertiary	Primary Teacher	Tertiary	Sec. HOD	S G	No	Coed/SS
Chantelle - (Manila)	Tertiary	Maths Teacher	Tertiary	Systems Analyst	G S B	Yes - Both	K/Coed/Coed
Christie - (UK)	Tertiary	Research Scientist	Tertiary	Research Scientist	G S	Yes - Both	K/Coed/Coed
Lois	Secondary	Home Maker	Secondary	Bank Manager	S B	Yes (No)	Coed-SS/Coed-SS
Shelley	Secondary	Sec/Home Maker	Tertiary	Managing Director	S G	Yes - Both	K/SS/SS
Anna - (Italy)	Secondary	Dressmaker	Secondary	Stonemason	G S G G	No	Coed/Coed
Angela - (UK/Zimbabwe)	Secondary	Sec/Home Maker	Secondary	Own Business	S B	Yes (No)	K/Coed/Coed
Caren	TAFE	Sec/Account/HM	Tertiary	Civil Engineer	G B S	Yes - Mum	K/Coed/SS
Emily	Secondary	Secretary	Deceased	Deceased	G G S	Yes - Mum	K/Coed/Coed
Jane - (UK)	Tertiary	Counsellor	Tertiary	Medical Doctor	S G G B	Yes - Dad	K/Coed/SS
Kate	Tertiary	Primary Teacher	TAFE	Eng. Surveyor	S B B B	Yes - Both	K/Coed/SS
Katelyn	Secondary	Secretary	Tertiary	Accountant	G G S	Yes (No)	K/Coed/SS
Lee Min - (Malaysia)	Tertiary	Art Teacher/Nurse	Tertiary	Nursing Director	S G	Yes - Dad	K/Coed/Coed
Lisa	Secondary	Nurse	Tertiary	Accountant	B S B	No	Coed/SS
Patricia - (Wales)	Secondary	H.Maker/Beauty	TAFE	Electrician	G S	Yes (No)	K/Coed/SS
Rebecca	Tertiary	Nurse	Tertiary	Research Scientist	S G	Yes - Dad	Coed/SS
Rosemary - (Sri Lanka)	Tertiary	Home Maker	Tertiary	Public Servant	S B B B	Yes - Both	K/SS/Coed
Sharon	Secondary	Bridal Cons.	Tertiary	Comp.Programmer	G G S G	Yes - Dad	K/Coed/Coed
Sylvia - (Poland)	Tertiary	Draftswoman/H.M.	Tertiary	Civil Engineer	S B	Yes - Dad	Coed/SS
Louise	Tertiary	Teacher/H.Maker	Tertiary	Research Scientist	S B B B	Yes - Dad	Coed/Coed

Table C: Collective Subjective Present Life-Career Rainbow – Institution A

	1955	1960	1965	1970	1975	1980	1985	1990	1995+	Yrs in study
Remote Situational Determinants			Cooper 1968		Girls - School & Society		1984 - Girls & Tomorrow		C'wealth of Aust 1995	
INSTITUTION A							1987 - National Policy		I.E. Aust 1996 Roberts & Lewis	
							1988 - Higher Education Policies		Roberts & Lewis 1996	
Astrid		civil	b 66			uni 83-86	work		PhD graduate	Two
Billie		civil	b 67				surveying & P/T uni 85-93		work	Five
Lin - (Malaysia)		computer systems	b 68				Aust 87	uni 89-93	wk - Singapore	Two
Zumei - (Malaysia)		electronic		b 70			Aust 89	uni 89-93 (extra yr)	work	One
Aggie - (Malaysia)		electronic		b 71			Aust 89	uni 89-93		One
Anita		chemical		b71				uni 89-93		Two
Jenny		chemical		b 72				uni 89-93	work	Two
Mandy		chemical		b72				uni 89-93	work	Two
Sally		chemical		b 72				uni 89-93	work	Two
Steve		chemical		b72				uni 89-93	work	Two
Valerie		chemical		b 72				uni 89-93	work	Two
Beverley - (Kenya)		chemical		b 74				uni 92-96 (extra yr)		Four
Carolyn		chemical		b74 - W/D eng 94 - P/T pharmacy 95				uni 92-??		One
Cecilia		**electrical**		**b 74**				**uni 92-96**	**work**	**Eight**
Michelle		civil--->mechanical 95		b74				uni 93-96		Two
Charlotte		chemical		b 75				uni 93-96		Frive
Helen		civil		b 75				uni 93-96		Two
Lola		chemical		b 75				uni 93-96		Two
Marie		civil		b 75				uni 93-97 (some repts)		Five
Terry		chemical		b 75				uni 93-96	work	Five
Vivienne		civil - Inst.B-->A 94		b 75				uni 93-97		Five

Table D: Collective Subjective Present Life-Career Rainbow – Institution B

	1955	1960	1965	1970	1975	1980	1985	1990	1995	Yrs in study
Remote Situational Determinants			Cooper 1968		Girls - School & Society		1984 - Girls & Tomorrow		C'wealth of Aust 1995	
INSTITUTION B							1987 - National Policy		I.E. Aust 1996	
							1988 - Higher Educ. Policies	Roberts & Lewis 1996		
Maggie	b 58	civil			uni 76-79	work 80				One
Haylia (Rumania)		electrical	b 67	primary/sec school in Rumania			yr 12 - 89	uni 90-93	work 94	Two
Beth		electronic		b 70			uni 88-91	work 92		Two
Hettie		electronic		b 70			uni 88-91	PhD student 92-now		One
Penny - (UK)		environmental		b 70 - schooled in Aust				uni 90-93	work 94	Two
Sandie		civil-geomechanics		b 70 - single sex years 5-10			uni 88-91	PhD student 92-now		Four
Sara - (India)		electronic		b 70 - some primary school in India			uni 88-91	work 92		Five
Sue		mechanical		b 71			uni 89-93		work 94	Two
Tammy - (Zambia)		mechanical		b 71 - schooled in Aust				uni 90-93	work 94	Two
Mars		mechanical		b 72				uni 90-93	work 94	Two
Robbie		environmental		b 72				uni 90-93	work 94	Two
Wendy		civil		b 72				uni 90-93	work 94	Two
Ivonne		electronic		b 72				uni 90-93	work 94/PhD	Two
Nichole		civil		b 73			repeat uni yr 1	uni 92-96	work 97	Four
Chantelle - (Manila)		commerce/electronic		b 74		Aust 84		uni 93-97		Four
Christie - (UK)		environmental		b 74			year off	uni 93-97		Five
Lois		commerce/civil		b 74				uni 93-97		Five
Shelley		civil		b 75				uni 93-96	wk 97 P/T Masters #	Five
Anna - (Italy)		science/mechanical		b 75				uni 93-97		Three
Angela - (UK/Zimbabwe)		civil		b 75				uni 93-96		Four
Caren		civil		b 75				uni 93-96		Five
Emily		commerce/civil/mechanical		b 75				uni 93-97		Three
Jane - (UK)		civil		b 75 - Aust 77				uni 93		Three
Kate		commerce/mechanical		b 75				uni 93-97		Five
Katelyn		science/general engineering		b 75				uni 93(Eng) - 94(Med)		Three
Lee Min - (Malaysia)		science/general engineering		b 75 - Aust 76				uni 93		Two
Lisa		general engineering		b 75				uni 93 - w/d Sept.93		One
Louise		chemistry/mechanical		b 76				uni 83 - PhD 97		Five
Patricia - (Wales)		commerce/civil		b 75				uni 93-97		Four
Rebecca		physics/mechanical		b 75 - Chinese parents				uni 93		Three
Rosemary - (Sri Lanka)		science/mechanical		b 75			Aust 88	uni 93-97		Five
Sharon		civil		b 75				uni 93-96	work 97	Four
Sylvia - (Poland)		science/environmental		b 75 - Aust 76				uni 93-97		Four

Table E: Personal Determinants of Present Life-Career – Institution A

Personal Determinants							
INSTITUTION A	**Info Processing**	**Learning Style**	**Personality**	**Leisure Interest**	**Voc. Interest**	**Job/Research**	**Aspirations**
Astrid	I a d r s	a **r t p**	Shy/Independent	Crafts/Sport	Structural	Work/Ph.D/Mum	Lecturer
Billie	C v d/i a s	**A r t p**	Perseverance	Sport/House/Pets	Trades Assistant	Construction	Project Work
Lin - (Malaysia)	C v i a g	**a R T p**	x x	Music/Art	Computers	Engineer/Asia	Manager
Zumei - (Malaysia)	C a d a s	**a r T P**	x x	Cycling/Home	Design	Engineer	Career Doubler
Aggie - (Malaysia)	C v d r s	a **R t p**	Feminine	Music/Sport	Human Resource	Engineer	Career Doubler
Anita	C v i a g	**A** r **t** p	x x	Triathalon	Troubleshooting	Technology	Consultancy
Jenny	I v i r g	**a** r t p	Courage	Sport	Nuclear Design	Oil & Gas	Family in 5 Yrs
Mandy	C v d r s	a **r t p**	Confidence	Netball	Design/Legislation	Environ. Protect	R & D
Sally	C v d r g	**a r** t p	Proactive	Badminton	Chem. Engineer	Mining	Consultancy
Steve	C v d a g	**a R** t **P**	x x	Music/Fishing	Field Work	Chem. Plant	Career Doubler
Valerie	C v d r g	a r t p	x x	Reading/Cooking	Production Team	Mining	Change Career
Beverley - (Kenya)	xx	x x	Intuitive	Aerobics/Hockey	Fluid Mechanics	Chem. Engineer	Work in Africa
Carolyn	C v d a s	**A r** t p	x x	Orienteering	Pharmacy	x x	Travel/Outdoors
Cecilia	C a d r s -->	**A R t** p -->	Sense of Humour	Music/Home	Ethics/Generation	Consult/pt M Eng	Travel/Consult
Michelle	I v d a s/g	**a** r t p	Creative	Jazz Ballet	Design	Civil	Work Overseas
Charlotte	C a d r g	a **R** t p	Happy	Sport	Safety & Design	Food Industry	Management
Helen	C a d r s	**a r t p**	Sense of Humour	Music/Art/Karate	Struct. Analysis	x x	Construct. Tech.
Lola	I a i r g	**A R** t p	x x	Crafts/Reading	Design	x x	Chem. Engineer
Marie	C v d r g	a **r T** p	Courageous	Church/P.T.Job	Hydrology	x x	Environmental
Terry	I a d a s	a **R T** p	x x	Keeping Fit	Oil & Gas	Mining	Operational
Vivienne	C a i a g	**A r T p**	Single Minded	Gym/Netball	Oil & Gas	p/t Oil & Gas	Operational/Fam
Prof. B	C v i r s	**a r** t **P**					
Prof. D	I v d r s	**a R T P**					
Prof. E	C v i a s	**a R T P**					

Table F: Personal Determinants of Present Life-Career – Institution B

Personal Determinants							
Institution B	**Info Processing**	**Learning Style**	**Personality**	**Leisure Interest**	**Voc. Interest**	**Job/Research**	**Aspirations**
Maggie	xx	xx	xx	xx	xx	Manager/Family	Family/Work
Haylia (Rumania)	C/I v i/d r s/g	**a r t p**	Perseverance	Classical Music	Management	Electrical	MBA/Manager
Beth	xx	xx	Assertiveness	Aerobics	Technology	Mines/Gold	Astronomy/Family
Hettie	xx	xx	Flexibility	Aquariums	Solar Research	Ph.D	Job/Family
Penny - (UK)	I v d a g	a r **t P**	Caring	Scuba Diving	Environment	Consulting Firm	Career/Family
Sandie	C v d r s	**a R t** p	Perseverance	Craft/Tennis	Geomechanics	Ph.D	Industry/Research
Sara - (India)	C a i/d r/a s/g	**a R T P**	Faithfulness	Rowing/Crafts	Software	Software Consult	Family/Lecturer
Sue	I v d r g	**a r t** p	Outgoing	Art/Music/Sport	Teamwork	Oil Refinery	Consulting
Tammy - (Zambia)	C a d a s	**a R** t p	Happy	Cycling/Sewing	Robotics	Mining	Robotics
Mars	I a i r g	**a r t** p	Perseverance	Kayaking	Oil & Gas	Petroleum Co.	R & D/Overseas
Robbie	I v d r g	a **R T** p	Innovative	Netball/Music	Environment	Main Roads	Family/Travel
Wendy	C v/a d r s	a **R t** p	Singlemindedness	Art/Crafts	Construction	Civil Construction	Construction
Ivonne	C/I v d r s	**a** r t p	Hard Working	Music	Communications	Research Lab.	Ph.D
Nichole	C v i a s	**A r t p**	High Achieving	Travel/Netball	Design	Oil & Gas/Masters	Project Mgt
Chantelle - (Manila)	C v d a s	a **R T P**	Sense of Humour	Computer Games	Design	Electronics	Study Art/Admin.
Christie - (UK)	I a d a g	**A r t p**	Sense of Humour	Cooking/Gym	Waste Mgt	Mining Industry	Management
Lois	C v i a s	**A** r t p	Caring	Art/Cycling	Hons/Graphics	Civil	No Family/Asia
Shelley	I v d r g	**A r** t **P**	xx	Netball/Gym	Hons/Design	Job/Masters	Mgt/Design/Asia
Anna - (Italy)	C v i a s	a **R T** p	xx	Netball/Aerobics	Engineering	xx	Engineering
Angela - (UK/Zimbabwe)	xx	**A r t p**	xx	Aerobics/Squash	Design	xx	Mgt/MBA
Caren	C v i r s	**A r T P**	Diplomatic	Different Cultures	Hons Design	Civil Eng. UK	Ecology/Mgt
Emily	C v i a g	a **R t** p	Perseverance	Walking/Music	Computer/Design	Mechanical	Eng./Commerce
Jane - (UK)	C v d a s	**a r t** p	Courage	Music/Netball	Geomechanics	Civil	Engineering
Kate	C v i a g	**a R T P**	Creative	Sewing/Sport	Hons/Design	Mech. Design	Grad. Program
Katelyn	C a d r s	**a r** t p	Singlemindedness	xx	xx	Medical Doctor	xx
Lee Min - (Malaysia)	C v d r g	a **R T P**	Sense of Humour	Music	Chem/Engineering	xx	Uncertain
Lisa	I a d a g	**A r** t p	xx	xx	xx	xx	Medical Doctor
Patricia - (Wales)	C a i a g	**A** r t p	Shyness	Music	Hons/Naval Arch.	Oil & Gas	Consult/Ph.D
Rebecca	I a d r s	a **R T p**	xx	Sports/Movies	Physics/Mech.Eng	xx	Consulting
Rosemary - (Sri Lanka)	C a i r s	**a R T p**	xx	Stamps/Sports	Mining	Commerce/Eng.	Management
Sharon	C v d r s	a **R T P**	Hard Working	Sports	Geomechanics	Water	Civil/Mgt
Sylvia - (Poland)	I a d r s	**A** r t **p**	Hard Working	Cycling/Music	Hons/Environment	Main Roads	Management
Louise	I v i a s	**a r t p**	Self-acceptance	Aerobics/Art	Hons/Polymers	Ph.D/Tutor	Environ. Eng.
Prof. F	I v I r g	**a R T** p					
Prof. I	c v i a s	**a R T P**					

Table G: Cecilia – Key Events in Growth and Exploration Stages of Life-Career Rainbow

EVENTS	1974 - 79 (Pre-school)	1980 - 86 (Primary)	1987 - 91 (3 Different Co-ed High Schools)
REMOTE	Girls, school & society	Girls & tomorrow	National Policy for Education of Girls
IMMEDIATE			
Mother	TAFE/Career Doubler	PA in private company	Public Service - Levels 1 - 3 & P/T Study
Father	Uni/Teacher	HOD - Maths	HOD - Maths & Higher Degree Studies
Teachers	Poor teacher/pupil relations	Recalls positive & encouraging teachers	Teacher as role model - Mr Wilson - upper school physics/chem
THEME 1	**Vocational Identity & Interest Development - Feminine Ambivalent & Paver of the Way**		
Interests	Art - dolls - make believe - friends/family	Computer games - art - friends - bikes	Art - music - dance - gardening - movies - friends
Roles			
THEME 2	**School Curriculum - Gaining Knowledge & Skills for Engineering - Arts for Leisure**		
Curriculum	Art	Co-ed - maths - English - computing	Compulsory Ind.Arts & computing - increasingly gender inclusive
Subject Choices		Computing	3 yrs comp - drama- art - music - biol - maths - physics - chem - ind arts - econ - Eng lit
Career Choices			Year 11 - Began to think about possible future career- chem eng 1st - elect eng 2nd
THEME 3	**Milieux & Structural Organisation - Development of Group Identity**		
Milieu			Physics more boys - chem more girls - 50/50 in maths
Friends	Powerful influence	Again a powerful influence	Encouraging a professional vocation
Peers			Gender power-over relations
THEME 4	**Self Evaluation (Locus of Control)**		
Achievements	Early work ethic - creative artist	Good results in school	Widened her options - good results in all subject areas
Personality	Gregarious - persevering	Happy - friendly - hard working	Persistence of personality traits - sense of humour
Learning Style			Info Processing - Cadrs / Learning Style **Artp**
C.Adaptability			Strong future aspirations in eng

Table H: Cecilia – Key Events in Exploration Stage of her Life-Career Rainbow

EVENTS	1992	1993	1994	1995		1996	
REMOTE	Williams Report '88		Parr & Johnston '94	C'wealth of Aust '95		IE Aust '96 Roberts & Lewis '96	
IMMEDIATE	Prof D & Prof A			New HOD			
THEME 1	Development of Vocational Identity and Interests						
Engineering	Occupation	Specific to Electrical	Practical aspects	Sense of vocation - wk exp'ence -p/solving		Vocation/specific to self - positive re future	
Engineer		Starts to personalise	Ethical/Practical role	Joins IE - diversity of roles		Personalised role as a woman in engineering	
Self-Agency	Future aspirations	Overseas - barmaid		Overseas/German/Internet			
Superiors		Jane/Des (Eng Lecs)		Woman mentor from IE - electrical engineer - Fred (Lect) & R (wk experience) & Tom (tech)			
Interest Dev'ment			Ethics	Alternative energies/generation		Protection ethics	
THEME 2	Curriculum - Immediate Determinants of Career - Gaining Knowledge, Skills, Processing in Engineering						
Curric. Content	Theory/wk overload			Design specifications - electronics		Lack of linkage between work and university	
Curric. Skill	Lacks pract. applic'n	Practical oriented	Needed more practical help from lecturers-real P/S-wk experience			Poor computer resources	
Curric. Evaluation			Self evaluation is high	Questions reliability of texts & assessment		Structures of opportunity poor for women	
Learning Style	Mismatch - N/ach	More T/L match		Connected knower - lack of linkages		Very wary of small group learning	
Role of Lecturer	Anecdotal	Good teaching skills - Mr S (computing)		Lazy & unavailable in labs		Poor prep and communication skills	
THEME 3	Milieux & Structural Organisation - Task - Development of Group Identity - Immediate Situational Determinant						
Milieu	Chilly			Getting cold		Antagonistic	
Fellows	Some affable	Friends & peers + M	B (girl friend)	Males increasingly competitive & withholding information - e.g. C			
Superiors	Some approachable - Dr L			Limiting structures of opportunity - gender harassment & withholding info by S & B			
Self	Stranger - N/affiliation					Very wary of all the males	
Hidden Curriculum				Awareness of gender agenda & policy of advantage for males			
THEME 4	Self-Evaluation						
		Academic failure	Repeating Yr 2	Academic success/ARTP/Ivrds		Project & exam success & job success	

Table I: Cecilia – Key Events in Establishment Stage of Life Career

EVENTS		1997	1998	1999	2000
REMOTE	Comm of Aus 95; IE Aust '96; Roberts & Lewis '96		Lawrance et at 98	Thornton 99	Wkplace Amend Act
IMMEDIATE	Collective career of graduate participants - Goldflam 96		Max, Rod, Dick, Paul, Les - on site	City Office - Len	
THEME 1	**Vocational Identity and Interest Development in First Posting**				
Entering Behaviour of Cecilia		City Office (9th Floor)	NW site - contract	City office (7th Floor)	
Vocational Identity-Paver of the way		High el. Eng. Identity	Daughter of crisis in situ	Eng. Identity very low	
Voc Interests - Protection - Ethics		Protection match - no follow up	On site work	Voc interest very low	
Aspirations - Masters - Overseas		High of work place		Very low - lack of future hope	
Personality - Anxious - Perseverance		anxious of doing wrong thing	Self efficacy very low - stress symptoms	Daughter of crisis	
Sense of Humour		Caustic	Lacked it	Unhappy	
THEMES 2 & 4	**Work Experiences - Professional Development - Immediate Situational Determinant**				
Workplace experience		Mundane tasks - Lowered expectations	Pushed to hard edges - seat warming in city	Project mgr - promise unfulfilled	
Academic Achievements - 68% overall		Masters started (mature learning styles)	P.D. hampered - withholding of info	Masters on hold	
THEMES 3 & 4	**Milieux - Relationships Superiors/Fellows**				
Work Milieu	High expectations of superiors	Unsupportive mentors	Unprovoked work & gender harassment	Lack of strong mentor	
Relationships with Males		Fellows competitive - Putdowns	Same as previous year	Fellows negative	
Leisure Role		Some		Absence of leisure	
Family Role		Highly supportive	Supportive at a distance	Highly supportive	
Friendships		Outside engineering	In Eng. Fell away - except Marion	Withdrawal from friends	
Financial Investments		Living at home	House purchase - living away	Living at home	

APPENDIX J

(A) SUPERVISOR TALKS LESLEY TO LESLEY

Ph. D. Method - training in analysis of unorganised qualitative data - using NUDIST software - feedback

To : Professor Lesley Parker
From : Lesley Newhouse- Maiden.

Reference : Handling Qualitative Data with NUDIST. Workshop
Saturday, 14th December 1991, 9 am. to 4.30 pm.

I spent a most profitable day at this workshop related to the use of a software programme for indexing and analysing qualitative data in a highly systematic way, that did not negate the freedom required to build up conceptual frameworks and emergent theories in the field of social science research.

The software package is presently used in conjunction with Apple Mac Computers, but will be available on IBM computers in the New Year. I believe that it would be in the interest of the Faculty of Education to contact the School of Nursing since they hold the "site" licence for the "NUDIST" software programme at Churchlands. Does "site" equate with "university"? It would certainly save cash if it did and we were eligible to use the programme for our qualitative research in the field of education.

The programme has two major aspects a) indexing original documents, both off- and on-line, into a separate highly systematic system and b) a built-in capability, which is both flexible and rapid, to progressively build-up conceptual frameworks and emergent theories. The programme's approach is far more objective and structured than "pure grounded theory" approaches. It is eminently logical in its procedures and rapid, without constraining the researcher to linear lines of research. Nor do the programmers negate the importance of statistical input to substantiate the qualitative findings.

Dr. Lyn Richards, who co-devised the soft ware programme with her husband, is a Reader in Sociology and an expert in qualitative research. She combined both areas of expertise during the workshop, which gave us at the end of the day: a) a knowledge of the principles and workings of the software programme; b) a comparative understanding

of the theoretical standpoints of other eminent qualitative researchers internationally, so that she could more fully defend her more systematic approach to the 'steady' evolution of conceptual frameworks and emergent theories and; c) examples of the utility of the software extracted from her own sociological /social scientific research.

In summary, the software held for me, [as a pure scientist (originally), an educator interested in people's differing perceptions of reality and as a psychologist/sociologist aware of the myriad of variables influencing perceptions and actions], a high degree of objectivity when used to systematise vast quantities of unorganised data and a very effective means of flexibly linking concepts to facilitate the establishment of a conceptual framework from which a new theory may emerge in one's particular field of endeavour.

APPENDIX J

(B) ABSTRACT FROM THE "LESLEY JOURNAL", AS I GRAPPLED WITH MY PHILOSOPHICAL STANDPOINT

Methodology Precis 28th February, 1993.
Conscious of my re-readings of Jaggar's theory principles of change, I have visualised my own career as past, present and future and am mindful of her quote that Before we can act to change a situation ... we must know how it has arisen and evolved (Jaggar & Rothenberg, 1978, p. 137). Women's standpoint, according to Jaggar (1983, p. 386) and interpreted by Tong (1992), is a "kaleidoscope of truths, continually shaping and reshaping each other, as more and more women work and think together ... for what it means to be a woman" (Tong, 1992, p. 193).

The best definition I have found for Gender, as my key social construct of analysis is from the Penguin Macquarie Dictionary of Australian Education (Tardif & Atkinson, 1989), who defined 'gender' in relation to "power over" relations, which from my socialist feminist perspective, emphasised a social construct that still influenced the unhealthy construction of the 'male' and 'female' identity within social and vocational roles in Australia: - A term that encompasses the notion of power relations and patterns of separation between males and females. These relationships are socially defined and constructed and are not biologically given. Hence gender as a concept is differentiated from sex which is based on biological determinants (pp. 145-146).

Deep reflection on the definitive exposition of Sandra Harding on 'What is feminist epistemology?' (1991: 105-137) in her book Whose Science? Whose Knowledge? has provided me with a source of encouragement to express my Christian world view, since it can credibly be incorporated within the feminist standpoint epistemology. Such alleged subjectivity in arriving at the truth of a situation being researched and contributing to knowledge and understanding would have been unacceptable even a decade ago in both pure scientific inquiry and in the social sciences that adopted the scientific paradigm with "its purported attempts to provide 'pure' descriptions and explanations of the regularities and underlying causal tendencies in nature and social relations" (Harding, 1991:105).

Further she states that a reliable picture of women's worlds and of social relations between the sexes often requires alternative approaches to inquiry that challenges traditional research habits (p.118). Harding (1991: 105) also noted how impossible it was to explain both male and female biology, or men's and women's lives where: the conceptual schemes in these fields and the dominant notions of objectivity, rationality and scientific method were too weak, or too distorted in some way or another, to be competent even for identifying---let alone eliminating---sexist and androcentric assumptions and beliefs and where it was also the opinion of most scientists that this feminist perspective was politics, as opposed to reason and observation. In arguing for a feminist epistemology, Harding (1991: 118), considered the psychologist Carol Gilligan's study of women's moral reasoning to be important for philosophy as well as ethics (1982), and instanced the way Mary Belenky and colleagues (1986) found

developmental patterns in women's thinking about reason and knowledge that pointed to gender bias in philosophic and scientific ideals and suggested its origins in gendered experience. These distinctive features of women's situation in a gender-stratified society are being used as resources in the new feminist research.

As a Christian woman involved with qualitative research, I wish to facilitate others' understanding of my world view, by voicing the basic presuppositions on which it is based. My conception of reality is both spiritual and physical, and it will influence my interpretation of observed data, my adoption of aspects of feminist theories, that are commensurate with my own ethics and morality; and as a consequence the way I conduct my research and the level of disclosure in the written thesis. My Christian world view acts as a consistent reference point and brings a greater depth of understanding when feedback into the interpretation of data by personalities in my research and my own day by day living. Like Cassidy, 1989, and Darling, 1969, I am aware of a close relationship between my psychological and emotional development and spiritual development. For example, to address the issues of the epistemological basis of knowledge may be addressed at both the spiritual and the physical level of reality. I should emphasise that, I perceive little conflict in the notion of different perceptions of reality in our understanding and interpretation of knowledge. As a scholar, I acknowledge that I shall be a learner all my life on both physical and spiritual dimensions (Runner, 1982). Feedback for me requires reflection at a deeper spiritual level through reflective journalling and meditating on the Word of God (Darling, 1969). I gain my strength through my sense of connectedness with the Father, through His only son Jesus Christ (Buber, 1937).

In turn, I value the 'I-Thou' relationship, that this type of collaborative research engenders, and so the work of Oakley (1981) provides a template for the confidentiality and depth of relationship that can develop, as a consequence of personal disclosure (Collins, 1981). This thesis has provided me with an opportunity to live-out my Christian world view, combined with the getting of wisdom to apply these principles to living and learning in every-day life (Cassidy, 1989). As a Christian academic, I am conscious too of my moral responsibility to safeguard the women participants and their potential vulnerability in my evaluating, interpreting and publishing their experience of the engineering course (Collins, 1981). This may, of necessity, influence the inclusion or exclusion of such data in the final thesis. As I read feminist perspectives, and new interpretations of theories of learning, sociology and psychology, I have tried to integrate these new understandings and reconcile these to my Christian tenets, and the way I conduct my professional and private life. I am fully in agreement with Freire, when he speaks of the need for 'cultural synthesis', where each person finds a voice in order to work for the common good and to develop a better way of living for humankind (Freire, 1972).