

THE DEVELOPMENT OF A
CONCEPTUAL MAP OF SOFT
OPERATIONAL RESEARCH
PRACTICE

By

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Abstract

Soft Operational Research (Soft OR) puts facilitation at its core, but much of the research concentrates on the tools and techniques of Soft OR, such as Cognitive Mapping, Soft Systems Methodology and Systems Thinking. This thesis addresses the ambiguity of how facilitators use Soft OR in practice by emphasising the tool-user rather than the tool. By exploring the role of the facilitator, a conceptual map of Soft OR practice is presented.

A constructivist interpretation paradigm is used to explore the mind of the facilitator using a knowledge management equation of mental material, thinking and thought, as a means to explore, explain and build accounts of Soft OR practice. The research methodology used a triangulation approach, using a range of tools and techniques to gather data including repertory grid, interviews and critical incident technique. The data was derived from case studies of practitioners from British Airways, Shell International and Academic Users, who had a substantive knowledge of Soft OR practice. The interpretation and construction of a conceptual map used Nvivo as an indexing and exploration tool, whereas Decision Explorer was used as a viewing tool to articulate and shape a final account of Soft OR practice.

The research highlights how facilitators reconcile with reality based upon the use of natural discourse and congruence modelling to embed social knowledge as tacit knowledge. Facilitators at a metacognitive level adapt and change tools and techniques depending upon the circumstances and environment. It is recognised that the model in Soft OR is, in fact, a map in which territories are negotiated. The symbols in the map are cryptic labels of knowledge that capture discrepancy that goes beyond consciousness and reasoning. This is balanced with the use of every day discourse as a means to find usable

structures in the works of Soft OR. Combined, these factors represent a contribution to knowledge of how Soft OR practitioners assemble a cognitive understanding of situations and how they make decisions on how to proceed.

PUBLICATIONS RELATED TO
THE THESIS

Yeoman, I & Sparrow, J & McGunnigle, F (2000) "Accessing Knowledge at British Airways: The Impact of Soft OR". *Journal of Organizational Change Management*. Vol 13, No 2 pp121-139.

Yeoman, I. S. & Sparrow, J. (1999) "Soft OR: A Comparative Case Study of British Airways & Shell International". IFORS International Conference, Beijing, China, August.

Yeoman, I. Sparrow, J. Laybourn, P. Watson, S. Frew, A & McGunnigle, F (1999) "A Tourism Organisations Soft OR Practitioners Perceptions of Problem Structuring Methodologies". In Lockwood, A (Ed) Proceeding of the Eighth Annual CHME Hospitality Research Conference. April 7-9th, University of Surrey.

Yeoman, I.S. & Sparrow, J. (1997) "Facilitation and the Soft OR Process". Paper presented at the Operations Research Society 39th Annual Conference. 9-11th September. Bath University.

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INTRODUCTION

Soft OR is the use of pictures, maps, diagrams and models by facilitators / consultants in order to help people understand problems; or visual aids that facilitate conversation or dialogue between different participants; or a process that combines facilitation with models. Soft OR can be described as methodologies, tools, and techniques, which have fancy names such as 'soft systems methodology', 'cognitive mapping', 'systems thinking', 'strategic choice', 'hexagons', 'systems dynamics', etc., etc. These names are usually found within the operational research community (OR), hence the name Soft OR, but I prefer the definition of 'mathematical models without numbers'

Anon 2003

1 Introduction

There is a sense that 'something is missing', 'under estimated', 'not accounted for' or a 'lack of understanding' about the role of facilitation in Soft OR. It is suggested that facilitation is the key element that represents the 'practice of Soft OR'. This is a subject that according to Taket (2002), is crucial to the OR process, but not often written about in the OR literature or even taught on OR courses. It is only recently in the 1990's, that authors have started to write about facilitation and Soft OR. Papers and books by Eden and Ackermann (1998), Phillips and Phillips (1993), Mingers and Rosenhead (2001) and Robinson (2001) partially address facilitation within the context of one or more Soft OR techniques or methodologies. According to White (2002), many of the proponents of Soft OR, acknowledge the issue of facilitation through working with soft methods, in helping groups focus on the task and reducing distraction. The facilitator in Soft OR is often seen as being paramount to the success of the process, but it is a concept that is unexplained. This thesis

attempts to re-address that balance through a conceptual map¹ of Soft OR practice that identifies facilitation at its core.

1.1 Soft OR Practice and Facilitation

Within the Operational Research (OR) community the terms ‘practice’, ‘Soft OR’, ‘modelling’ and ‘facilitation’ are currently in vogue. These terms are aligned with the role and practice of Operational Research in the United Kingdom. *The Journal of the Operational Research Society* has recently published a range of papers on these topics (Keys & Midgley 2002; Pidd 2001; Tacket 2002; Mingers 2002a; Ormerod 2002a) that highlight the necessary research and debate in the subject. Ormerod (2002a:475) states that “OR is defined by its practice”, but this practice lacks understanding around the concept of facilitation. Robinson (2001) points out that the soft skills of OR are largely difficult to articulate and teach, but these are often the essential creative skills within OR. Skills that are ‘intangible’, ‘difficult to code’, ‘tacit’ and ‘only noticeable’ when something goes wrong. Munro (2001:52) describes this as *like riding a bike or a craftsman*, as craftsmen tend to use their tools subconsciously. There seems to be a lack of understanding of how Soft OR practice works at this subconscious level (Sparrow 1998).

One of the problems of studying Soft OR is the difficulty of distinguishing between the component parts. The component parts of Soft OR could be hypothesised to be ‘modelling’, ‘facilitation’, ‘tools’ and ‘consultancy’. These parts are not individual elements, but elements that are blurred at the edges. These elements make Soft OR a methodology and hence it is difficult to follow a reductionist viewpoint when trying to study the subject. Therefore, any study of Soft OR and facilitation, must study ‘the whole’ rather than the

¹ The term *map* is used throughout this thesis to imply *a guide to*, rather than model which means *final* or

individual part. In this thesis, the term Soft OR practice refers to the combined elements of 'modelling', 'tools', 'facilitation' and 'consultancy'.

Rosenhead (1997) views Soft OR as 'contaminated', implying practitioners alter and bastardise Soft OR tools and techniques. It is hypothesised that this 'contamination' of Soft OR practice, is based upon individual preference, circumstances and skills. Contamination overlaps with the subject of pluralism (White & Taket 1997), pragmatism (Ormerod 1997) and mixed-mode modelling (Ormerod 2001). These elements reflect what happens in the real world when Soft OR is put to use (Checkland 1981, Friend 2002, Eden & Ackermann 2002). There are many case studies that observe the practice of Soft OR, for example, Ormerod (1999, 1998, 1995) observes how Soft OR practitioners use and combine different tools and techniques in OR projects. These case studies observe the functionality of practice but do not get into the mind of the Soft OR practitioners or facilitators to understand how they make decisions of application and contamination.

Studies by Ackermann (1996), Phillips and Phillips (1993), and Vennix (1995), give functional accounts of how facilitation works in Soft OR. But these studies concentrate on what the facilitator should do rather than account for how facilitation happens from a cognitive perspective. Cognition and Soft OR is addressed by Eden and Ackermann (1998) in their book *Making Strategy; The Journey of Strategic Management*. The authors highlight how consultants and facilitators balance social and cognitive issues when treating practice as a negotiation process. The problem of accounting for the cognitive side of Soft OR practice is a problem of recall and observation. Previous studies by Ledington and Donaldson (1997), Munro and Mingers (2002) and

definitive (Huff & Huff 1990).

Mingers and Taylor (1992), are often cited as the best studies so far which address how practitioners actually use the techniques and methodologies of Soft OR. These papers address the ‘which method when’ (Munro & Mingers 2002) syndrome as practitioners move towards a pluralistic approach of combining several methods within an intervention; which coins the phrase ‘multimethodology’ (Mingers & Gill 1997). These studies have a range of fundamental and crucial flaws. As Munro and Mingers (2002: 378) point out:

We should first acknowledge the limitations of the research – the inevitably ad hoc nature of the sampling frame and its bias toward the UK; the inclusion of both OR practitioners and those from a systems background; differences of interpretation of terms within the questionnaire; the subjectivity of certain answers, especially concerning the success of particular methods; and the problems of incorrectly completed questionnaires.

Additionally, all of these studies use a survey method to try and capture the reality of Soft OR practice. Ledington and Donaldson (1997; 239) and Munro and Mingers (2002) identify the problem of the researcher trying to interpret cognitive decisions using a quantitative survey technique, which is not appropriate when addressing the complexity of a Soft OR practitioner’s mind. These studies asked participants to recall the practice of Soft OR in an environment of ‘after the event’ and in many cases substantially later. For example, Ledington and Donaldson’s (1997) survey of Soft Systems Methodology (SSM) users, asked participants to recall their practice of SSM according to Checkland and Scholes (1990) four point criteria. Participants had difficulty making a judgement of when they had in fact used Checkland’s SSM against this criteria. Hence, Ledington and Donaldson (1997:239) observe:

It is difficult to envisage how a claim to be using SSM might be objectively verified.

To overcome many of these problems, this thesis attempts to explore the mind² of the Soft OR practitioner in a qualitative manner rather than quantitative survey method. As Grinyer (2000) and Mezias *et al* (2000) point out, facilitation is a cognitive process as the facilitator develops his or her own conceptual model of the critical issues around them. This thesis attempts to construct and explore the world of the Soft OR practitioner through developing a conceptual map that goes beyond Munro and Mingers' (2002: 369) 'which method when'. It also explains Rosenhead's (1997) contamination theory and supports Ormerod's (2002a) justification that OR is shaped by its practice.

Ackoff (1987) discussion on the relevance of OR in a modern world and the subsequent marginalisation of OR, through the integration of analytical techniques which are no longer the preserve of the OR community, has partially led to the growth of a number of so called Soft OR techniques (Fildes & Ranyard 1997). This sense of past, tying to present has a relevance to the practice of Soft OR as Sparrow (1998) hypothesises that Soft OR is tied up with the past in a world of rationality, logic and formality. It is Soft OR's connection to rationality and reasoning (Pidd 2001, Eden and Ackermann 1998) that ties it to the past. Sparrow recognises that Soft OR has witnessed a movement from a need to work with logical and optimal solutions towards the use of processors that structure and amplify the thinking of participants that is more than reasoning and logic. Sparrow observes that supporting participants in a problem solving process, entails more than knowledge that is conscious

² The term 'mind' is described as *the collective cognitive knowledge of the individual*, taken from the works of John Sparrow and his book *Thinking in Organisations*. Sparrow's work is referred to, throughout this thesis.

and rational. Sparrow's (1998) equation propositions that knowledge has three dimensions, five kinds of mental material, two forms of thought and three types of thinking. Therefore, Sparrow represents knowledge as an equation:

$$\textit{Knowledge} = \textit{mental material} + \textit{thought} + \textit{thinking}$$

Sparrow's equation provides a useful means to explore the world of the Soft OR facilitator to interpret, assemble and account for, how Soft OR practitioners or facilitators develop a conceptual map of Soft OR practice. Sparrow's equation represents the breadth and diversity of knowledge classification that captures the richness of cognition. Although Sparrow's equation is not infinite or perfect, it is useful³ as a means to interpret the mind or the cognitive processes of the Soft OR practitioner.

White (2002: 152) describes Soft OR as *facilitating modelling or visual aids facilitating conversation or dialogue to take place between different participants*. It is the words of 'modelling' and 'facilitation' that have a local meaning to Soft OR that needs an integrated explanation. The use of models in Soft OR methodologies such as Cognitive Mapping (Eden and Ackermann 1998), Soft Systems Methodologies (Checkland 1981), Systems Thinking (Senge 1992), and Strategic Choice (Friend 2001), set out to help participants capture, analyse, and feed back a problem under discussion, in order that problems can be actioned. According to Rosenhead (1989a) Soft OR methodologies provide decision-makers with a means to identify a problem and frame a problem, capturing stakeholders perspectives and the richness of discourse. This enables solutions to be generated in a feasible and political

³ Throughout this study, Sparrow's (1998) equation was used as a 'viewing tool' in order to construct and interpret accounts of Soft OR practice. It is used within the essence of constructivist interpretation, where the equation is not deconstructed but accepted as purposeful. Such an understanding allows the researcher to use the equation as a framework in order to make sense of phenomena of Soft OR.

manner, leading to resolution. What is not understood, is how facilitators or Soft OR practitioners, assemble a cognitive understanding of the situation and make decisions on how to proceed.

The purpose of this thesis is to construct a conceptual map of how facilitators work in the world of Soft OR practice. A contribution to knowledge is recognised, based upon a gap in the literature which does not account for the reality of Soft OR practice and flaws in previous studies. A contribution to knowledge is based upon connecting multimethodology, plurality and contamination through the world of the Soft OR practitioner or facilitator. This thesis takes a cognitive approach to explain the world of Soft OR. It is hypothesised that facilitation is the unexplained component of Soft OR rather than methodology, tools and techniques. By addressing the components of Soft OR practice, i.e. modelling, facilitation, techniques, a more comprehensive account of Soft OR practice can be achieved, as it is recognised, that the sum of the parts, is greater than the individual components of Soft OR practice. It is this interrelationship of the component parts that will deliver a richer understanding of the practice of Soft OR.

1.2 Aims & Objectives

1.2.1 Aim

To develop a conceptual map of Soft OR practice.

Chapter 1

1.2.2 Objectives

To explore the world of the Soft OR practitioner from a cognitive perspective. This cognitive perspective will explain ‘how’ practitioners make Soft OR work in context.

To identify a gap in the Soft OR literature based upon disparities and weaknesses in previous works. The literature will be used to identify a range of concepts in order to build a conceptual map of Soft OR practice.

To construct a conceptual map of Soft OR practice using a constructivist’s interpretation paradigm.

To construct an interpretation of emerging Soft OR practice that is derived from questioning and reflecting upon findings from a series of case studies, using Sparrow’s (1998) knowledge management equation as a framework to explore, explain and build accounts of Soft OR practice.

To make recommendations to the OR community based on the implications of these findings that will enhance practice and professionalism in the subject.

1.3 Chapter Structure

1.3.1 Chapter 1 - Introduction

Chapter 1 provides an overview of the subject, providing an introduction to the thesis and highlighting the importance of the area of study.

Chapter 1

1.3.2 Chapter 2 – Literature Review

The literature review allows the researcher to evidence the issues of Soft OR practice to ensure that the complexities and multiple dimensions of Soft OR are addressed as a range of considerations in this thesis.

This chapter starts by identifying the development of OR and subsequent emergence of Soft OR. The chapter highlights that previous studies have focussed on tools, techniques and methodologies in which Soft OR has become a theoretical proposition. Further, the component parts of Soft OR are explained as ‘the consultant’, ‘the facilitator’ and ‘the use of models in Soft OR’. The chapter highlights a number of disparities and weaknesses in previous studies based upon ‘inappropriate methodology’, ‘lack of research in the area of Soft OR cognition’, ‘misunderstanding the concept of facilitation’ and ‘studying Soft OR in a holistic manner’. These concepts build up a picture that identifies a lack of understanding of ‘how’ Soft OR works in practice; in particular, the use of a grounded theory that explains pluralism, pragmatism and multimethodology in action.

1.3.3 Chapter 3 – Research Methodology

The fundamental focus of the research methodology chapter addresses three points. The research paradigm; research methods; and a demonstration of how the construction was derived?

The first part of this chapter explains why a constructivist’s paradigm was used. A constructivist’s interpretation paradigm is about capturing and interpretation of multiple viewpoints across practitioner’s expertise, experience and local knowledge. This involves the researcher exploring the complexity of viewpoints as a Bricoluer. The Bricoluer is faced with a

Chapter 1

situation of constructing a bricolage or piecing together a set of patterns of Soft OR practice. The Bricoluer works with emerging data using a range of tools, techniques and approaches. Central to the constructivist's interpretation is how the Bricoluer makes sense of these accounts of Soft OR practice through a series of decision points or anchors.

The second part of this chapter sets out to show the reader how the methodology was used. This involved a process of triangulation, following a grounded theory approach in which the Bricoluer made judgements to points of theoretical saturation and sensitivity. The triangulation of Soft OR practice used a range of tools and techniques to gather data including repertory grid (Kelly 1955), interviews and critical incident technique (Flanagan 1954). Data is derived from purposeful cases of Soft OR, which places "the best brains available into the thick of what is going on" (Stake 1994: 243). These cases are from British Airways, Shell International and Academic Users who represent an expertise and substantive domain knowledge of Soft OR practice.

The interpretation of the practices of Soft OR has to deal with the variety and argumentation of Soft OR practice. Therefore, it was appropriate to use a computer assisted qualitative data software (CAQDAS) to aid with the interpretation of Soft OR practice. Two software packages assisted the Bricoluer in the interpretation and construction of a bricolage of Soft OR practice. NUDIST Nvivo was used to explore, index, search and construct across the variety and complexity of different Soft OR accounts. Whereas, Decision Explorer (DE) was used as a viewing tool to articulate and shape a final account of Soft OR practice. The final part of the chapter demonstrates to reader of this thesis, a comprehensive example of the construction and

interpretation process, from initial interviews through to the development of a conceptual map of Soft OR practice.

1.3.4 Chapter 4 – Presentation of Results

This chapter shows how the conceptual map of Soft OR practice was constructed around a series of clusters. The practice of Soft OR is presented through a series of cognitive maps using DE as a means of tracing a construction. The cognitive maps allowed the Bricoluer to articulate the knowledge and meanings found in Soft OR practice.

1.3.5 Chapter 5 – Discussion of Findings

A conceptual map of Soft OR practice is clustered around the following themes:

- Knowledge in Soft OR
- Knowledge in Discourse
- Knowledge Metacognition
- Social and Cognitive Congruence
- Knowledge Transformation
- Facilitating Knowledge
- Knowledge Congruence

This conceptual map of Soft OR practice highlights how facilitators use Soft OR models as congruence maps and cryptic labels of knowledge. These cryptic labels of knowledge act as accessing points to the knowledge cells in Sparrow's knowledge equation (1998). Working with congruence maps highlights how the facilitator uses the terms 'abandoning', 'balancing', 'adapting', 'switching' and 'boundaries' in Soft OR practice. These terms are

higher order concepts of metacognition (Nelson 1999) for facilitation, that are local to Soft OR practice.

Another interesting interpretation sees facilitators validating the reliability of knowledge in Soft OR practice through iteration. Iteration links into the complexities of power and politics, as facilitators become aware of these issues through negotiating and balancing knowledge which emerges as social and cognitive congruence. This highlights the use of discourse in knowledge transfer, through socialisation of knowledge and skilled behaviour. These interpretations of Soft OR practice see Soft OR follow a grounded pragmatic theory of practice, which provides an interpretation and explanation of these practices. The chapter concludes with a comparative analysis between the literature review (Chapter Two) and the research finding and the resultant implications for the OR community.

1.3.6 *Chapter 6 – Conclusions*

Munro and Mingers' (2002) paper sets out a flawed interpretation of 'which method when' understanding of Soft OR practice which does not get into the mind of the Soft OR practitioner. A contribution to knowledge is identified which is more robust than Munro and Mingers' (2002) paper, as it explains 'how Soft OR practitioners assemble a cognitive understanding of situations and how they make decisions on how to proceed'. The implication of this 'how' significantly shifts the understanding from methodology to facilitator. It is more important to see how the facilitator makes Soft OR work in context rather than concentrating on the tools and techniques of Soft OR.

1.4 Conclusions

Ormerod's (2002a) viewpoint that OR is defined by its practice and Rosenhead's (1997) theory of contamination are fundamental observations that drive this thesis. If these observations have a degree of truth, an explanation is needed. An explanation based upon 'how' rather than 'which method when' is explained through a conceptual map of Soft OR. This insight moves our understanding from methodology, tools and techniques, onto the facilitator. This study captures the cognitive elements of Soft OR practice that are currently missing in the OR literature.

LITERATURE REVIEW

2 Introduction

According to Taket (2002:126), the starting point in Operational Research (OR) is facilitation. “No matter what type of OR one is involved in, facilitation is a necessary part of the process”. However, facilitation is not often written about within OR literature as it seems to be lacking or misunderstood as a concept, even to the extent that the OR community does not know how facilitators or practitioners assemble a cognitive understanding of situations and how they make decisions on how to proceed. Fundamentally, there is little understanding of the mind of the facilitator or the tool-user in Soft OR practice.

Many Soft OR authors tend to search for a philosophical paradigm which explains the underpinning mechanisms of Soft OR (Mingers 2003: Flood & Jackson 1991a: Midgley 1997) which, at times, is a narrow interpretation of practice. For example, John Mingers’ (2003) recent paper in the *Journal of Operational Research Society* attempted to search for a basic mechanism that explained the workings of Soft OR practice through its ontology, epistemology and axiology. The paper attempted to explain how Soft OR could be used in a number of problem interventions, based upon Munro and Mingers’ (2002) ‘which method when’ approach. What Mingers fails to identify, is that the biggest influence in Soft OR is the facilitator, as it is the facilitator who shapes the practice of Soft OR. This shaping is coined “contamination” by Jonathan

Rosenhead (1997). This is where practitioners adapt, adopt and combine methodologies and techniques based upon their own experience, environment and problem intervention. It is contamination that drives the practice of Soft OR, based upon pragmatism and pluralism (Ormerod 2002a; 2002b; 2002c).

The literature review identifies the development of Soft OR and the subsequent emergence of Soft OR based upon its theoretical propositions. This sets out to explore deficiencies in previous studies of Soft OR. These studies account for Soft OR methodologies and techniques based upon 'which method when', rather than accounting for how Soft OR practitioners actually use methodologies and techniques. By the end of the chapter, the reader should understand deficiencies in previous studies and why the facilitator or practitioner is the most important component that shapes, or influences, the practice of Soft OR. The chapter then outlines a number of concepts that are of importance in shaping this thesis namely, 'limitations of OR', 'emergence of Soft OR', 'multimethodology', 'pragmatism', 'modelling', 'discourse', 'politics', 'knowledge', 'facilitation' and 'practice'. These concepts are the foundation for exploring the issues of Soft OR practice and influence the subsequent construction of a conceptual map of Soft OR practice.

2.1 Operational Research

If the past shapes the present and future of Operational Research, that past must be explored (Ormerod 2002a). It is the work of historian Hobsawm (1997) that Ormerod cites;

Past is a permanent dimension of human consciousness an inevitable component of the institutions, values and other patterns of human society. Each generation copies and reproduces its predecessor as far as possible.

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Despite this attachment to the past, innovations occur in the interstices between those aspects that are formalised and handed down through the ages. OR community may hold very dear the change imperative that they apply to client organisations, viewed dispassionately as systems, they may be willing prisoners of their own past in terms of organisation and values. OR is much more likely to adapt to external pressures than to choose and bring about some new direction.

Ormerod (2002a 476-477)

The proposition that Ormerod makes, concerns tying OR to its past, as this influences the present and future. Hence, it is important to trace the development Soft OR practice to its past in order to construct an interpretation of the present and the future.

Operations Research (OR) or Operational Research (USA version) is defined by the British Operational Research Society as:

“The application of the methods of science to complex problems arising in the direction and management of large systems of men, machines, materials and money in industry, business, government and defence. The distinctive approach is to develop a scientific model of the system, incorporating measurement factors such as chance and risk, with which to predict and compare the outcomes of alternative decisions, strategies or controls. The purpose is to help management determine its policy and actions scientifically”.

Jackson (1992: 77)

Operational Research came to the forefront during World War II, when military problems typically required optimisation, subject to constraints (Lehaney et al. 1997). OR was the ‘scientific approach to management’ (Fildes & Ranyard, 1997). The first textbook on OR appeared in 1957, and was written by Churchman, Ackoff and Arnoff (1957). Operations Research

(OR) was an activity that formed part of the science of management (Hunri 1954), which was successful in helping Britain during the second world war. As a result, OR groups grew up in the 1950's and 1960's, following the principles of Taylorism (Hunri 1954; Fildes & Ranyard 1997) in energy, transport, mining, health, computing and banking predominately in nationalised industries. These groups' successes flourished on the application of emerging technologies i.e. mathematical equations applied to computer advances. The groups primarily acted as internal consultants to the organisation. According to the Operational Research Society (Ormerod 1996), in 1972, at its peak – there were 181 operations research groups in organisations. Since the 1980's, the number of OR groups has substantially declined, the largest groupings are now British Airways and Shell International. With the denationalisation of industries and series of downsizing in larger companies in the 1980's and 1990's, the role of operations research has virtually disappeared as an internal function, with many companies having opted to outsource the OR activity (Fildes & Ranyard, 1997; Ormerod 2002a).

The decline of OR has been for fundamental reasons as OR failed to establish itself at the strategic level in organisations and became associated with a limited range of mathematical techniques (Ackoff 1979). The problems that OR defined as being within its compass during the 1950's and 1960's, ceased to be of first-ranking importance to corporate management and OR moved down or out of the organisation. According to Fildes and Ranyard (1997), organisations downgraded the need for a rational analysis of problems and models in the organisation, as they could not tackle the problems of a chaotic and unrational world (Churchman 1979; Checkland 1981; Ackoff 1979). The fall of OR groups in the UK highlights this decline. For example between

1985 to 1995, groups fell from 22 to 10 in Engineering / Manufacturing, 20 to 10 in Food, Drink and Tobacco and 10 to 3 in Chemicals / Oil industries (Fildes et al 1999). According to Fildes and colleagues, this drop is due to the decline of manufacturing and a shift towards services. Influenced by government policy of that decade, the decline of nationalised OR groups have shrunk from 16 to 5 in the same period. Whilst British Airways is the only major company to grow, because of the success of yield management, most organisations who previously had OR groups, have now outsourced these, resulting in a growth of specialist independent experts in Operational Research (Ormerod 1996).

2.2 Limitations of OR

The key limitation of OR is its bias towards mathematical arguments that are unrelated to practical problems (Ackoff 1961). Whilst technically based problems suit a technique-oriented approach, many post-war organisational difficulties had much more to do with humanistic, rather than a scientific approach. Other arguments have suggested that OR is incompatible with changes in knowledge (Sparrow 1998). The philosophy of OR therefore is not practical in today's problematical world. This is because OR fundamentally is positivist in nature (Mingers 2000), which has a belief in universal laws, empirical verification through induction, and observer value freedom. These beliefs have been attacked by Hanson (1958) and Kuhn (1970) who demonstrate fundamental flaws in such approaches. This has prompted a promotion of phenomenology, ethnomethodology and hermeneutics as being more appropriate to a chaotic and unrational world in today's organisations (Checkland 1981).

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The role of OR has changed, with many techniques being absorbed into business processes (Fildes et al 1999). For example, linear programming is widely applicable in the oil industry, but is no longer the preserve of OR groups, contributing towards the decline of OR groups in that industry. In the Banking sector, OR has developed credit-scoring models that are used by trained personnel, who may not belong to a dedicated OR group. Fildes and Ranyard (1997) conclude that despite the intent of the founding fathers of OR, many groups found their scope was limited to tactical problem solving and analytical models based approaches, with few groups making an impact at a strategic level.

Fundamentally OR is about quantitative modelling. By scanning the 2000 volume of the Journal of the Operational Research Society, the weight of research activity is dedicated to mathematical applications and theories (Ormerod 2002a). This mathematical and quantitative approach to problem management is the prevailing paradigm of OR: a paradigm that does not reflect the human complexity of problem structuring. Many authors including Checkland (1981), have stated that the basic philosophy and methodology of hard quantitative OR type approaches, makes them unsuitable to application in social structures. Checkland argues that there is much corroborating evidence of the failure in such situations.

Checkland (1981) argues that the hard or quantitative approaches failed in their intention to tackle complex social problems because of human dimensions and the argument of phenomenology (Lehaney et al 1997). Ackoff (1979) criticises OR on the grounds that although it helped man land on the moon, in his own experience it had failed spectacularly to solve some of the problems of inner cities in the USA. Ackoff's criticism of OR is

based on the values of OR, in which there was a risk of paralysis by analysis (Pidd 2001). Ackoff's criticisms were aimed at academic Operational Researchers, as he propositioned that the future of OR was bleak unless some major changes occurred.

Problems with human complexity and multiple stakeholders with different value systems are incompatible in an positivist OR paradigm (Fildes & Ranyard 1997; Pidd 2001; Checkland 1981; Ackoff 1979). These problems were labelled 'messy' by Ackoff and unsuited to the hard OR approach. This was perceived by Johnson and Scholes (1993) partly because of the difficulties associated with attempting to introduce change, which is not taken into consideration by Hard Operations Research approaches. This is linked to a lack of recognition of human factors in the process of solving problems (Boddy & Buchanan 1992).

2.3 Emergence of Soft OR

Ackoff (1979) argued that OR would die if change didn't occur. It was a response by the UK Operational Research Society which led to the establishment of The Institute of OR, in association with the Tavistock Institute for Human Relations (Stringer 1967) that cleared a way for the development of a range of methodologies called Soft Operations Research or Soft OR¹. Soft OR addresses the problem-structuring side of modelling (Ledington & Donaldson 1997). Soft OR attempts to address many of the shortcomings identified by Ackoff (1979) and Churchman (1979), in dealing

¹ For a review of soft OR methodologies, please refer to Appendix A.

with chaotic and unstructured problems that are relevant in a problematic world (Rosenhead 1989a). One of the concerns in OR, is the relevance of its theories, tools and techniques to real-world practices of management (Rosenhead 1989b, Ledington & Dolnaldson 1997). Therefore, is Soft OR based upon Ormerod's (2002a) view that an understanding of the past is tied to the present and future through extending rationality and logic?

Ormerod (2002a: 477) goes on to state that in OR "a consistent model should be developed which makes sense of the phenomena according to some scheme of rationality". It is this link of rationality and sense making that emerges from developments of Soft OR. All of the Soft OR methodologies are consistent with reasoning and formality as a knowledge schema (Sparrow 1998). This type of knowledge is based upon a logic to interpret concepts, in which people merely look for internal coherence (Thomas 1986:11) where

certain claims or alleged facts are given as justification or explanation for others

This view is supported by Toulmin *et al* (1979: 13), as

the whole act of making claims, challenging them, backing them up by producing reasons, criticising those reasons, rebutting those criticisms, and so on.

It is process of argumentative analysis in which discourse is engaged to make sense of the world (Fisher 1988). This reality within formal planning suggests that these logical methodologies fail, as 'they do not meet the reality test' (Gilmore & Camillas 1996).

2.4 Multimethodology, Pragmatism and Soft OR

Many of the Soft OR methodologies and techniques that emerged in the 1980's and early 1990's met with mixed success. This was down to the application and ability of the methodologies to change and be workable outside an environment of OR (Sparrow 1998; Fildes & Ranyard 1997). This ability and application is highlighted in the growth of the term multimethodology (Mingers & Gill 1997). This term has grown from a number of OR authors, who developed meta-theoretical frameworks for problem interventions, based upon combining methodologies and techniques (Mingers 2003, Jackson & Flood 1991a). Multimethodology is based upon an OR approach to problems, where the problem situation can be classified against a methodology. This understanding is based upon Munro and Mingers' (2002) *which method when* approach where a conscious choice is made about methodology and techniques in a problem intervention at the design stage. A possible flaw in such an approach is related to conscious choice and premeditation. This has already been raised by Munro (2001) and Ormerod (2001; 2000), who challenge the usefulness of meta-theoretical frameworks as not being of relevance not liked by practitioners.

TSI (Total Systems Intervention)..... An approach that has been prominent in the literature, has not proved as popular an approach with practitioners as proponents had hoped..... The failure to find resonance with practice may, I believe, stem from a misplaced insistence on academic rigor, language that is not easily accessible, and from the disdain with which Jackson views the business of conducting investigations. He places too much emphasis on methodologies, paradigms, and meta-methodologies, which are of great interest to academics pursuing theory development, but are of limited interest to the majority of practitioners.

Ormerod (2000: 882)

Further, Munro (2001) notes that Soft OR interventions are driven by the facilitator at a subconscious level rather than a methodological choice at a conscious level. Munro's interpretation lies in the fact that decisions about interventions are, in fact, automatic, rather than premeditated. Munro's standpoint is based upon the assumption that the practitioner in the situation knows more than can be articulated through a meta-theoretical framework which does not represent the local relativism (Lincoln & Guba 2000) of the problem intervention.

The term multimethodology (Mingers 1997) has grown out of a pragmatic approach of facilitators and consultants using Soft OR methodologies and techniques. According to Rosenhead (1997), pragmatism is characterised by methodologies and techniques that are contaminated. The more practitioners use Soft OR, the greater the likelihood that methodologies and techniques will be disseminated and adapted. Practitioners become more creative in their usage and can change ingredients. This point is highlighted by Mingers & Taylor's (1992) survey of Soft Systems practice that shows how Checkland's (1981) methodology was changed according to practitioners' expertise and locality of the problem. This characteristic of contamination and change is located in the paradigm of Soft OR interpretivism, with the practitioner in the centre of activity because of the social and cognitive richness that surrounds the process or problem construction and resolution (Robinson 2001).

The investigation into adaptation of Soft OR is highlighted by a number of authors (Bennet 1985, Eden 1990, Taket 1993, Ormerod 1995). An extensive range of surveys of Soft OR practices (Munro & Mingers 2002;

Mingers & Taylor 1992; Ledington & Donaldson 1997) highlight the combining of methodologies and techniques as common place, drawing the conclusion that practice is overtaking theory. These surveys are often cited (Mingers 2003; Connell 2001) as the most comprehensive surveys of Soft OR practice and multimethodologies, but these studies are fundamentally flawed, for the following reasons:

....inevitably ad hoc nature of the sampling frame and its bias towards the UK; the inclusion of both OR practitioners and those from a systems background; differences of interpretation of terms with the questionnaire; the subjectivity of certain answers, especially concerning the success of particular methods; and the problems of incorrectly completed questionnaires

Munro & Mingers (2002: 375)

The problem lies with the research methodology used in such studies, trying to recall how practitioners used Soft OR methodologies, often a long time after the event using a quantitative survey method. This is not appropriate for a research problem which tries to capture the 'recall of events', especially when asking practitioners to make judgements against Checkland and Scholes'(1990) four point criteria of SSM usage. A quantitative survey method fails to capture the richness of an event (Eastby-Smith et al 1991), as participants would have difficulty recalling exact decision points of how they actually used Soft OR methodologies and techniques. At best, the recall would be blurred, partial and anchored (Russo & Shoemaker 1992; Flanagan 1954).

A more probable explanation of multimethodology based upon contamination, may be found in Taket & White's interpretation (Taket &

White 1993; White & Taket 1997) of Soft OR, drawing from Burrell and Morgan's (1979) 'Sociological Paradigms and Organizational Analysis' (SPOA) who forward that the success of theory depends upon a pragmatic and pluralistic approach. It is as if theory has an emancipatory power (Munro 1997) in which theory is trying to break free from oppression, in order to be something. This emancipatory power, turns theory into practice, as practitioners dissolve and adapt theories to the realities of the situations. This is a world where pragmatism is a theory based upon meaningful knowledge in action or 'practice' rather than an obscure philosophical debate.

The purpose of a pragmatic and pluralist understanding of knowledge, is that the debate focuses on 'realism' of knowledge (Cupchick 2001). An understanding of 'realism' and 'practices' of knowledge, is justified on the grounds that Soft OR is about practice and how these practices are carried out. It is this interpretation of practice that is important. The main argument put forward against pragmatism is that it is a 'theory without knowing' (Mingers 2000). Pragmatism does not provide information about why a particular theory or model does or does not work. Pragmatism does not set out to find an explanation. According to Raitt (1976:835) "we do not ask if it is true, only if it works...we validate not verify". Thus, Soft OR facilitators may use a technique or methodology, but be unaware in which circumstances it is valid or invalid, as pragmatism has no explanation (Mingers 2002a).

What is known is that many Soft OR interventions work but there lacks an account for how and why they work. This is highlighted by Eden and Ackermann's (2002) JOURNEY making process based upon over 200 case studies, that is grounded in a pragmatic approach of realism. Further

substantive works by Friend (2002) and Checkland and Stowell (2002) are grounded in over thirty years of Soft OR practice.

2.5 A Philosophy of Practice

The reality of practice is a representation of experience (Quine 1986), as practice represents the truth of how knowledge is carried out. Rorty (1980, 1993) characterises modern philosophy as the struggle between pragmatism and representation, between philosophy as a commentary and philosophy as a critique on claims of knowledge. The modern concern with epistemology arises out of philosophy that was summarised by Descartes' 'cogito ergo sum' which effectively established the mind body dualism. This set up the split between 'mind' and the 'universe'. This raises the question of 'how we know' and 'how we practice'? Here the emphasis is on 'how' in Soft OR practice. This is the mind of the Soft OR facilitator or practitioner in how they make decisions about 'how they practice'. This emphasis on 'how' has not really been researched in Soft OR, as this is the world of 'subconscious', 'implicit' and 'tacit knowledge'.

Rather academic research in Soft OR has concentrated on knowledge that is accessible and conscious (Munro & Mingers 2002; Mingers & Brocklesby 1997; Mingers 2000; White 2002; Omerod 1995; Omerod 1998; Robinson 2001; Lehaney 1999). Very little research has attempted to appreciate the cognitive side of Soft OR with the notable exemption of Colin Eden and Fran Ackermann's work at Strathclyde University (Eden & Ackermann 1998; Eden & Spencer 1998) on strategy making and using cognitive mapping as a negotiation device in senior management groups. What is not understood is how the Soft OR practitioner considers knowledge that is more

than ‘deliberation and rational’ (Grinyer 2000). As a lot of cognition in human beings takes place in ways that lay outside immediate consciousness (Yeoman et al 2000). The influence of ‘skills’, ‘intuition’, ‘mood’ etc, may have been acknowledged by Soft OR writers but never appreciated and explored in a robust manner.

2.6 Rationality, Logic and Knowledge Representation

Soft OR emphasises knowledge that is based upon rationality and logic as Pidd (2001) emphasises in his paper on the *Future of OR*

...procedural rationality is concerned not so much with the outcome of a deliberation but the nature of the deliberation process. Behaviour is said to be procedurally rational when it results from some sort of deliberation. Thus the focus is the process of decision making, on how it is done and how it should be done. Hence, in these terms, irrational behaviour is impulsive behaviour that occurs without adequate consideration and thought. Procedural rationality is thus closer to the common sense view of reason than might be the case with substantive rationality. In these terms, the focus is on developing procedures that may enable people to make better decisions.

These attempts to apply procedural rationality are often called ‘Soft OR’. Checkland’s Soft systems approach in which systems ideas are applied to the process of enquiry. Others who have developed procedurally rational approaches to interventions and change are Eden and his colleagues. Friend and his co-workers and others.

Pidd (2001: 1184-1185)

Soft OR researchers believe that:

formal structures of soft methods provide a language to talk...and may even take the heat out of a conflict situation by forcing the debate to operate at a different level of abstraction

Lehaney, Clarke & Paul (1999:888)

Sparrow (1998) shows this as a fundamental flaw of Soft OR, as research

suggests that formality and logic cannot deal with the fundamentals of knowledge transfer, based upon Nonaka and Takeuchi's (1995) socialisation and externalisation of knowledge. If Soft OR (according to Sparrow) is wrapped up in formality and logic, tacit knowledge is not accounted for. Soft OR lacks an unifying theory or framework with which to classify alternative kinds of knowledge and guide its elicitation.

Sparrow (1998) draws upon the cognitive literature to consider knowledge². Sparrows proposes a knowledge equation that is an active combination of particular mental material being represented in a particular form of thought and processed with a particular type of thinking. The equation is represented by:

$$\text{Knowledge} = \text{mental material} + \text{thought} + \text{thinking}$$

Sparrow's (1998) equation draws upon five types of mental material that human beings process. These are semantic understanding (Tulving 1987), episodic memories (Tulving 1983), skilled behaviour (Schmidt & Hunter 1983), tacit feel (Polyani 1958) and unconscious interpretation (Freud 1915). Thought is represented by two forms, propositional (Anderson 1990) and imagistic (Wheatley et al 1989). The final element of the knowledge equation is the type of thinking that is occurring. Sparrow proposes three types of thinking: reasoning (Sparrow 1998), mood (Matlin 1994; Kuiken 1991) and autistic (Buzan 1993; Fournier and Guiry 1993). Yeoman and Sparrow (1997) suggest that one might make distinctions between alternative Soft OR techniques using Sparrow's knowledge equation as a reference framework. They concluded in a study of Soft OR at British Airways (Yeoman et al 2000), that the practice of Soft OR was fundamentally based

² For a comprehensive description of Sparrows (1998) knowledge equation, please see appendix B

around semantic understanding, reasoning, and propositional thought. But this study had the limitation that it drew upon Kelly's (1955) repertory grid methodology as a means to distinguish between different Soft OR methodologies and techniques. Repertory grid considers knowledge in a semantic (Marsden 1997) rather than an episodic manner, therefore, not capturing the richness of Soft OR practice. OR consultants could clearly distinguish between different types of Soft OR techniques, when thinking about them in a rational manner, but they could not recall how Soft OR methodologies were used in practice. Yeoman *et al* (2000) did not capture the richness of Soft OR practice, as Soft OR is an activity process that is shaped by the facilitator locating knowledge in action.

Knowledge in action according to Blosch (2001) is about how pragmatism as a philosophy manipulates knowledge of the real world. Studies by Yeoman *et al* (2000); Mingers (2003); Munro & Mingers (2002); Mingers & Taylor (1992); Ledington & Donaldson (1997) do not capture Blosch's philosophy of how methodologies and techniques work in the real world, as knowledge in action is missing. Soft OR, when practised, no longer becomes a theoretical proposition. It strips away any boundaries of trappedness (Nietzsche 1969; White & Taket 1997) leading to Rosenhead's (1979) contamination. Contamination allows practitioners to move away from 'intellectual myopia' and bring success as realism (White & Taket 1997) as observed in Eden and Ackermann's (2002) two-hundred case studies and Checkland's (Checkland & Stowell 2002) thirty-years of practice of how practitioners make Soft OR work.

2.7 Modelling and Discourse

2.7.1 Modelling

According to White:

...developments in Soft OR emphasise the use of problem structuring methods of facilitated modelling to help participants in a group share different perspectives. The visual aid facilitates conversation or dialogue to take place between different participants. Approaches such as SODA, strategic choice approaches, and soft systems methodology help participants, via workshops led by facilitators and through modelling approaches, to capture, analyse and feedback to the participants, the substance of the issues under discussion.

White (2002: 152)

From White's explanation on how facilitators use Soft OR models, traditional models in Soft OR, are maps of problems (Grinyer 2000), telling people how to get from A to B, representing an abstraction of a problem. The model in OR is the overarching aspect that is shared in all methodologies and techniques, both hard and soft. The models differ in format and structure, but they are amenable to some form of formal, logical or systemic analysis (Mingers 2003). The model in Soft OR is what communicates the problem or situation. Belton and Elder (1994) discuss the use of visual interactive models in Soft OR as an aid for managers to learn about their own subjective values. Bright and Johnston (1991) discuss how visual interactive modelling helps OR to move from looking at 'closed problems', where the boundaries are less clear. Hodges (1991) describes various uses for 'bad' models. Eden and Ackermann (1998) use cognitive maps as a visual learning device in strategic management to aid strategic decision making. Lehaney *et al* (1999) state that SSM models are a means to debate a problem, which is further supported by Robinson's (2001) research. In effect, Soft OR models

communicate a sense of place, some sense of here in relation to there.

Cossette and Audet (1992) define models and cognition as graphic representation made by a subject with regard to an object in the context of a particular interaction. Langfield-Smith and Wirth (1992) state they are diagrammatic representations of an individual's cognition. Like maps, they represent a spatial relatedness, concerned with focusing people's minds to comprehend the problem situation (Yeoman & Sparrow 1997). They are maps of memory, the groups in which to hold knowledge (Eden & Ackermann 1998) and a visual interaction device through which negotiation happens. Modelling is 'representation of territory on paper' that encourages a holistic synthesis of people's perception of a problem, for example, an emphasis on relationships (Fletcher & Huff 1990)

The emphasis of knowledge in action, is a theme that has pursued many researchers in the field of modelling. In particular, the works of Friend (2002); Forrester (1961) Eden and Ackermann (1998); Checkland (1981); Hodgson (1981); Ulrich (1983) Friend and Hickling (1987); Lehaney et al (1997) Yeoman et al (2000); Mingers (2003) and Senge (1992) share a common theme, improving organisational action through the world of models. All of these researchers and many more in the field of OR, give elucidation to the proposition that models have emancipatory powers. This idea, that models, represent more than the symbols and can action change, is closely related to the indissociability of thought and action (Cossette & Audet 1992), even their reciprocal subordination (Weick 1979; Huff & Huff 2000), solidly anchored in the epistemological foundation of these researchers, but not explicit in nature.

However, there is no common theory that explains the emancipatory power of the model and how it happens. Research in the cognitive mapping and modelling literature (Eden & Spencer 1998; Eden & Ackermann; Cossette & Audet 1992; Fiol & Huff 1992; Huff & Huff 2000) search for an answer in the structure of the map, as an idiosyncratic map in which people share thoughts and action. The emphasis is on the structure of the map, as a pictorial and reflexive tool in which the maps become a procedure for self reflection. It is the words or symbols in the maps that modify attitudes or behaviour. Here the emphasis of the research focuses on the notions of natural logic, schematization, contextuality, representation, knowledge and schema. These are the foundations of modelling that draw upon Grice (1989) and Denis's (1989) concepts of representation and structure. This emphasis on structure, firstly, misses the importance of discursive representation i.e. knowledge that is not conscious. Secondly, this does not address the role of the facilitator in constructing such a discursive representation.

Even those researchers emphasising models as a representation of action and thought (Huff & Huff 2000; Cossette & Audet 1992; Ackermann & Eden 1998) are caught up in a world of logic, whether formal or natural. This contextualisation of logic, uses schematization (Barlett 1932), constructs (Kelly 1955) and linguistics (Grice 1989) found in argumentation (Antaki 1994) which are propositional, semantic and conscious (Sparrow 1998). This schematization based upon argumentation and conscious knowledge, is recognised as cognitively limited, leading to a simplification of reality (Axelrod 1976; Weick 1979).

Cossette *et al* (1992) discusses models as epistemological foundations, in

which models have emancipatory power. The emancipatory power is based upon using the model as a means of transaction through iteration and reflection (Blumer 1954). Interaction with the model is evidenced by Heijden (Heijden et al 2000; Heijden & Eden 1998) and Eden's (Eden & Ackermann 1998) work in scenario planning and JOURNEY making, where reflection on one's own experience is the basis for how new actions are planned and executed. This draws upon Kolb and Rubins' (1991) theory of learning and strategy cycle. The model in this process is a visualization of experience, in which Heijden and Eden (1998) pick out Weick's (1979) 'how do I know what I think....until I see how I act'. This characteristic of visualisation and reflection is evidenced in many case studies of Soft OR practice. For example;

The process of iteration or repeated refinement until you decide enough is enough is central to the methodologies

Waring (1996:23)

The system is which being simulated is the patient flow through one clinic of the outpatients department, but the root definitions is for all intervention systems that utilizes simulation modelling, but which is not itself being simulated. Apart from the internal / external criteria bubble, all other bubbles are linked, and the process is iterative.

Lehaney, Clarke & Paul (1999: 886)

Conceptual modelling...a number of iterations were required before an accommodation of views was reached as to the nature of the process

Robinson (2001: 907)

Soft OR recognises and integrates participants subjective perspectives, the

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importance of mutual learning, iterative process design and adaptive decision making

Hjortso (2003:4)

Operate iteratively, so that the problem representation adjusts to reflect the state and stage of discussion among the actors.

Mingers & Rosenhead (2003: 2)

Over emphasis on iteration and reflection through casual models is highlighted by Langfield-Smith and Wirth (1992) and Grice (1989) suggesting participants' schemas are blurred by prior experience, producing a schema that is cognitively limited, leading to a simplified reality. Causality models also reinforce prior beliefs, through loops and cycles that lead back to those prior beliefs. Participants become locked into a mechanism that reinforces beliefs rather than breaking assumptions. This may be seen in system dynamics (Forester 1994) and cognitive maps, which rely heavily on causality as a means of visual representation and learning. Models which emphasise reflexive control through loops and cycles produce their own language that is based upon logic and rationality (Weick & Bougon 1986). Language can also limit cognition within the realms of bounded rationality (Simon 1957) supporting Sparrow's (1998) conclusion that Soft OR models blur and shape our understanding of a problem in a narrow perspective.

There are many examples in the literature (Robinson 2001; Sparrow 1998 & Lehaney et al 1999) that recognise the model in Soft OR as a means for organising discussion, debate, and argument. Checkland and Scholes' (1990) note that the model in SSM, are not models of the real world activity, but models for debate and discussion. Such an interpretation falls within the realms of Bougon's (1992) research. Here, models are a representation

of abstraction, based upon the proposition that the model does not represent reality, as people see and read models in different ways. The model, as Checkland (1981) and Eden and Ackermann (1998) have stated, are abstracts of the problem. Bougon's (Table 2.1) classification shows how such models are abstracts.

Table 2.1: Participants' classification of models in group decision making (Bougon 1992)

1. Accumulation	Participants may seek separateness and multiplicity as goals
2. Average	Participants may seek to find compromise within perspectives
3. Congregation	Participants may seek to find common interest
4. Synthesis	Participants may seek to find 'logical' patterns of overlap and restrict their attention to those aspects
5. Group map	Participants may seek to find a 'shared' map of a doctrinal nature
6. Integration	Participants may seek to establish an overarching conception that locates each of the individual perceptions

2.7.2 *The Model as a Tool*

The emphasis that the model is a representation of abstraction, follows Checkland and Scholes' (1990) interpretation, in which models are a means for discussion and debate, connects to the work of Adam and Avison (2003), Kern (2003), Payne (1991) and Radardel (2003) in which the models are viewed as tools. Tool-use theory, is heavily influenced by the early works of Vygotsky (1978) where tools are not about what they were designed for, but the way and how they are used.

This is the world of *notion de catachresis*, a term that is borrowed from

linguistics and rhetoric which refers to the use of the word beyond its accepted meaning. Radardel (2003) describes this as the use of tools for which they were not designed for. *Notion de catchresis* is a concept that designates the difference between the planned and real use of artefacts. Radardel emphasises that it is 'more important to study the surgeon than the surgeon's knife, highlighting the importance of facilitation and practice rather than studying the methodology. For example, research by Mingers (2003) forwards how Soft OR tools and methodologies could be used in practice. The paper is limited to one interpretation of practice not accounting how different practitioners would shape and change the methodology, as the *notion of catchresis* cannot be reduced or defined as one single transaction or reduced to a particular interpretation.

Notion de catachresis emphasises how tools and techniques belong to the practitioner rather than the designer, as it is the practitioner that shapes the success of the tool, technique or methodology. This is because the user of artifacts are anthropocentric - in which the facilitators (in the case of Soft OR) are the centre of knowledge and activity. The tool is just an instrument that shapes knowledge in a certain manner. The tool is purposeful and justified in the terms of guiding, assembling and disassembling knowledge. However, it is the facilitator or user of the tool that should be studied not the tool its self. This is because tools, techniques and methodologies only exist when they are practised. This practice depends on adaptability (Richards 1983) and utilisation. Richards demonstrates that methodologies, tools and techniques are unsuccessful when they control the process, as knowledge cannot be disassembled and learning fails. The success of knowledge transformation and elicitation depends upon the modifications to procedures, rather than rules and constraints. This is a point that Sparrow (1998) strongly

emphasises in Soft OR, in which logic and rationality bring a set of rules and regulations that constrain knowledge transformation.

2.7.3 *Social and Cognitive Congruence*

According to Weick (1990), models represent a socially constructed world and territory in which issues are debated. This is the main purpose of the model in Soft OR (Checkland & Scholes 1990), a process which Eden and Ackermann (1998) call ‘social and cognitive congruence’, where participants balance cognitive understanding with social dimensions. This negotiation of territory, to a certain extent, depends upon the level of discrepancy in the model, as the model is a means in which participants engage in a process of politicking, bringing influence, manipulating information and creating territories. The model is a means for taking action or a guide to the problem. Weick (1990: 4) illustrates this in the following story.

A small Hungarian detachment was on military manoeuvres in the Alps. Their young lieutenant sent a reconnaissance unit out into the icy wilderness just as it began to snow. It snowed for two days, and the unit did not return. The lieutenant feared that he dispatched his people to their deaths, but on the third day the unit came back. Where have they been? How had they made their way? Yes, they said, we considered ourselves lost and waited for the end, but then one of us found a map in his pocket. That calmed us down. We pitched camp, lasted out the snowstorm, and then with the map we found our bearings. And here we are. The lieutenant took a good look at this map and discovered, to his astonishment, that it was a map of the Pyrenees.

That map was not an accurate representation of the Alps but it served a purpose. Models in Soft OR may not be an accurate representation of the model but an abstraction. Participants in the problem solving process ‘seek and see in models’. Discrepancy (Bougon 1992) in models engages participants as it helps them make sense of the world that is around them.

Weick (1979) describes this process as 'sense-making', which is associated with the terms of 'simplicity', 'generality', 'accuracy' and 'congruence'.

Discrepancy represents the differences between individual models and group models, taking account of cognitive and social systems (Bougon 1992; Eden & Spender 1998; Jenkins 1998). One of the keys to congruent models is the level of semantic network. Lincoln (1985) notes that complexity in models leads to semantic dissonance. Many researchers in the field of modelling suggest that keeping models simple, through clustering and limited networks, (Hodgson 1992; Senge et al 1994; Bougon 1992) allows participants to probe and explore concepts in which they hook and anchor discourse as a means of negotiating territory. This characteristic of modelling is called cryptic labelling. Cryptic labelling is where the map becomes the territory for negotiation. This label acts as a doorway in which underlying and deeper knowledge is discovered and negotiated. The model is, in fact, a map which is socially constructed based around a series of cryptic labels. The cryptic label in the model acts as a gateway to meaning and understanding. The label in the model becomes a holding device or frame of reference in which people interact to resolve and construct problems (Bartunek 1984; Silverman 1970).

However, 'meaning' is a very fuzzy concept. It is something that is not static but dynamic, pausing here and there – moving from small scale to large scale. A process that is bound up in linguistics, visual representation and non-verbal communication (Kintsch 1974). 'Meaning' (Graesser et al 1997) in human minds is quite elaborate and diverse, because they are anchored in a rich body of experiences and background knowledge, which varies from person to person. 'Meaning' is often 'fragmented', 'vague', 'redundant',

‘open-ended’ and ‘sketchy’. What is observed within the soft OR literature, is a notable absence of research into how the Soft OR model is used and viewed. This absence does not connect modelling and discourse around the terms of ‘meaning’, ‘cryptic labels’, ‘discrepancy’ and ‘negotiation’.

2.7.4 Discourse

What is discourse? The term, according to Van Dijk (1997a), refers to the form of language used or ways of talking. Discourse has evolved and developed from ‘ways of talking’ into styles of talking, talk-turning, and talk in culture. Discourse, debate, language and conversation are fundamental parts of Soft OR practice. It is Checkland (1981) who propositions that SSM is a means to discuss and debate a problem. Pidd (1998) argues that the formal structures of softer methods provide a language to talk by trying to take the heat out of a conflict-ridden situation by forcing the debate to operate at a different level of abstraction. Pidd goes on further to say that softer approaches are a means by which people can debate their perceptions of the world in order to reach accommodation and consensus (Lehaney et al 1999).

This emphasis on formal structure as a means to debate problems, draws upon the history of OR, where history shapes the present and the future (Ormerod 2002a). This history is bound in ‘science’ in which observations are made in a real world and described accurately in order to understand problems and formulate solutions (Jackson 1992). OR is a discourse of science in which it could be hypothesised that Soft OR is a natural extension of this scientific and positivist world. Science and positivism (Lincoln & Guba 2000) is a world in which power searches for truth, in which problems have difficulty reconciling subjectivity and interpretation against objectivity.

Sparrow's (1998) proposition that Soft OR which is governed by rules and regulations, surfaces a discourse of rationality and logic. This discourse is a poor frame for knowledge elicitation and explanation. Sparrow (1998) draws upon Tversky and Kahneman's (1973, 1974) framing effect, in which the framework for discussing and presenting the problem profoundly influences how participants understand and learn about the problems. By using a discourse of rationality and logic, participants recycle the problem based upon semantic understanding, reasoning and propositional thought (Yeoman et al 2000).

A reasoned discourse, according to Adams and Avison (2003), structures conversation around 'identification', 'collection', 'correlation', 'connection' and 'reflection'. These concepts are identified as negative framing effects (Adams & Avison 2003; Avison & Fitzgerald 2003; Antaki 1994; Lyytinen & Hirschheim 1987; Wastell 1996; Whitley 1997; Wynekoop & Russo 1995) due to a structured and logical representation of problems. Wynekoop and Russo (1995) and many others (Yeoman et al 2000; Sparrow 1998; Stone 1993; De Grace and Stahl 1993) go on to state that these negative framing effects also have the characteristics of 'inflexibility', 'expert-based', 'narrow in scope', and 'do not necessarily lead to increased productivity'. These characteristics combine to paint a picture of process logic where discourse is bound to limited knowledge. Knowledge that is limited to consciousness and explicit knowledge transfer when viewing such a framework based upon Nonanki and Takuechi's (1995) knowledge categorisation. This negative framework impinges on natural conversation, therefore, not allowing the socialisation of knowledge transfer that is implicit in tacit understanding.

It could be propositioned, where discourse is highly structured and based upon logic, that there is little opportunity for open dialogue and deeper explanation (Antaki 1994). This discourse produces expert-based language which is logical to the expert but not to the commoner. A point raised by Taket and White (1993) when they suggest the language of Soft OR becomes a barrier for learning and emancipation. Sparrow (1998) believes that Soft OR produces a language which is cognitively blinkered in which participants cannot engage in comprehensive and effective learning because of the rules, structure and process logic which produces a bounded cognitive schematisation of the problem situation. Hence, Soft OR has a negative framework which becomes its own scaffolding (Vygotsky 1962) in which participants cannot escape. What Soft OR may lack is a recognition to deal with knowledge in an uncertain and adaptive manner. Knowledge in business requires manoeuvrability in order to promote diversity and creative abrasion in the group decision-making process (Sparrow & Bentley 2000).

Checkland (1981) and many others (Lehaney et al 1999; Eden & Ackermann 1998; Mingers 2003) state that soft OR is about debating problem situations, but there is a lack of understanding of how facilitators and practitioners in soft OR manage discourse in conversation. There is a lack of research that correlates the principles of conversation styles and management with the use of models in the field of soft OR. For example, no research is evident that correlates how participants listen to information and how facilitators control the flow of information. Chafe (1994) classifies information flow as 'rhetorical', 'referential', 'thematic' and 'focus' management.

Rhetorical management is where participants must be clear about the goals and intentions of discourse interaction as these greatly constrain the

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propositional content of production and construction of knowledge. The key words are emphasis, importance and presupposition of language – which guide how the content is interpreted, especially in semantic understanding. Billig (1987) produces a useful classification of rhetorical explanation. Referential management is where participants must keep track of the referents and propositions they have in common. The key point here is that certain concepts in discourse are held in common between parties. Information held in common, forms part of the conceptual scaffolding on which the speaker and listeners depend for effective communication. Thematic management is where participants must keep track of the central elements around which the discourse is developed. Focus management is where the participants must keep track of which referents they are dealing with at any given moment and must take steps to ensure they are the same. Chafe (1994) and Billing (1987) produce a useful classification in which to make a judgement about discourse and conversation styles.

Judgements can be made about how participants contribute to the discourse in conversations. Buffny (1993) uses the term conversation slots, in a world of rationality and logic (Antaki 1994). These slots are closed or small whereas conversation that is described as ‘free flowing’, ‘social’ and ‘natural’ produces a conversation slot that is large and easily filled. Antaki (1994) proposed that closed or small slots in discourse are attributed to a reasoning paradigm. This follows Heider’s (1958) attribution theory of explanation and causality. Language in a reasoned paradigm is limited based upon a meaning of science which produces a literal vignette (Sabini & Silver 1982) of narrow semantic understanding. This discourse misses out on knowledge that is labelled ‘episodic’, ‘tacit’, ‘autistic’ and ‘mood’ (Sparrow 1998). Comparing reasoned discourse to attribution theory focuses the mind

of the participant on knowledge that is thinkable rather than unthinkable. Discourse and thinking emerge as a continuous cycle of conscious knowledge which misses out knowledge that is deeper or unconscious (Billig 1987). A pattern of discourse emerges that produces similar behaviour amongst participants in group decision making. Behaviour and language are characterised by formality and procedure of a scientific disposition. Behaviour does not change, as the attribution in reasoned paradigm cannot shift participants' mental models as the discourse reinforces rather than changes understanding (Semin 1980; Antaki 1994). Much of Buffny's (1993), Antaki's (1994) and Grice's (1989) work is based upon research that is about 'laboratory observations' and 'discourse in isolation'. Therefore, the richness of social discourse has not been attributed or studied. Research that is only based upon discourse analysis cannot capture the holistic properties of environmental attributes (Ladson-Billings 2000; Gubrium & Holstein 2000), disclosure (Argyris 1969), relationship building (Vickers 1988) and intuition (Agor 1989)

Previously in this chapter, the terms 'accuracy', 'meaning', 'discrepancy' and 'congruence' in soft OR models were explained (Weick 1979). In the terms of discourse and facilitation, Scriven (1996) associates the management of these terms as 'resolve puzzlement', 'elucidate', 'paraphrase', 'makes clear', 'fill-in detail', 'supply stages', 'reclassify', 'reinterpret' and so on. In this relationship iteration is the key, as it is the facilitator who is searching for meaning through interpretation through words, language and discourse. This involves trying to fill in the detail and anchor conversations (Antaki 1994). This means the facilitator is dealing with the issues of reliability and validity of knowledge, as searching for interpretations is a vague process and unsure science. Here, the facilitator is

constantly checking the meaning of the discourse through iteration. Iteration as a concept, is identified in SSM (Checkland 1981) as meaning is constantly checked and re-checked before moving on to new stages.

2.8 Negotiated Political Knowledge

As previously stated, Soft OR is associated with reasoned knowledge. This is evident in the work of Eden & Ackermann (1998); Jackson (1992); Checkland (1981), Senge (1994). A reasoned knowledge schema is the central focus of 'sense-making' in Soft OR, as a means of interpreting knowledge (Pidd 2001). This occurs in a world of 'negotiated order', 'procedural rationality', 'bounded rationality', and 'procedural justice' (Eden & Ackermann 1998) that directs soft OR, in which facilitators negotiate knowledge.

Rationality is connected to negotiation as a means of making sense of the world (Strauss & Schatzmann 1963). Here, cognitive frameworks are built around scripts, social roles and forces that maintain an equilibrium of cognitive and social knowledge (Pidd 2001). Pidd states that Soft OR is about procedural rationality in which participants feel they have embarked upon a journey of reasoning in order to make sense of the world. That is, that the procedure itself is the outcome of publicly stated reasoning and so can gather cognitive commitment from the participants. Eden and Ackermann (1998) express this as an extension to the notion of procedural justice as well as contributing to the negotiation process in its own right. Procedural justice (Thibaut & Walker 1975; Folger & Knonovsky 1989) is addressing the fact that people are concerned with fairness of the procedures used to arrive at a decision as well as the decision itself. But this reliance on rationality as a

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means of negotiation, may be counter-intuitive. As Daniels (1998) demonstrates, managerial strategy groups make mental decisions that are not based upon 'objectivity' or 'rationality' but 'politics', 'intuition' and 'gut-instinct'.

Politics is concerned with power, and power influences discussion and movement of people in discourse. Power, according to Eden and Ackermann (1998), deals with how participants' aspirations are disputed, how conflict is managed and how participants compete with each other. Checkland (1981) identifies: 'feasible and desirable change' as a means to generate debate about possible changes which might be made within a perceived problem situation. Change is about culture, power, politics, people and timing according to Hicks (1991) in which the underlying manifestations become prominent. This is where SSM becomes a cyclical process of debate and iteration, where rich pictures, root definitions and conceptual models are reshaped and reinvented. This is the emancipatory power of Systems Thinking (Munro 1997) which engages with Kolb's (1991) theory of learning.

Political feasibility is about determining the extent of change and the likelihood of change, dealing with the situation of political judgements. Schumann (1999) in the facilitation literatures, singles this out as the most important issue of facilitation. Kirk and Broussine (2000) define politics to mean principles or commitments which drive people's actions and interventions. Politics is a means of acquiring and using power in organisations. Facilitators are part of this dimension of organisational politics. What is observed in the Soft OR literature, is that facilitation is often treated as a politically free and neutral concept.

The facilitator has no interest in the outcome, and no authority to impose decisions. The authority of the facilitator arises only from the perception of the group that they are being helped constructively to make progress with their problem. To perform this role, the facilitator needs to be trusted by all participants, and so cannot be a player in the situation which the group is concerned to change.

Mingers and Rosenhead (2001: 340)

However, it is difficult to disaggregate the role of the facilitator from the role of the consultant. The role of the OR consultant is fundamentally an analytical and modelling skill, brought to bare on specific problems through information collection, discussion and structuring (Fildes & Ranyard 1997). Part of the role of the consultant concentrates on process skills rather than analytical skills (Ormerod 2002a). Tools, techniques, and methodologies become one continuum in which differentiation is hard to perceive (Ormerod 1996; 1997). The consultant or facilitator therefore cannot be disaggregated from political knowledge, as they are central to the process or can be seen as an agent of political change. It is the facilitator or practitioner who is working with clients through mediums of language, symbols, structures and rules of the organisation, involving a process that has been described as the 'management of meaning' by Pettigrew (1977). Facilitation, at least, becomes an understanding of political awareness, in such a way to understand participants' experiences, how they engage in issues of power and how politics are structured within the organisation.

Sparrow (1998) acknowledges the work of Stokes (1994) in which group participants are wary of disclosure and contribution in the group decision-making process. Disclosure and contribution rely upon 'relationship',

'friendship', 'loyalty' and 'dependency' in the political arena. These concepts are part of the process of relationship building (Vickers 1988) in which judgement is made about disclosure and contribution. Defensive routines (Argyris 1969; 1990) are associated with the concepts: 'not contributing', 'resisting ideas', and 'finding excuses'. This machismo arises for a variety of reasons i.e. 'personal goals and needs', 'personal identity', 'acceptance' and 'distribution of power and influence'.

Another observation in the Soft OR literature, is the lack of attention paid by non-academic researchers (Ledington & Donaldson 1997) to real-world situations. Real-world situations are about how Soft OR methodologies and techniques are used within negotiation. What is important to observe, is how Soft OR works in action, in which facilitators overcome and deal with the process of negotiation and political feasibility. The literature on power and politics is extremely diverse and deep (Kirk & Broussine 2000) drawing upon both social and cognitive perspectives (Eden & Ackermann 1998). Observations need to be made that capture the 'how' of negotiation which both deconstructs and constructs an explanation of negotiated practice.

2.9 Moving Towards the Practice of Soft OR?

2.9.1 Facilitation

According to Ledington and Donaldson (1997), there has been a growth in the literature on developing Soft OR methods and processes, but a lack of work of practical transferability into industry. One of the most important areas of Soft OR that has been neglected is an understanding of the concept of facilitation (Grinyer 2000; Taket 2002). According to Taket, given the importance of facilitation stressed by proponents of Soft OR, very little work

has been done on facilitation. Taket states:

Firstly, no matter what type of OR one is involved in, facilitation is a necessary part of the process. Secondly, this is often unnoticed, or assumed to be true only for some types of OR. Thirdly, facilitation is not often written about with OR literature. Before the 1990's literature within Operational Research, management science and systems paid only extremely limited attention to facilitation within groups.....

Taket (2002:126)

The concept of facilitation is being used increasingly in OR (Phillips & Phillips 1993; Eden & Ackermann 1998; White 2002; Taket 2002; Mingers & Rosenhead 2001), with many writers advocating an explanation of the concept and its meaning within the context of Soft OR. Bentley (1994) states the word 'facilitate' comes from the Latin *facilis* which means 'to make easy'. *The Oxford English Dictionary* (1989) defines facilitation as an 'active process, means of facilitating or moving forward'. Facilitation as a concept appears across a number of subjects i.e. 'therapy' (Rogers 1951), 'training' (Cross 1996), 'education' (Heron 1977), and 'technology support' (Clawson & Bostum 1996).

In the field of therapeutic counselling (Rogers 1951), the therapist is a facilitator in a neutral format in which they reflect back clients' statements in order to help patients clarify their thoughts. In education, Heron (1989) sees the facilitator as a catalyst to stimulate discussion in a group rather than to impart information. Brookfield (1986) goes on to define facilitation as helping adults to make sense of and act upon. Whereas, Beckett and Wall (1985) view facilitation as a process of direction. Other researchers have gone on to study types of interventions or modes of facilitation. Heron

(1989) considers a number of facilitation concepts from cathartic to structured interventions, whereas Bentley (1994), considers 'acts of facilitation' around the concepts of 'listening', 'questioning', 'communicating', 'acting', 'reviewing' and 'adapting'.

Trying to isolate the concept of facilitation is theoretically impossible when studying Soft OR. Many writers have emphasised the concept of facilitation in OR as a neutral and non-interventionist concept (Mingers & Rosenhead 2001; Eden & Ackermann 1998; Phillips & Phillips 1993) listing a range of do's and 'don't's on how to make a facilitator's workshop run well. In fact, facilitation cannot be disentangled from consultancy and modelling, as Soft OR is about both process and analytical skills. The practitioner, the facilitator and the consultant, cannot be disaggregated from each other, as they are perceived to have the same or similar semantic meaning (Ormerod 1996; 1997), recognised as process consultation (Schein 1998)

2.9.2 Practice, Facilitation and Soft OR

Lehaney and colleagues (Lehaney et al 1997) suggest that Soft OR has arisen from Hard OR because of the complexity of problems; this complexity and wickedness is founded in the human dimensions of problems (Mingers & Rosenhead 2001). Soft OR provides a mechanism of structuring and presenting problems to clients in a semantic structure through propositions of language. The research literature has emphasised the development and refinement of methodologies and techniques from the perspective of those researchers involved in the process. Much of this research is identified with a number of key academic researchers such as Checkland (1981); Eden & Ackermann (1998); Mingers (2003); Friend (2001); Rosenhead (2001); Senge (1994); and Flood & Jackson (1991a). What is lacking, is research

outside those key academics in which research by practitioners and non-researchers is articulated by Ledington and Donaldson (1997). It is important to identify how Soft OR works in real-world situations rather than a theoretical interpretation. This is more than the Great Warwick corridor debates between Ormerod (1999; 2002a; 2002b; 2002c) and Mingers (2002a; 2002b) about theoretical disposition and practice.

Even research that has focused on the non-research community, has been fundamentally flawed (Ledington & Donaldson 1997; Mingers & Taylor 1992; Munro & Mingers 2002) as it has not been able to capture the richness of Soft OR practice. This failure is due to the use of survey methods to capture the richness of events, where participants would have difficulty recalling exact decision points of how they actually used Soft OR methodologies and techniques. This recall at best would be blurred, partial and anchored (Russo & Shoemaker 1992).

Even research within the OR community, which emphasises a meta-theoretical framework, fails to have any relevance or uptake outside those academic authors. As Ormerod (2000) points out, too much emphasis is placed upon academic rigour and language that is not accessible to front-line practitioners. This language (White & Taket 1997) becomes a problem of trappedness and expertise, which is unable to transcend outside a world of OR.

The literature seems to be in conflict. On the one hand, Soft OR has been successful. The development of Eden & Ackermann's (2002) JOURNEY making process is grounded in over 200 case studies. Checkland's (Checkland & Stowell 2002) soft systems methodology (SSM) must be

acknowledged as one of the most well-respected and written about approaches within the Soft OR literature. SSM has been around for over thirty years and clearly has transcended outwith the systems and OR community into mainstream business practice. Sparrow (1998) fails to explain or account for this success, but emphasises the point that the past of Soft OR shapes the present and the future. Such an interpretation is based upon a world of positivism that acknowledges Ackoff's (1979) argument that technically based approaches in a world of logic and rationality, do not marry with the diversities of knowledge found in the world of business and management. Sparrow (1998) reconciles that Soft OR methodologies and techniques are an extension of positivism and science, that are dressed-up for a post-modernist world but, in fact, are shrouded in reasoning and logic. Soft OR methodologies are consistent with reasoning and formality as a knowledge schema; a type of knowledge based upon logic to interpret concepts, where knowledge is processed at a conscious level in order to make sense of the world around us (Fischer 1988). This world of rationality and deliberation in which problems are debated, considered and developed, using procedurally rational approaches to the interventions of problems in which change can be brought about, is the world of many Soft OR authors. Over and over again, Soft OR authors emphasise the use of rationality as a means to interpret problems. These arguments are captured by Keys (1995):

...technology which produces designed abstract systems, as a result may also produce designed physical systems, by a scientific means by use in organisations. The designed abstract systems take the form of information about different ways of organisational effectiveness, and the associated designed physical systems will be methods of achieving these ends...

Keys (1995; 330)

It is this emphasis on technology and design within which the creation of knowledge through physical and abstract models of conscious knowledge summarises what Soft OR tries to be, a world of science and positivism where Soft OR authors are caught in the past and history of OR.

There has to be an explanation for the success of Soft OR because knowledge is more than rationality which seems to be unaccounted for in the Soft OR literature. As Munro (2001) emphasises, methodological choice and application is not found at a conscious level but rather at a subconscious level in which choice of methodology or technique is automatic rather than premeditated. By emphasising methodological choice at a subconscious level rather than a conscious and premeditated level, most of the previous research in Soft OR practice could be found lacking. It could be propositioned that Soft OR practitioners do not find any usefulness in meta-theoretical frameworks that try to explain Soft OR interventions and indicate when methodologies should be used. Rather, practitioners who use Soft OR methodologies and techniques are more concerned with knowledge in action and 'how' Soft OR works. This is a justification of realism of knowledge in which pragmatism is observed.

Knowledge is accepted to be more than reasoning and deliberation, as much cognition takes place outside the immediate consciousness. The influence of 'skills', 'intuition' and 'mood' should be acknowledged as a means of knowledge transfer. What is not accounted for in the Soft OR literature, is how socialisation and externalisation of knowledge happens (Nonaka & Takeuchi 1995). Many authors within Soft OR talk about knowledge creation through language of rationality, logic and reasoning. Whereas knowledge creation is a synthesising process through which the individual

and the environment interact to transcend emerging contradictions that are found in the problem intervention. It is this transcendation that is not explained in Soft OR. Inter-connection between people and structure, makes a knowledge transaction that is dynamic and inter-linked from individual to societal level. This transaction is an entity that creates knowledge based upon action and interaction. In the centre of this knowledge creation and transaction process, is the facilitator. It is known that this knowledge and transaction process takes place, as Soft OR technologies and techniques such as JOURNEY (Eden & Ackermann 1998) and SSM are grounded in success. Pragmatism may equate to success as Nonaka and Tomaya (2003) indicate that pragmatism is the key to knowledge transaction and creation processors such as externalisation and socialisation. Pragmatism is about learning-by-doing as an effective method to test, modify and embody explicit knowledge as one's own tacit knowledge. However, within the Soft OR literature, pragmatism is often dismissed by Soft OR authors. The main argument put forward against pragmatism is that it is a 'theory without knowing' (Mingers 2000). Pragmatism does not provide information on why a particular theory or model does or does not exist. Jackson (1992) goes on to state that researchers must not follow the road of pragmatism, as a conscious link must be maintained between methodology, intervention and theory.

Pragmatism is little understood in the soft OR literature, combined with fact, there is a lack of research into how non-researchers use soft OR methodologies (Donaldson & Ledington 1997). If pragmatism is the key, there is no account of how knowledge is created and transacted within the Soft OR literature. It is not understood how explicit knowledge and tacit knowledge (Nonaka and Tomaya 2003) is amplified through different modes of conversation. The Soft OR literature has not amplified this conversion

beyond understanding of logic and rationality. Therefore, the Soft OR literature has only accounted for a partial understanding rather than a full account of knowledge classification, transaction and creation. Soft OR, so far, only accounts for reasoning, propositional thought and semantic understanding (Yeoman et al 2000; Sparrow 1998), missing out on other numerous concepts of mental material, thought, and thinking that are found in Sparrow's (1998) knowledge management equation.

Pragmatism is a theory, based upon meaningful knowledge in action rather than an obscure philosophical debate. This is where the 'realism' equates to the successful practice of Soft OR as pragmatism manipulates knowledge of the real world. This manipulation accounts for knowledge that is more than reasoning and logic, which is often not found within the Soft OR literature. Many studies within Soft OR have not captured the realism of Soft OR practice outside the world of the expert. Therefore, many accounts of Soft OR methodologies and techniques may be trapped by a theoretical proposition (Nietzsche 1969; White & Taket 1997; Sparrow 1998). Further, Rosenhead's (1997) interpretation of 'contamination' is not fully accounted for, but it is an explanation of why Soft OR methodologies such as JOURNEY and SSM have been successful.

As pragmatism is about knowledge in action in which theory is separated from practice, this can be interpreted as oppression in which the emancipatory power (Blosch 2001) surfaces as contamination or realism. It may be that the model in Soft OR is an emancipatory device, as people see and read models differently. The model in Soft OR is described as a visual learning device to aid strategic decision-making (Eden & Ackermann 1998) or a means to debate a problem (Lehaney et al 1999). But, again, much of

the Soft OR literature discuss Soft OR models as a means to structure problems through 'logic', 'causality', and 'linkage'. This goes hand in hand when language and discourse is all about 'identification', 'collection', 'connection' and 'reflection' (Adams & Avison 2003) in which a negative framing effect brings process logic and a narrow interpretation of the problem. This framework is bound by its own scaffolding. (Vygotsky 1962) in which participants cannot escape. Pidd (1998) argues that formal structures of softer methods provide a language to debate in a reasoned manner. This is a language of rationality, connection and reflection (Antaki 1994) in which understanding is recycled rather than expanded upon.

The success of Soft OR has to account for knowledge outside formality and logic. It is this gap between reasoning and alternative kinds of knowledge that is apparent in the literature. The success of Soft OR as highlighted by Eden and Ackermann's (1998) two-hundred case studies and Checkland's (Checkland & Stowell 2002) thirty-years of practice, must be based upon more than rationality and logic.

If much of the research in the Soft OR literature focuses on the designer and experts of Soft OR methodologies and techniques, then there will always be a link between theory and practice. But, if there is a lack of research that focuses on non-researchers, we misunderstand or do not represent how methodologies and techniques are actually used in practice. We therefore do not understand the concept of contamination (Rosenhead 1997), adaptability and utilisation (Richards 1983). This means we have not explored the mind of the Soft OR practitioner in a deep and meaningful way, failing to capture the essence of 'how' Soft OR works in practice. Thus, a void appears in the soft OR literature based upon supposition that we lack an understanding of

how facilitators or Soft OR practitioners assemble a cognitive understanding of situations and how they make decisions to proceed.

2.10 Conclusions

From this literature review, a number of disparities and weaknesses are identified which form the foundation of this thesis:

- The vast majority of the Soft OR literature is identified with key expert authors (Mingers 2003; Checkland 1981; Eden & Ackermann 1998) who are accomplished academic researchers. What is identified is a lack of research into non-researchers that use Soft OR methodologies and techniques (Donaldson & Ledington 1997).
- Research that has attempted to cover non-researchers use of Soft OR methodologies and techniques, has been fundamentally flawed based upon a research design of quantitative survey methods, that has tried to recall and capture practitioners use of SSM often a long time after the event and out of context. Such recall and capture of Soft OR practice is often blurred and partial (Russo and Shoemaker 1992).
- Many Soft OR authors have constructed meta-theoretical frameworks in order to help users apply different methodologies and techniques within the same problem intervention (Jackson 1992; Mingers 2003; Flood & Jackson 1991a 1991b, 1994c; Mingers & Brocklesby 1997; Midgley 1997). However, many of these frameworks are based upon conscious choice and premeditation in a problem intervention, whereas, many decisions about application, choice, adaptability and utilisation, are based at a sub-conscious and automatic level (Richards 1983; Munro 2001).

Chapter 2

- Research by Radardel (2003) emphasises that the ‘tool user’ rather than the ‘tool’ itself that should be studied. A point that is often missed in the soft OR literature.
- Soft OR is identified as a world of logic and deliberation in which problems are debated, considered and developed (Pidd 1998) using reasoned thinking, propositional thought and semantic understanding (Yeoman et al 2000; Sparrow 1998). But this reconciliation of knowledge creation, transaction and classification, does not reconcile Sparrow’s (1998) knowledge management equation with the success of Eden and Ackermann’s (2002) case studies and Checkland’s (Checkland & Stowell 2002) successful practice. Firstly, this success may be based upon knowledge found outside reasoning and rationality that is not accounted for in the Soft OR literature. Secondly, the knowledge creation process (Nonaka & Tomaya 2003; Nonaka & Takeuchi 1995) of externalisation and socialisation is not accounted for in the Soft OR literature as a means of explaining explicit and tacit knowledge transactions.
- The key to knowledge creation is identified as pragmatism (Nonaka & Tomaya 2003; Sparrow 1998), which is often dismissed by Soft OR authors (Mingers 2001; Jackson 1991) as a ‘theory without knowing’. However, pragmatism seems to be the key to making Soft OR methodologies work in practice. This is the emancipatory power of Soft OR, in which practice is about knowledge in action.
- There is no explanation in the Soft OR literature that demonstrates how models and discourse work together as a knowledge creation and transaction process.

- The success stories of Soft OR must reconcile with contamination (Rosenhead 1997). This contamination is about how the methodologies and techniques are used, adapted and utilised (Richards 1983). In order to find an explanation of success and contamination, attention must be paid to the mind of the user, rather than the tool itself. Much of the literature in Soft OR focuses on methodologies and techniques (Mingers 2003; Hodgson 1992; Mingers & Taylor 1992; Forrester 1961; Lehane et al 1997) emphasising design and creation rather than facilitation and practice (Taket 2002; White 2002).

A range of gaps has been identified in the literature that draws upon the disparities and weaknesses in previous works. More importantly, the concepts of 'facilitation', 'modelling', 'practice', 'pragmatism', 'multimethodology', 'discourse', 'knowledge' and 'politics' are not fully accounted for in the literature. These concepts are foundation for exploration and construction that explain how the practitioner makes Soft OR methodologies and techniques work in practice.

RESEARCH METHODOLOGY

3 Introduction

This chapter explains the research paradigm, methods employed and a demonstration of how a construction was derived. Firstly, why the researcher used a constructivist interpretation paradigm. Secondly, how the research methods were deployed through recalling practitioners cognitive understanding of how Soft OR was used in context. This means accessing multiple and personal constructions from the minds of the practitioners that can be elicited, refined, and constructed by the researcher (Guba & Lincoln 1994). Such a construction used Sparrow's (1998) knowledge equation as a means to view and make sense of the phenomena that surrounded the practices of Soft OR. Finally, a comprehensive example of how the conceptual map of Soft OR practice was derived from initial interviews through to cognitive maps.

3.1 Part I : The Researcher and the Paradigm

When research is based upon subjectivity with the researcher acting as a filter or interpretation device, it is important to understand the context of the researcher and the phenomena being researched. One such approach, where the researcher is faced with situations of multiple types or accounts of knowledge, the researcher can be viewed as a Bricoleur. A Bricoleur is a:

Jack of all trades or a professional 'do it yourself' person

Levi-Strauss (1966: 17)

It is the researcher as the Bricoleur who pieces together the research as a set of cognitive patterns which represents a conceptual map of Soft OR practice. Such a pattern is called a bricolage (Levi-Strauss 1966) which represents a series of findings that 'make sense' to the researcher (Weick 1979).

This approach to research takes an emergent construction, that changes as data emerges from the different tools, techniques and approaches to elicitation (Weinstein & Weinstein 1991). The Bricoleur deploys a triangulation approach across different spheres in order to secure understanding from the depth of phenomena of Soft OR practice. Objectivity is never captured (Denzin & Lincoln 1994; Nelson et al 1992), but a range of alternatives to validity becomes the focus. The researcher becomes the interpreter of events unfolding. This triangulation brings rigour and depth to a conceptual map of Soft OR practice. It is the Bricoleur who has a feeling for the research: a perception that is greater than the explicit data. It is dependent upon the ability of the Bricoleur to adapt, manage and feel the research through a self-reflexive process (Nelson et al 1992).

3.1.1 The Researcher as a Constructivist Interpreter

Guba's (1990) assumption that all research is interpretative, places the Bricoleur in the centre of the research. This paradigm of constructivist interpretation (Schwandt 1994) is based upon an ontology, where reality of knowledge is predominantly specific and local. It is a form of knowledge that

is expertise and grounded in practice. This epistemology views knowledge in a subjective and transactional manner as merely suggesting directions along which to look, rather than providing descriptions of what to see (Blumer 1954). This methodological¹ stance is founded upon subjectivity and interpretation in which the Bricoleur explores the mind of the Soft OR practitioner in order to construct a conceptual map of Soft OR practice.

Fundamentally, the constructivist interpretative paradigm believes that the world of events and meaning must be interpreted (Schwandt 1994). This process of construction is about clarifying through discourse, the language of those researched. The process is about 'questioning' and 'searching' for a construction, where the Bricoleur has a 'knowing' and 'being', rather than being concerned with methods (Wolcott 1988, 1992).

The Bricoleur as a constructivist interpreter works within this reality, constructing and interpreting a practical and instrumental function of knowing and being. These constructions according to Guba & Lincoln (1989) are about 'making sense' of the research. Making sense is concerned with how the research is managed and the level of sophistication that is deployed to interpret the research findings

Guba and Lincoln (1989: 143) associate this with the 'meaning' of construction. The level of sophistication must be meaningful, as a construction that is not meaningful is, in fact, a 'malconstruction'. Devices in the research process must ensure that this is discussed. Guba and Lincoln use the words of 'incomplete', 'simplistic', 'unformed' and 'internally

¹ It is important to remind the reader that the constructivist interpretation paradigm is subjective rather than an objective process, where researchers set out to construct and interpret rich narrative accounts of phenomena rather than a scientific, final, clinical and numerate account of the world (Guba 1990; Saratakos 1998)

inconsistent' with the term 'malconstruction'. Constructions can also work 'in conflict' with each other as a new phenomena unfolds. It is important that the Bricoleur can manage this process. Here the notion of 'tracing' knowledge is raised. Any construction must show a 'trace', to a certain degree, in the formulation of that construction (Mertens 1998).

3.1.2 Variety and Argumentation of Knowledge

Easterby-Smith (Easterby-Smith et al 1991; 40) asks the question "How will the research stand up to outside scrutiny and will anyone believe what I am saying about it?". Easterby-Smith and colleagues use the language of 'sampling theory', 'validity', 'reliability' and 'generalisation' to frame answers to that question.

Searle (1999) argues that words like 'validity' and 'reliability' are largely discredited in relation to capturing experiences in social constructivism research. Gergen and Gergen (2000) argue that the modernist assumption of an empirical world that can be studied objectively by qualitative methods is no longer sustainable. A point that scientific emphasis on theory generated by researchers gets in the way of paying attention to the experiences of interpretation. By focusing on the words of 'validity' and 'reliability' even within a phenomenological paradigm, a cognitive schematic interpretation binds the researcher to a scientific interpretation. It is the emancipation of the terms 'validity' and 'reliability' that must be used in a more flexible way, that satisfy the questions that Easterby-Smith and colleagues ask. 'Validity' and 'reliability' are replaced by 'variety' and 'argumentation'. Variety is a representation of multiple meanings whereas argumentation is concerned with construction and tracing of such 'variety'.

3.1.2.1 Variety of Knowledge

Getting inside the mind of the Soft OR practitioner means capturing and recalling a diversity of accounts and experiences of how Soft OR is practiced. These accounts and experiences are held in a range of schemas (Sparrow 1998). The Bricoleur is concerned with the elicitation and representation of such schemas. These schemas represent knowledge that is an alternative to objectivity and validity (Denzin & Lincoln 1994), as the combination of schemas brings depth and a variety of knowledge that replaces validity (Flick 1992). This variety helps the Bricoleur construct a transformation of knowledge in order to grasp the rich understandings of Soft OR practices, helping the Bricoleur deal with the reality of Soft OR practice.

The Bricoleur is faced with a diversity of knowledge through different constructions. These constructions are based upon recalling episodic memories from stories (Tulving 1972), accessing tacit understanding (Polanyi 1958; 1966) and reconciling semantic differences between different Soft OR techniques (Tulving 1972). This diversity of knowledge places the Bricoleur in the situation of knowledge construction and interpretation, in order to make sense of the world of the Soft OR practitioner (Goodman & Elgin 1998). Variety of knowledge is appropriate to the paradigm of constructivist interpretation (Schwandt 1994), in which language of meaning becomes a discourse of interpretation and variety. This variety is what Dewery (1958) sees as 'beauty' which builds a full and complex interpretation. A 'beauty' of the whole rather than a reductionism of knowledge. Variety of knowledge fulfils an epistemology of subjectivism which engages a dialogical methodology in which alternative discourse and voices are engaged and

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explored (Lincoln & Guba 2000).

3.1.2.2 *The Argumentation of Knowledge*

The Bricoleur is piecing together the variety of knowledge to produce a close set of practices of Soft OR that makes sense in an integrated manner. This process is a cognitive construction of events and the world of the Soft OR practitioner as it unfolds. The process is ‘complete’, ‘complex’, ‘formed’ and ‘internally consistent’ (Mertens 1998). The basis of this construction is the ability ‘to trace’ knowledge through argumentation. This is where the Bricoleur leaves a trace or trail in order that the reader can see how a conceptual map of Soft OR practice was constructed.

This process of argumentation of knowledge raises the issues of ‘acting’ within the phenomena, in which the Bricoleur is negotiating an appreciation of Soft OR practice, discovering new patterns derived from the emerging phenomena. The Bricoleur is tracing the accounts and variety of Soft OR into an integrated account and understanding. This is *the argumentation of the variety of knowledge* formed in Soft OR practice. It is the process of ‘credibility’, ‘validity’, ‘trustworthiness’ and ‘authenticity’ that is found in the construction of a conceptual map of Soft OR practice. The complexity of argumentation is managed through the presentation of results to the reader, called ‘argumentation validation’ (Becker 1989; Lamnek 1988).

Constructing an interpretation of Soft OR practice is, at times, more than the physical knowledge found in data. It is how the data is put together that builds a rich picture that makes sense, that accounts for the multiplicity of Soft OR practice (Saratakos 1998). This *argumentation of the variety of knowledge*, is the criterion used to answer Easterby-Smith’s (Easterby-Smith et al 1991: 40) question, “How will the research stand up to outside scrutiny and will anyone

believe what I am saying about it?" Argumentation of the variety of knowledge replaces the terms validity and creditability found in qualitative research.

3.2 Part II : Research Methods

The second part of this chapter guides the reader through the methods used and why. At the centre of process, are research methods that allow the Bricoluer to use Sparrow's² knowledge equation (1998) as a means to make sense of the data, in order to shape some initial thoughts about a conceptual map. The use of Sparrow's equation allowed the Bricoluer to bring order to the process of conceptual map building. By using Sparrow's equation, the Bricoleur had a means to investigate, iterate, play and connect the phenomena and concepts of Soft OR practice in a meaningful way. Such a starting point is essential in qualitative research (Guba & Lincoln 1994).

3.2.1 Purposeful Sample

The sample or population for this research is the next consideration. Constructivist interpretation is associated with case study work in many studies (Marsden 1997; Gubrium & Holstein 2000; Charmaz 2000), combined with the fact that one of the simplest rules of determining casework is:

Place the best brains available into the thick of what is going on.

Stake (1994: 243)

Usually, case study research involves observational behaviour of groups (Yin 1989). However, Erikson (1986) and Schwandt (1994) place an emphasis on cognition, individuality, expertise and exploration of the mind. Schwandt

² For a comprehensive description of Sparrows (1998) knowledge equation, please see appendix B

(1994), as a constructivist interpreter, discusses construction of meaning from case studies through ‘criss-cross’ meaning and patterns of phenomena or knowledge. Hence, it is deemed purposeful to study the best brains that practice Soft OR through a cognitive case study. A purposeful sample is where the researchers purposefully chose subjects who, in their opinion, are thought to be relevant to the research topic. In this case, the judgement of the Bricoleur is more important than obtaining a probability sample (Sarantakos 1998). This research draws upon practitioners’ experience, a type of knowledge that is local, relative, deep, ill-structured and expert based, which is determined to be purposeful for this thesis.

3.2.1.1 Purposeful Cases of Soft OR Practice

Three purposeful case studies were identified in which access was granted and expertise was prevalent in order to construct a conceptual map of Soft OR practice. These purposeful cases were *British Airways, Shell International and Academic Authors / Consultants*.

3.2.1.1.1 British Airways Case

British Airways (BA) is one of the largest airlines in the world, serving 170 different destinations in more than 70 countries. Operational research within BA plays a major role in improving the company’s efficiency and profitability i.e. maximising passenger revenue yields (Anon. 1992). Operational Research consultants provide support in information, capacity management, marketing, customer services, revenue management, crew scheduling and strategy, plus many more. Traditionally, the work has involved modelling, statistical analysis, simulation and a variety of hard OR approaches.

The purpose and role of OR at BA is documented in the philosophy statement of the OR group (British Airways 1999) to provide *effective change through*

analytical excellence. A range of work objectives support this mission statement:

- We help you get to the bottom of your complex problems
- We give you the information you need to make better decisions
- We help bring changes in which you can have confidence
- We bring logic to numbers and ideas
- As well as using analytical techniques, we use lots of common sense
- Our methods are original and creative
- We challenge the way things are done
- We bring a fresh point of view
- We take a step back and look at problems objectively
- We look at the future as well as the now

BA (Anon. 1992) undertook a study of Soft OR alternatives, as a means to assess and adopt a Soft OR tool. This study examined a range of Soft OR methodologies and techniques in terms of: needs of the organisation, BA culture, software, and so on. The research recommended strategic choice (Friend 1989) and SODA (Strategic Options Development and Analysis) (Eden 1989). More specifically, cognitive mapping was adopted from the SODA methodology and since 1993 has been the main problem structuring device used by the Operational Research Group.

British Airways employs 170 consultants (Yeoman et al 2000). From these consultants, a purposeful case of Soft OR practitioners was identified after consultation with Felix McGunnigle³. BA identified Soft OR as problem structuring methodologies (Yeoman et al 1999). Twelve consultants within

³ Felix McGunnigle (Senior OR Marketing Analyst) was identified as the point of contact at British Airways. After initial contact with Keith Rapley (Research Manager, British Airways OR).

BA were identified as experts in Soft OR, who had experience of using multiple rather than singular Soft OR methodologies and techniques. It was important that these consultants could articulate an expert constructivist model of several Soft OR methods in order to compare and contrast them. The interviews took place at British Airways Waterside HQ, Heathrow, over five days in 1998.

3.2.1.1.2 Shell International Case

Shell International is one of the largest oil companies in the world. The role of OR is to support the function of management within the company through a range of business consultancy projects. Dodd and Hocking (1994) developed a classification of Soft OR techniques at Shell International as a guide for managers within the organisation faced with: 'hard to define' or 'messy problems'. This classification matrix was based upon the evaluation issues of:

- Capture ideas and clarify issues
- Identify constraints, boundaries and actors
- Analyse and structure relationships between issues
- Identify options and criteria
- Analyse and evaluate options

Within this evaluation matrix: Hexagons (Hodgson 1992), VOCATE/CATWOE (Checkland 1981), Cognitive Mapping (Eden 1989), Systems Dynamics (Forrester 1994), Decision Analysis (Watson & Buede 1998), and Conflict Analysis (Howard 1999) were favoured. Shell International has worked with Peter Senge (1992) in the development and application of Systems Thinking, which is now the most common Soft OR methodology at Shell International.

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Shell International employs 24 consultants within the field of OR. With the assistance of Alex Orman⁴, 5 consultants were identified with an expertise in Soft OR who could provide domain knowledge of Soft OR practices. These Soft OR consultants were interviewed over four days between 1998 and 1999.

3.2.1.1.3 *Academic Consultants' Case*

Soft OR can be identified with a number of key authors within departments of Management Science and Operational Research within UK universities. These key authors have been mentioned by Lehaney et al (1997), Yeoman et al (2000) and Rosenhead and Mingers (2001), and are elaborated in greater detail in Chapter 2. Many of the authors have a range of colleagues within their university departments that practice Soft OR and publish extensively within the OR literature. It was justified to build up a purposeful case around these authors and followers. Table 3.1, identifies these key authors who, for access reasons, were restricted to academics who still practiced Soft OR methodologies and techniques.

⁴ Alex Orman (Senior Consultant) was the point of contact at Shell International. Alex, was previously a Lecturer at Southampton University. Alex had a forte for Soft OR within the Information Management group at Shell International, having commissioned Dodds, R & Hocking, A (1994) *Solving Messy Problems: A guide to Problem Structuring Techniques*. Report Ni. IC 93-075. Shell International Petroleum Maatschappij BV: Hague.

Table 3.1: Academic Users

Key Author	Associated Methodology	University
Peter Checkland	Soft systems methodology	Lancaster
Colin Eden and Fran Ackerman	Cognitive mapping JOURNEY	Strathclyde
Bob Flood	Total systems intervention	Hull
Michael Jackson	Total systems intervention	Lincolnshire
John Friend	Strategic choice	Lincolnshire
Jim Bryant	Drama theory	Sheffield Hallam
Jonathon Rosenhead	Robustness Analysis	London School of Economics
Larry Phillips	Decision Conferencing	London School of Economics

The authors identified in Table 3.1 formed the basis of the purposeful case. These key authors and colleagues were contacted between 1999-2000, to identify opportunities for accessing and selection for interviewing within each university. Candidates for the interviews had to have an expertise and domain of knowledge of several Soft OR methodologies and techniques. The number of academic consultants interviewed at each university is identified in Table 3.2

Table 3.2: Number of Interviewees per University

University	Number of Interviewees
Lancaster	3
South Bank	2
Sheffield Hallam	2
Luton	4
Strathclyde	2
Lincolnshire	1
London School of Economics	2
Hull	5

3.2.2 *Methods Employed*

3.2.2.1 *Data Management*

Different research methods were employed to capture the variety of knowledge and the sequential use of such methods in order to demonstrate the argumentation of knowledge. Data Management is concerned with data capture and data interpretation. Two methods were deployed for the capture of data, repertory grid and semi-structured interviews. The data interpretation used a *computer assisted qualitative data analysis software (CAQDAS)* approach in order to deal with the variety and argumentation of knowledge.

3.2.2.2 *Data Capture*

3.2.2.2.1 *Personal Construct Theory and Repertory Grid*

Repertory grid is a technique that sets out to understand individuals perceptions and constructs used to understand their world. Repertory Grid is based upon George Kelly's (1955) Personal Construct Theory (PCT), which regarded individuals as scientists in their own right, continually exploring,

developing and understanding their world around them. Repertory Grid has been used widely in many contexts, including: Managerial Decision-Making (Dutton et al 1989); Human Resource Management (Donaghue 1992); and Organisational Behaviour (Arnold & Nicholson 1991). Repertory Grid is useful to the Bricoleur operating within a constructivist interpretation paradigm, as the focus is on the interpretation of meaning rather than a construction of qualitative data (Searle 1999). This meaning resides not in the data itself but in an interpretative process. The data that is interpreted is considered neither true or false but meaningful to the Bricoleur.

PCT has many boundaries, Dyson (1995) mentions that PCT is concerned with recognising and recalling information from semantic memory. Repertory Grid is about forcing participants to think in a reasoned manner in order to distinguish and find differences between concepts i.e. Soft OR methodologies (Yeoman et al 2000). This focus on semantic memory excludes the relevance of episodic memory i.e. personal accounts of events and experiences (Tulving 1983). Klein and Lewis (1985) conclude that PCT has strength in focusing on declarative knowledge, but weak in recalling procedural (skilled knowledge).

Kelly (1955) has been criticised by researchers (Dyson 1995; Neimeyer & Neimeyer 1993) for his lack of understanding of philosophical predecessors and PCT would be richer if it had been able to draw on these traditions. Kelly (1955) has been criticised on three broad grounds in respect to social process. Firstly, for not adequately addressing the social origins of constructivism. Secondly, for seeing social process only in the terms of individual processes and finally, for the extent to which persons are free to choose in the development of repertory grid.

Franscella and Bannister (1977), Marsden (1997) and Winter (1999) to some extent conclude that constructs cannot be man's only intellectual tool for interpreting given data. In particular, Marsden (1997) focuses on the over use of repertory grid as a quantitative technique, when the original intention of repertory grid lies in the qualitative interpretation of data. The data elicited is not seen as a final representation of meaning, but a subjective device for exploration of further reasoning.

3.2.2.2.2 *Semi-Structured Interviews with Critical Incident Technique*

Interviews were used to gather data in order to gain depth of meaning from Soft OR practitioners. Easterby-Smith et al (1991: 72) states that the:

primary purpose of the interview is to understand the meanings interviewees attach to issues and situations in context that are not structured in advance by the researchers assumptions.

Burgess (1982: 107) presents the importance of interviews as:

the opportunity for the researcher to probe deeply to uncover new clues, open up new dimensions of a problem and secure vivid, accurate, inclusive accounts that are based on personal experience.

Burgess (1982: 45) goes on to say that interviews are:

how individuals construct the meaning and significance of their situations...from the complex framework of beliefs and values, which they have developed over their lives in order to help and explain and predict events in their worlds.

Easterby-Smith et al (1991: 733) states that:

researchers must therefore be able to conduct interviews so that the opportunity is present for these insights to be gained.

In order to capture the accounts of Soft OR practice based upon episodic memories, critical incident technique (CIT) was employed as a method within the interview in order to tease out information which might not be readily expressed. Flannagan (1954) defines CIT as a set of procedures for collecting direct observations of human behaviour in such a way to facilitate their potential usefulness in solving practical problems and developing psychological principles. An incident is observing human activity that is sufficiently complete to permit inference or prediction to be made about the person performing the act. By critical, the incident must occur in a situation where the purpose or intent of the act seems fairly clear to the observer with its consequences being sufficiently definite to leave little doubt concerning its affect.

The purpose of using CIT is to back-track on accounts of Soft OR practices, in order that those accounts can be explained or clarified to highlight levels of importance. CIT was used effectively when dealing with the recalling of episodic moments through different time frames (Nagay 1949). The importance of episodic memories balances the elicitation of reasoned, propositional and semantic understanding when using repertory grid (Yeoman et al 1999; 2000). In recalling accounts of Soft OR practice, the focus is to find those critical moments or incidents of how Soft OR practitioners use different methodologies and tools.

3.2.2.3 *Data Interpretation*

At this stage, it is important to note how the Bricoleur viewed the data. Fundamentally, a conceptual map of Soft OR practice is formed through a process of iterations between the data found in each research method, using Sparrow's (1998) knowledge equation as the starting point. The Bricoleur gains useful insights of how the Soft OR practitioner uses different tools and methodologies from the different accounts and interpretations constructed from different research methods. It is the ability of the Bricoleur to code, clarify, construct, reconstruct and deconstruct, that is the foundation of the coding process found in grounded theory (Partington 2000, Glaser & Strauss 1967) and the ability to use different methods through a process of triangulation. This triangulation is an endless process until the Bricoleur reaches a point of theoretical saturation, here the Bricoleur feels the bricolage is complete.

Throughout this process of construction and interpretation, different methods are used as guides rather than rigid rules. This follows the original principles of grounded theory in which Glaser and Strauss (1967; 8) state that the theory is to "stimulate others to codify and publish their own methods of generating theory". Glaser and Strauss are clearly aware of the problems of describing a highly linear format of grounded theory.

It is important for the Bricoleur to stimulate rather than freeze thinking (Glaser & Strauss 1967) in order to conceptualise and build a rich conceptual map of Soft OR practice. Grounded theory becomes a mechanism for interpreting data rather than rigidly coding data. It is important to find simplicity rather than procedural complexity (Bryman 1985), as a linear approach to grounded

theory puts a constraint on epistemological relationships of constructivism interpretation. In this research, a grounded theory has been adopted that is closer to Partington's (2000) and Charmaz's (2000) interpretation, which is a guiding principle in the use of triangulation of methods.

3.2.2.3.1 *CAQDAS Approach*

A Computer Assisted Qualitative Data Analysis (CAQDAS) approach, according to Barry (1998) and others (Buston 1997, Kelle 1997, Plaß & Schetsche 2000, Corti 2000) helps in the automation of processing data, speeding and livening up the coding process which is fundamental in a grounded theory approach. A CAQDAS approach helps the Bricoleur view relationships of phenomena and data through the ability to trace and track data, hence supporting the principle of the Bricoleur as a constructivist interpreter. A CAQDAS approach provides a formal structure for notes and memos to develop an analysis platform, which is consistent with triangulation and grounded theory (Strauss & Corbin 1990, 1994).

Three CAQDAS approaches were deployed:

- RepGrid II
- NUD*IST Vivo
- DECISION EXPLORER

3.2.2.3.1.1 REPGRID II

The software package RepGrid II (Centre for Personal Computer Studies, 1996) was used for the analysis of the RepGrid interviews. Two forms of analysis were conducted. Firstly, principle component analysis of the construct spaces. This function is seen in the PrinCom algorithm, which

identified major patterns of expert's thoughts on Soft OR. Secondly, a cluster analysis is used from the Focus algorithm, which is a distance-based cluster analysis that progressively groups the 'most similar' constructs together. This reveals patterns in categorisation. RepGrid II is a sophisticated program that allows the Bricoleur to view data in such a manner that each Soft OR methodology and technique could be categorised and distinguished against a range of characteristics.

3.2.2.3.1.2 NUD*IST VIVO

NUD*IST VIVO (Richards 1999) is a software program that works with documents through facilitating and indexing the components of these documents. NUD*IST VIVO or Nvivo is able to search for words and phrases very quickly enabling the retrieval of indexed text segments, related memos, searching and construction of hierarchical tree nodes and free association nodes. Nvivo draws upon many of the features of its predecessor NUD*IST 4 (Buston 1997). Nvivo offers a range of functions which allows the Bricoleur to index, code, search, combine retrieve, and trace the accounts of Soft OR. The selection of Nvivo was deemed good enough (Buston 1997) for the research, as the Bricoleur was comfortable with the software. Nvivo was easy to use and did not require specialist training, presenting few barriers to use. Additionally, Nvivo offered the opportunity to the Bricoleur to code and change data 'on screen' which was a significant improvement over NUD*IST 4. Nvivo also worked with 'rich text' rather than 'plain text' enabling the easy importing and exporting of data between software packages.

3.2.2.3.1.3 DECISION EXPLORER

DECISION EXPLORER (DE) is an interactive tool for assisting and

clarifying problems (Jenkins 1998), using the principles of cognitive mapping (Eden et al 1983). DE allows a visual display and analysis of cognitive maps in such a manner that it permits 'multiple viewpoints', 'holding of concepts', 'tracing of concepts' and 'causal relationship management'. Jones (1993:11) states that:

is a collection of ideas (concepts) and relationships in the form of a map. Ideas are expressed by short phrases which encapsulate a single notion and, where appropriate, its opposite. The relationships between ideas are described by linking them together in either a causal or connotative manner.

DE is a rich interactive tool that allows for the movement of concepts and connections in order that the Bricoleur can be in the centre of the meaning of Soft OR practices, seeing how the phenomena unfolds. DE helps the Bricoleur produce the bricolage. This is where the Bricoleur pieces together the research to produce a close set of practices and interpretations that present a series of findings, which 'make sense' (Levi-Strauss 1966, Weick 1979). The most important feature of DE (Eden & Ackermann 1998) is the ability to categorise concepts, values and emergent themes. DE allows the Bricoleur to elicit data, code concepts for example using 'set management' commands. DE is a process of allowing the Bricoleur to emerge or stand back from the data. It is an exploration and systemic tool for a constructivism interpretation.

3.3 Part III Demonstration

This part of the Chapter sets out to show how a construction and interpretation of a conceptual map of Soft OR practice was formulated. Such a demonstration can only be viewed as an example. At the end of this demonstration, the reader will have a clearer idea of how a conceptual map of

Soft OR is constructed and how Sparrow's (1998) knowledge equation was deployed. The demonstration starts with the Repgrid and semi-structured interviews, which are used to record the different dimensions and accounts of Soft OR practice. Once these accounts have been captured, a detailed analysis is provided through RepGrid II and NUD*IST vivo. These software programs are used by the Bricoleur to gain a sense of feeling about the accounts, issues and dimensions that are found in the interviews. The construction of the map of Soft OR practice, was derived through Decision Explorer. This demonstration follows the path from an initial interview with Keith Rapley (British Airways) to a final conceptual map of Soft OR practice.

Such a demonstration is based upon the following steps:

Step 1: The Rep Grid Interview

Step 2: Semi-Structured Interview with Critical Interview Technique (CIT)

Step 3: RepGrid Analysis

Step 4: Nvivo Analysis

Step 5: Decision Explorer – Construction of a Conceptual Map of Soft

3.3.1 Step 1: The RepGrid Interview

The purpose of the RepGrid interview enables the Bricoleur to compare and contrast different Soft OR methodologies and techniques, enabling a semantic and reasoning understanding of the subject. The Repertory Grid procedure compares alternative entities (Soft OR methodologies and techniques) systematically. These entities are referred to as 'elements' within the procedure. The interview follows the process of eliciting constructs using the minimum card triad method (Bannister & Fransella 1971). Each of the elements selected was written down on postcards. Keith Rapley was then asked to pick three cards at random, the cards were then turned over, and

Keith Rapley was asked “Which two Soft OR methods had one thing in common, which the other Soft OR methods does not have?” The term selected by Keith Rapley was then recorded. Keith Rapley was then asked to provide a word or phrase that could be described as “rather than” for the remaining Soft OR method. This process was repeated until five or six constructs had been generated. Keith Rapley was then asked to score the constructs along a scale of one to five, with the first generated construct (known as the pole) representing one, and the opposite pole representing five. This process was repeated until at least twenty constructs had been generated and scored. The repertory grid interview lasted 45 minutes.

3.3.2 Step 2: Semi-Structured Interview with Critical Interview Technique (CIT)

The purpose of the semi-structured interview with CIT was to establish and construct meanings of Soft OR with experts in a non-semantic manner, drawing upon a more personal, episodic, tacit feel and unstructured account of Soft OR practice. To achieve this, a range of key questions were used as in Table 3.3.

Table 3.3 Interview Questions

Questions
How would you define Soft OR?
How would you define facilitation?
Does Soft OR have any attributes that are specific to facilitation?
What are the key attributes or dimensions of Soft OR?
What skills are required in facilitating Soft OR?
What is the style of debate engendered by Soft OR?
Does Soft OR create new knowledge or recycle old knowledge?
What does a client get out of a Soft OR session?
What is the thinking process that happens in Soft OR?
What are the boundaries of Soft OR?
What doesn't Soft OR do?
What style of listening does Soft OR engender?
What does a Soft OR approach achieve?

These questions were drawn from Sparrow's (1998) model of knowledge and the literature on Soft OR and facilitation. The questions were used as starting points, followed by how, what, why, if and when, etc., depending upon the avenues followed. The questions were used with Keith Rapley as a means to explore statements that emerged from the interview and as a means to explore emerging points. In order to capture the conversation and analyse the data at a

further stage, a tape-recorder was used to record the interview. The interview with Keith Rapley lasted 45 minutes.

3.3.3 Step 3: *RepGrid Analysis*

The software package RepGrid II (Center for Personal Computer Studies 1996) was used to analyse Keith Rapley's repertory grid interview. Within the software package, several modes of analysis were used. The PrinCom algorithm identified construct spaces and patterns from the interview, whereas the FOCUS algorithm is a distance-based cluster analysis that progressively groups the most similar constructs together, revealing patterns of categorisation. The purpose of the RepGrid analysis was to establish Keith Rapley's perception of the differences and similarities between Soft OR methodologies and techniques. Elements are described as Soft OR methodologies and techniques whereas 'constructs' describe differences and similarities. The process of analysis follows a prescribed formula as suggested by the software program RepGrid II. This analysis was interpreted based upon the tutoring of Professor John Sparrow (1997) and the Center for Personal Computer Studies at Calgary University (1996). For the purpose of presentation of results, a series of short-hand codes were used for each RepGrid analysis report. These codes were as follows:

C = construct

Com = component

E = element

CC = construct cluster

EC = element cluster

FOCUS = cluster analysis

PRIMCOM = principle components analysis

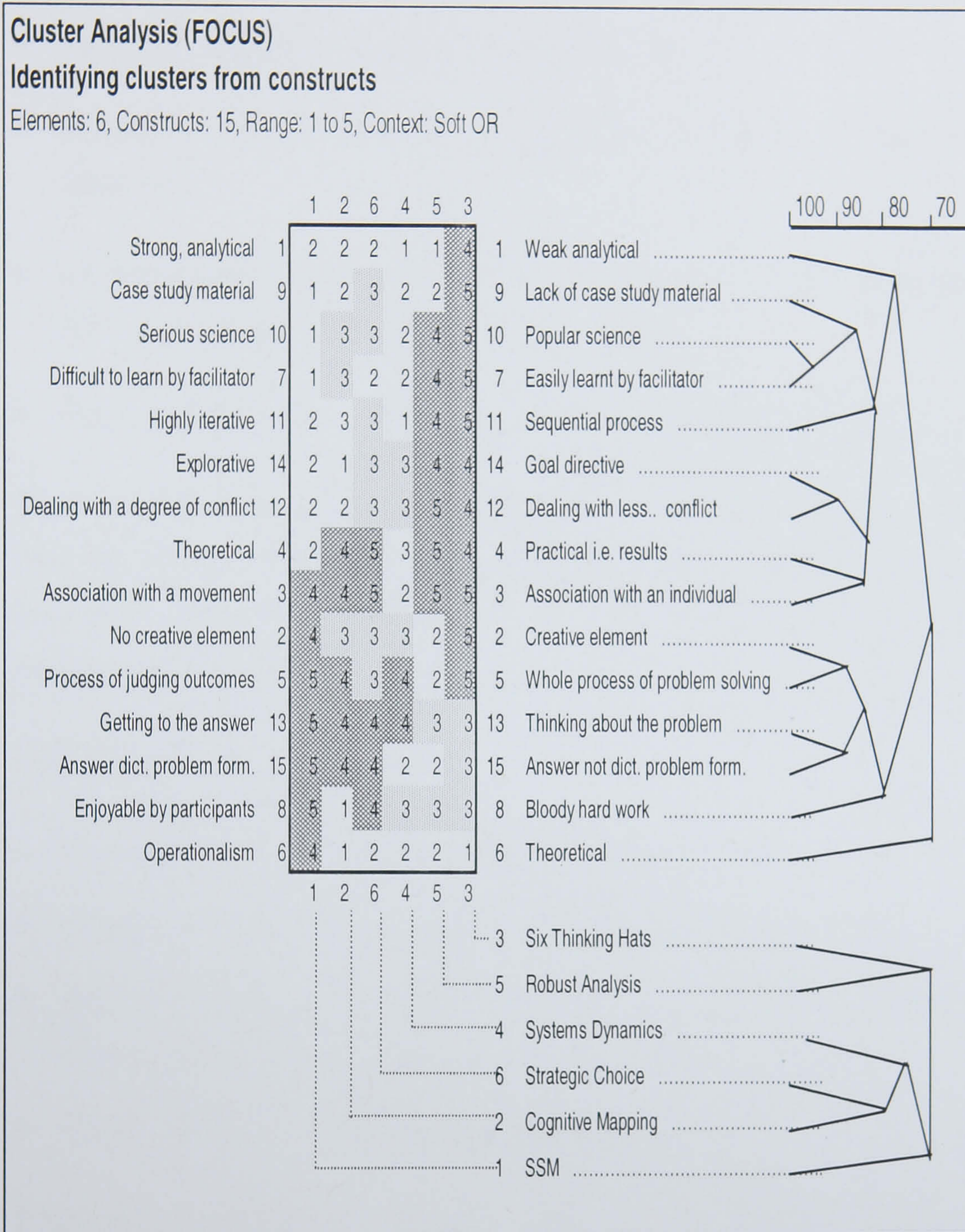


Figure 3.1 Keith Rapley – FOCUS Analysis

Figure 3.1 identifies the clusters found in the FOCUS analysis from Keith Rapley’s interview. Each set of constructs and elements in Figure 3.1 is given

a reference code. The constructs:

- No creative element – creative element, is labelled C2.
- Process of judging outcomes – whole process of problem solving, is labelled C5.
- Answer dictated by problem formulation – answer not dictated by problem formulation, is labelled C15.
- Getting to the answer – thinking about a problem, is labelled C13.

These four constructs had a degree of similarity which is recognised as 82% from the FOCUS analysis. This cluster was coded CC1 and labelled *degree of separation thinking*. This label was the Bricoleur's interpretation of combining the four sets of constructs.

CC2 relates to:

- Case study material – lack of case study material is labelled C9.
- Serious science – popular science is labelled C10.
- Difficult to learn by facilitator – easily learned by the facilitator is labelled C7
- Highly iterative – sequential process is labelled C11.

These sets of constructs are coded CC2 and are labelled *degree of subconscious skill* with a 83% similarity pattern.

CC3 relates to the constructs:

- Explorative – goal directive, is labelled C14.
- Dealing with a degree of conflict – dealing with a lesser degree of conflict, is labelled C12.

This set of constructs was coded CC3 and was labelled *function of the technique* with a 90% similarity score.

CC4 relates to the constructs:

- Theoretical – practical i.e. results, labelled C4.
- Association with a movement – association with an individual, labelled C3.

This set of constructs was coded CC4 and labelled *derivation of technique* with a similarity score of 83%.

From Figure 3.1, three construct sets stand out on their own and were not clustered. These were:

- Enjoyable by participants – bloody hard work, is labelled C8.
- Operationalism – theoretical, is labelled C6.
- Strong analytical – weak analytical, is labelled C1.

By following the pattern of similarities, these clusters were further merged to find higher level clusters which represented the thinking of Keith Rapley. Subsequently the clusters:

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CC1 + C8 + C6 = CC5

CC5 was labelled *thinking style* with a 73% degree of similarity.

CC2 + CC3 + CC4 + C1 = CC6

CC6 was labelled *transferability* with a 79% degree of similarity.

To summarise, the following clusters were identified that pertained to Keith Rapley's thinking and understanding of Soft OR methods and techniques:

CC1 – *degree of separation thinking*

CC2 – *degree of subconscious skill*

CC3 – *function of technique*

CC4 – *derivation of technique*

CC5 – *thinking style*

CC6 - *transferability*

The Bricoleur then internally validated these clusters to make sure that they 'felt right'. This involved double checking the FOCUS scores and whether the clusters 'painted' an appropriate picture of Keith Rapley's interview. The next stage involved comparing the FOCUS construct clusters against elements. The elements are the Soft OR methodologies and techniques.

Table 3.4 Comparison of Constructs Cluster Against Elements

	Soft systems methodology	Cognitive mapping	Six thinking hats	Systems dynamics	Strategic choice	Robustness analysis
CC1 – degree of separation	Scoring 4/5 suggesting no sub processes of separation thinking. Concerned with problem rather than solution	Scores mainly 4, therefore concerned with problem rather than sub-process	Scores 5 for creative / wholeness, but 3 scores for thinking about problem. Scores 2 for dictation of problem. Mixed results	Scoring 2's, therefore concerned with separation thinking	Scores ¾ suggesting an 'in between process'.	Scores mainly 2's, therefore a degree of separation.
CC2 – degree of subconscious skill	Scoring 1, in this area suggesting a high amount of sub-conscious skill. Checkland designs the process as framework; involving a high amount of facilitation – suggesting the process is learnt rather than taught.	Scoring 2/3, suggesting sub-conscious process takes place. The basic modelling process is learnt, suggesting facilitation carries the sub-consciousness	Scores 4/5 suggesting a lack of skill required that is sub-conscious. Basic principles are transferable.	Mixed results from 1-3, suggesting a sub-conscious process in learning the modelling process.	Scores mainly 3, suggesting a degree of sub-conscious, especially in the facilitation and modelling building process.	Scores mainly 4's therefore a lack of sub-conscious process.

Table 3.4 shows a partial example of a comparative analysis between different Soft OR methodologies and techniques. Such an analysis is constructed from the FOCUS clusters against the elements (Soft OR) enabling the Bricoleur to show a clear distinction between the elements. This is probably the first stage of analysis where the Bricoleur can see clear separation and distinctiveness between Soft OR methodologies and techniques.

A further cluster analysis from Figure 3.1 distinguishes between elements. For

example, Cognitive Mapping (E2) converges with Strategic Choice (E6) forming the element cluster (EC) *exploration through models*. This cluster is given the number EC2 which shows a 79% degree of commonality between Strategic Choice and Cognitive Mapping according to Keith Rapley's RepGrid.

A principle components analysis is shown in Figure 3.2, from which scores of over 10% were only considered.

Principle Components Analysis (PRIMCOM) ⁵					
Identifying Components from Constructs					
PrinCom Calculator		27-Aug	12:56:41		
PrinCom Output		27-Aug	12:56:54		
Percentage of Variance for each Component					
<i>Percentage of Variance for each Component</i>					
	C1	C2	C3	C4	C5
1	52.66	21.15	14.10	9.15	2.95
<i>Construct Loadings on Each Component</i>					
	C1	C2	C3	C4	C5
C1	-1.174	2.121	0.321	-0.107	0.103
C2	0.270	-2.215	-0.145	-0.577	-0.012
C3	1.594	-0.613	1.009	1.684	0.254
C4	1.905	1.136	0.093	1.145	-0.770
C5	-0.743	-2.242	-0.726	-0.808	0.275
C6	1.744	0.296	-1.617	0.035	-0.496
C7	3.117	-0.117	-0.630	-0.261	0.798
C8	0.989	0.937	-2.578	0.391	0.422
C9	-2.511	1.359	0.345	0.431	1.022
C10	-3.137	0.091	0.348	-0.169	-0.045
C11	2.923	-0.893	1.014	0.485	0.481
C12	-2.084	-0.948	1.042	0.621	-0.345
C13	-1.607	-0.415	0.092	0.242	0.105
C14	-1.826	-0.280	-1.422	1.148	0.286
C15	1.395	1.655	-0.143	-1.621	-0.000
<i>Element Loadings on Each Component</i>					
	C1	C2	C3	C4	C5
E1	-4.707	-2.014	1.549	0.136	0.656
E2	-0.837	0.329	-3.004	1.448	0.355
E3	4.798	-2.916	-0.314	-0.872	0.056
E4	-2.225	1.554	-0.850	-2.322	-0.491
E5	2.820	2.918	1.497	0.235	0.791
E6	0.151	0.129	1.121	1.375	-1.367

Figure 3.2 Principle Components Analysis

⁵ Copy typed from Rep Grid II for clarity

Component 1 (Com1) is identified with a percentage variance of 52.66. In order to find a meaning for Com1, the construct loadings are explored using the highest positive and negative scores for Com1. From Figure 3.2, the highest positive loadings are identified as C7 (3.117) and C11 (2.923). C7 is identified from the right-hand pole in Figure 3.1 as 'easily learnt by the facilitator'. C11 is similarly identified as 'sequential process'. From Figure 3.2, the highest negative loadings are identified as C9 (-2.511) and C10 (-3.137). C9 is identified from the left-hand pole in Figure 3.1 as 'case-study material' and C10 as 'serious science'. Com1 is labelled *rational problem solving approach* as against *non-rational approach to problem solving*. This process is repeated for Com2 and Com3.

Table 3.5 shows principle component scores between different elements

Table 3.5 Principle Component Scores

	Soft systems methodology	Cognitive mapping	Six thinking hats	Systems dynamics	Strategic choice	Robustness analysis
Com1 – <i>Rational problem solving approach as against non-rational approach to problem solving.</i>	7.036	6.142	-4.264	-5.485	6.654	8.665

The final stage of Keith Rapley's RepGrid analysis involved an interpretation of all the component parts. The Bricoleur is trying to make sense of the 'sum of the parts'. This involved the Bricoleur searching and exploring for some

sort of meaning, commonality or difference between the parts. The following is an extract from Keith Rapley's Rep Grid report:

SSM is a process rather than a methodology (Com2 - -6.433) as Checkland states (1981) SSM is concerned with the problem as whole, but a high amount of sub-conscious skill is involved (CC2 / CC32). This can be explained through transferability of the technique (CC6), because the success of the process depends on the level of facilitation skill. Because of transferability, this skill is difficult to learn, theory based (CC4) and surfacing unconsciousness. SSM first order of thinking is rationality (Com1 – 7.036). This lack of transferability is also tied up with different styles of thinking, that is associated with SSM i.e. systems thinking and autistic. The process also requires a high degree of cognition (Com3 - -18.574), as the process asks participants to think about thinking.

Cognitive mapping is an exploration through models according to the cluster that has emerged from the elements (EC2). Cognitive mapping is concerned about wholeness and process rather than separation thinking or sub-process (CC1). The basic process has an amount of sub-conscious skill involved, as the process is learnt rather than taught (CC2). This maybe due to the facilitation skill element. The process follows a path of exploration, surfacing unconsciousness through conflict (CC3). Sub-consciousness is reinforced through the difficulty of transferability on certain issues, although the process is practical, operational and easy (CC4 / CC5). The emphasis on thinking is rationality through systems thinking (CC5 / Com1 – 6.142). The reliance on rationality, produces moderate levels of cognition (Com3 - -0.154).

Keith Rapley perceives the elements as a process rather than a technique. These processes are complex, learned and expert-based which use rationality

as a means to think about problems in a structured manner. The use of Soft OR processes are difficult to learn in a formal environment and can only be learnt effectively through practice.

Step 2 represents an interpretation of one interview. Each interview was written up as a scientific report which allowed the Bricoleur to capture the data in a formal manner. A scientific report in the form of hard-copy allowed further iteration and exploration of each report.

3.3.4 Step 4: Nvivo Analysis

NUDIST VIVO (Richards 1999) as mentioned earlier, is a software programme that works with documents, through facilitating and indexing the components of these documents. NUDIST VIVO or Nvivo is able to search for words and phrases very quickly, enabling the retrieval of indexed text segments, relating memos, searching, and construction of hierarchical tree nodes and free association nodes. Nvivo offers a range of functions which allows the Bricoleur to index, code, search, combine, retrieve and trace accounts of Soft OR. Nvivo offered the opportunity to the Bricoleur to code and change data “on screen”, which is clearly demonstrated in this section.

All of the interviews were transcribed and saved in ‘rich text’ format in order to import the transcripts into Nvivo. The transcripts were structured in such a manner that Nvivo would only read the answers rather than the questions. This is an important consideration when the Bricoleur would start coding.

The transcripts were grouped in Nvivo according to the purposeful sample cases. These cases or sets (Nvivo language) were British Airways, Shell International and Academic Consultants. The Academic Consultants’ set was further broken down according to the University location i.e. Sheffield

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Hallam, London School of Economics, etc. These sets brought together transcripts into a group enabling the Bricoleur to search through each individual purposeful case or set.

Nvivo uses a coding system based upon nodes. A node is a project database which represents a particular category. Each node contains data which has been coded against specific criteria i.e. facilitation, semantic understanding, etc. There are two types of nodes within Nvivo. Tree nodes represent text from documents that have been coded in a hierarchical tree. Free nodes represent text and ideas that are unorganised, or free-standing, that emerges from the transcript.

As a starting point, all of the documents were coded using Sparrow's (1998) knowledge equation. Sparrow's model was used to construct a tree node system that could be used for a first reading of all of the transcripts in this stage.

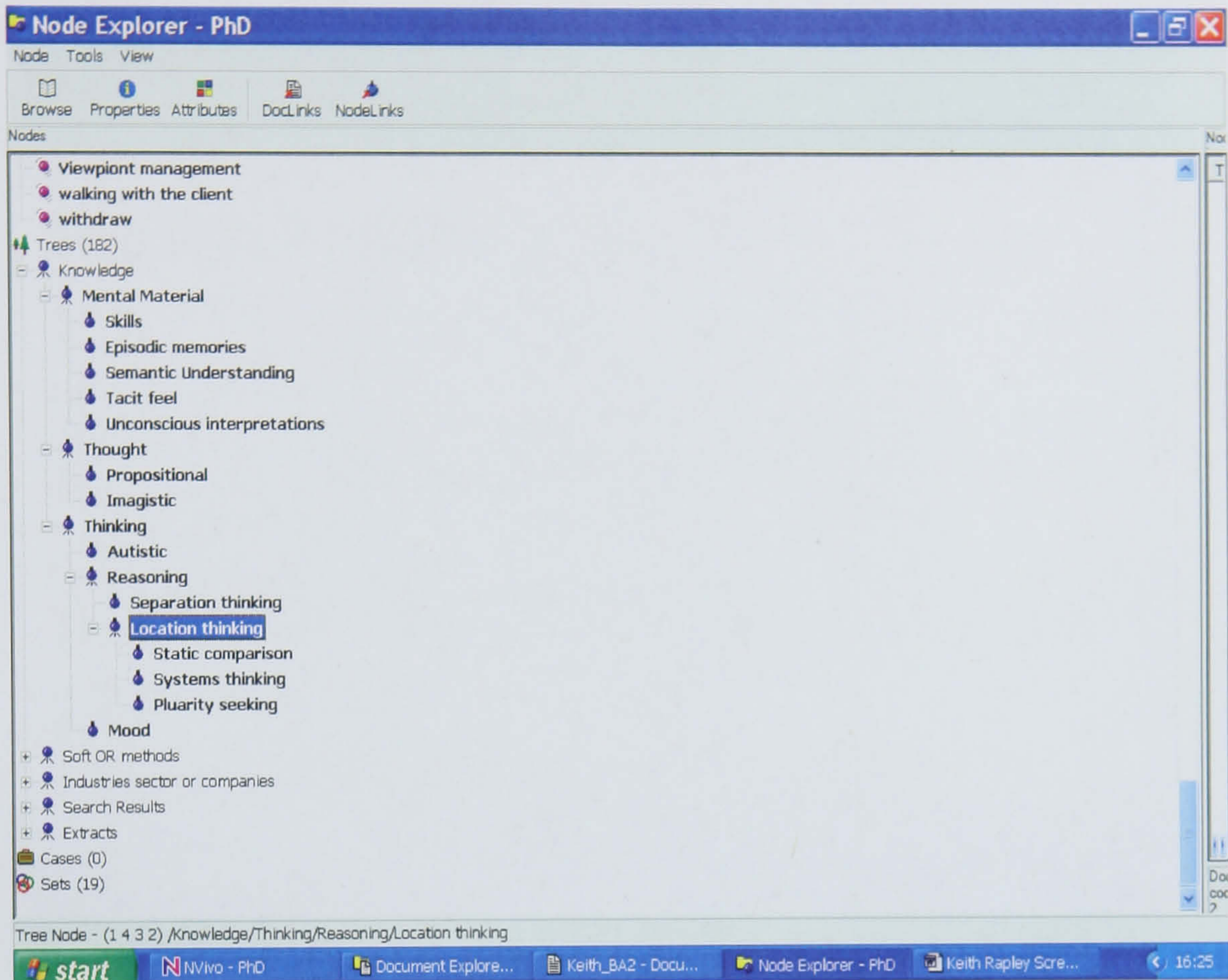


Figure 3.3 Sparrow's Knowledge Equation Hierarchical Tree Node System

This allowed the Bricoleur to get a feel for the transcripts in a systematic manner through the hierarchical node system. Figure 3.3 shows how the tree node system was structured within the Nvivo project manager.

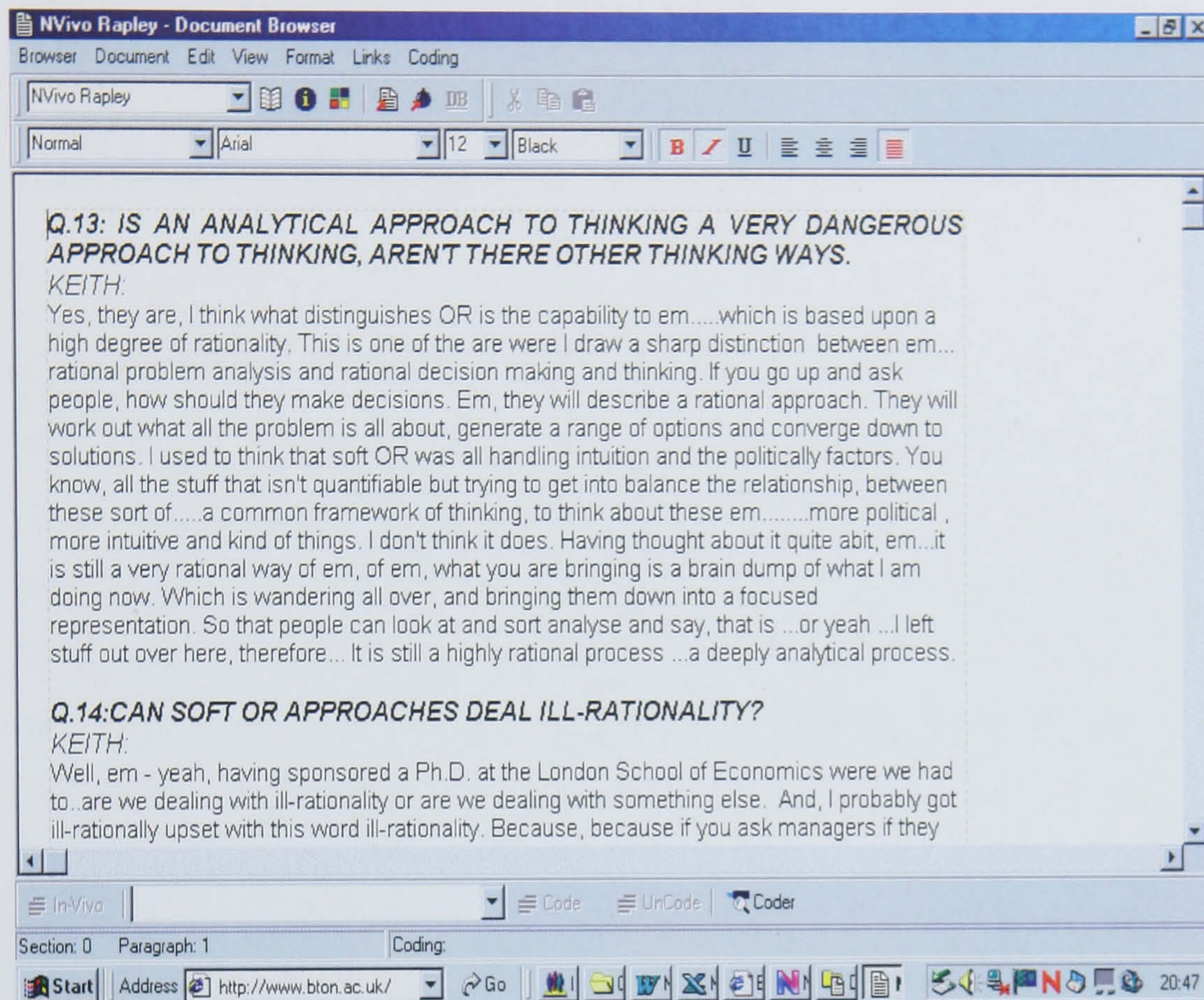


Figure 3. 4 Keith Rapley – Q13 & 14 from Nvivo

Figure 3.4 shows how the text was structured on screen after it was imported from a Word document. Below is a short extract from Keith Rapley's interview.

Q.13: IS AN ANALYTICAL APPROACH TO THINKING A VERY DANGEROUS APPROACH TO THINKING, AREN'T THERE OTHER THINKING WAYS.

KEITH:

Yes, they are, I think what distinguishes OR is the capability to em.....which is based upon a high degree of rationality. This is one of the are were I draw a sharp distinction between em... rational problem analysis and rational decision making and thinking. If you go up and ask people, how should they make decisions. Em, they will describe a rational approach. They will work out what all the problem is all about, generate a range of options and converge down to solutions. I used to think that Soft OR was all handling intuition and the politically factors. You know, all the stuff that isn't quantifiable but trying to get into balance the relationship, between these sort of.....a common framework of thinking, to think about these em.....more political , more intuitive and kind of things. I don't think it does.

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Having thought about it quite abit, em...it is still a very rational way of em, of em, what you are bringing is a brain dump of what I am doing now. Which is wandering all over, and bringing them down into a focused representation. So that people can look at and sort analyse and say, that is ...or yeah ...I left stuff out over here, therefore... It is still a highly rational process ...a deeply analytical process.

Q.14: CAN SOFT OR APPROACHES DEAL WITH ILL-RATIONALITY?

KEITH:

Well, em - yeah, having sponsored a Ph.D. at the London School of Economics were we had to..are we dealing with ill-rationality or are we dealing with something else. And, I probably got ill-rationally upset with this word ill-rationality. Because, because if you ask managers if they are acting in an intuitive way. Em, they would get very upset about calling it ill-rational. They are making decision on an entity reasonable basis, a rational basis still. If I choose to take action A, over action B because I know in previous situations, like the current situation. As action A has tended to work and action B hasn't. Em, they will perceive that to be a very rational choice. Em, and it would be very hard to argue with that. Equally, if they are going to choose to do something because em, em em...they em, em, because they em, because this is going to be acceptable to the other stakeholders. It may not be the best choice, but it is the one that has the least faults, in the eyes of other factions. These are quiet rational from a quantitative reasons, for making a choice. A good reason from a rational analysis point of view. Em

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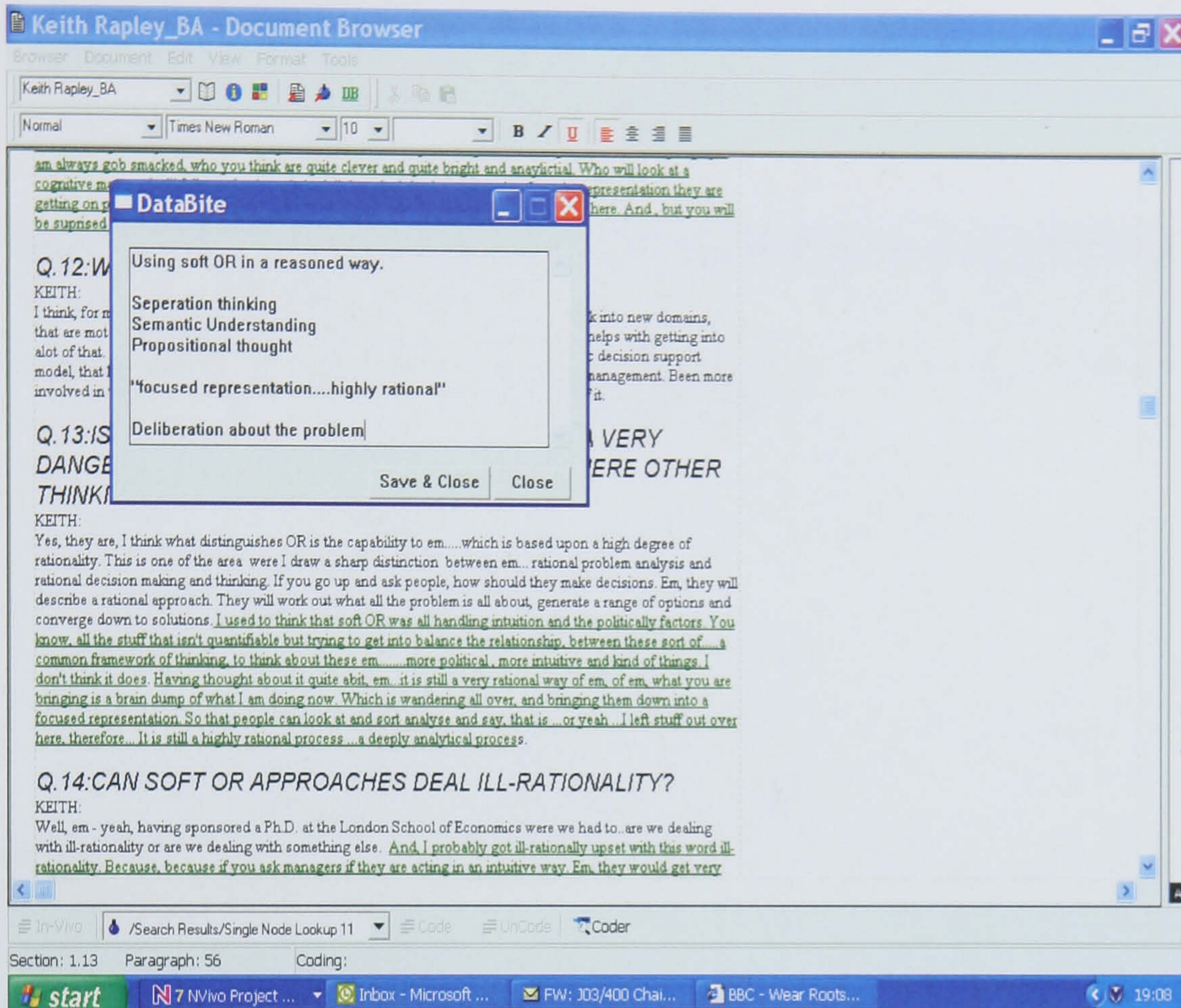


Figure 3.5 Using DataBites with Keith Rapley

Figure 3.5 shows the use of a 'databite' to help the Bricoleur mark passages of text with a special colour and underlining. A databite draws upon the use of internal memos which is a key component of grounded theory (Strauss & Corbin 1994). These databites are annotations of text which represented notes, hunches and thoughts of the Bricoleur. In figure 3.5, a databite has been created that highlights a passage of text which means to the Bricoleur that Keith Rapley is highlighting how participants in a problem intervention deliberate about a problem. The words 'focussed representation... highly rational' show how Soft OR is used in a reasoned manner. The Bricoleur makes a judgement to connect this text to the nodes of 'separation thinking',

‘semantic understanding’, and ‘propositional thought’.

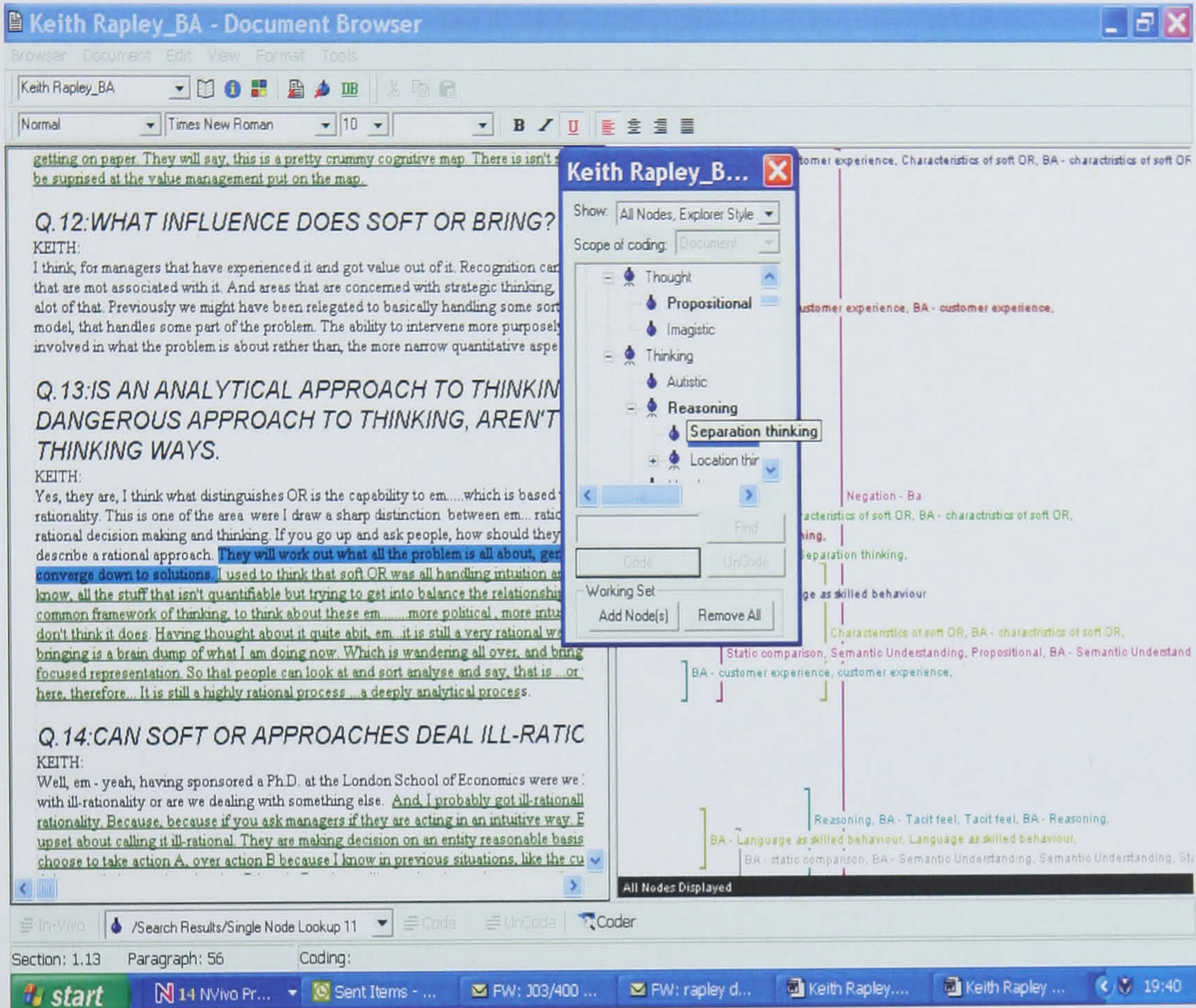


Figure 3.6 Using the Coder in the Keith Rapley Interview

Figure 3.6 shows how a *separate thinking tree node* has been coded against the interview text.

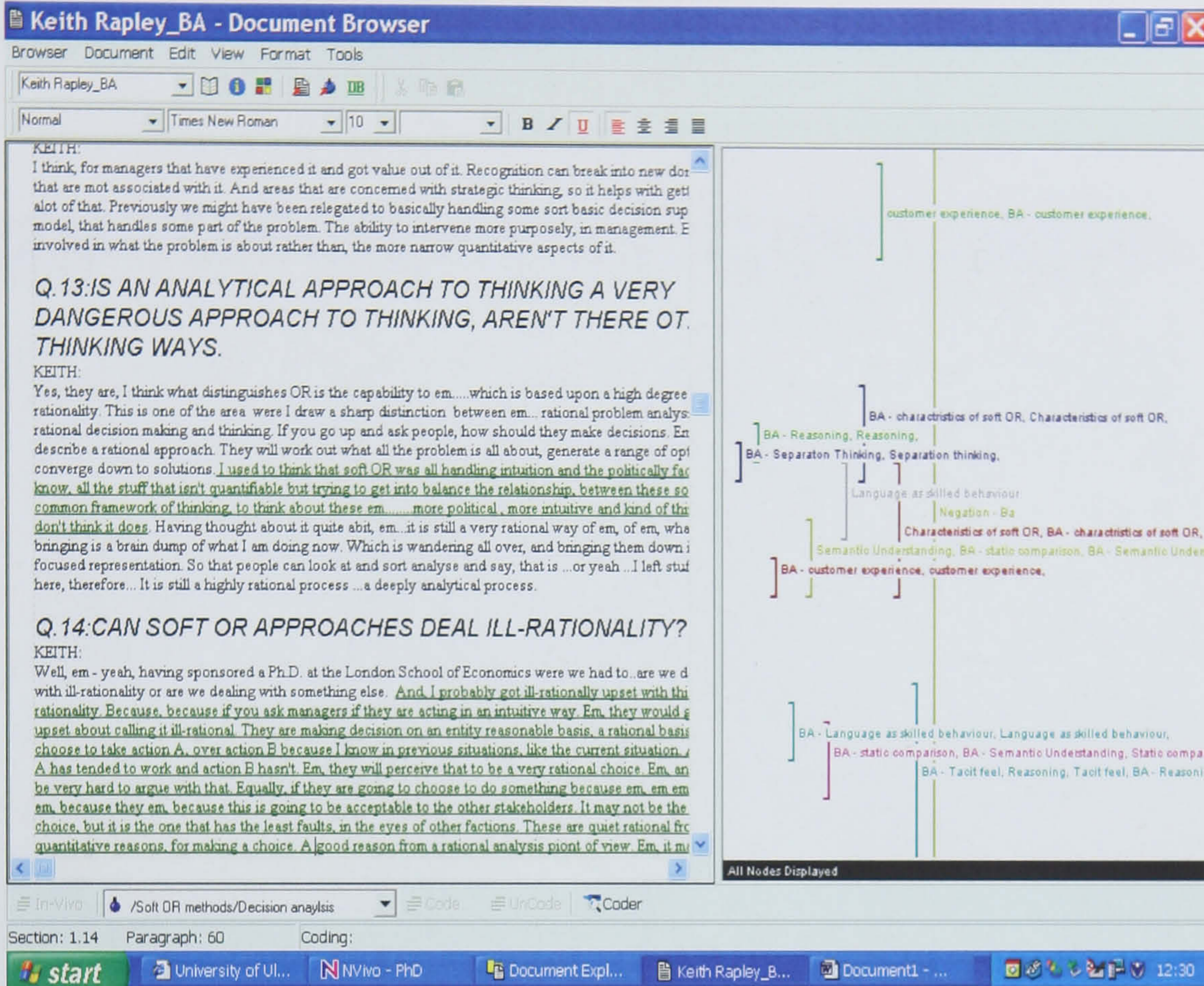


Figure 3.7 Visual Coding Strips

Figure 3.7 demonstrates how the node system was used on screen. The Bricoleur by working with nodes on screen could see instantly how an interview transcript was unfolding and see the relationship between different types of nodes. At this stage, the Bricoleur views and reviews the nodes within Sparrow's (1998) model of knowledge.

Once the transcripts had been coded against Sparrow's (1998) knowledge equation, attention turned to the actions of the facilitator. By using free nodes, which were created from transcripts as patterns emerged. 'Facilitation' and 'modelling' are identified as the key concepts in which freenodes were created. These concepts were building blocks for other concepts. Figure 3.8

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shows a list of free nodes created by the Bricoleur in Nvivo.

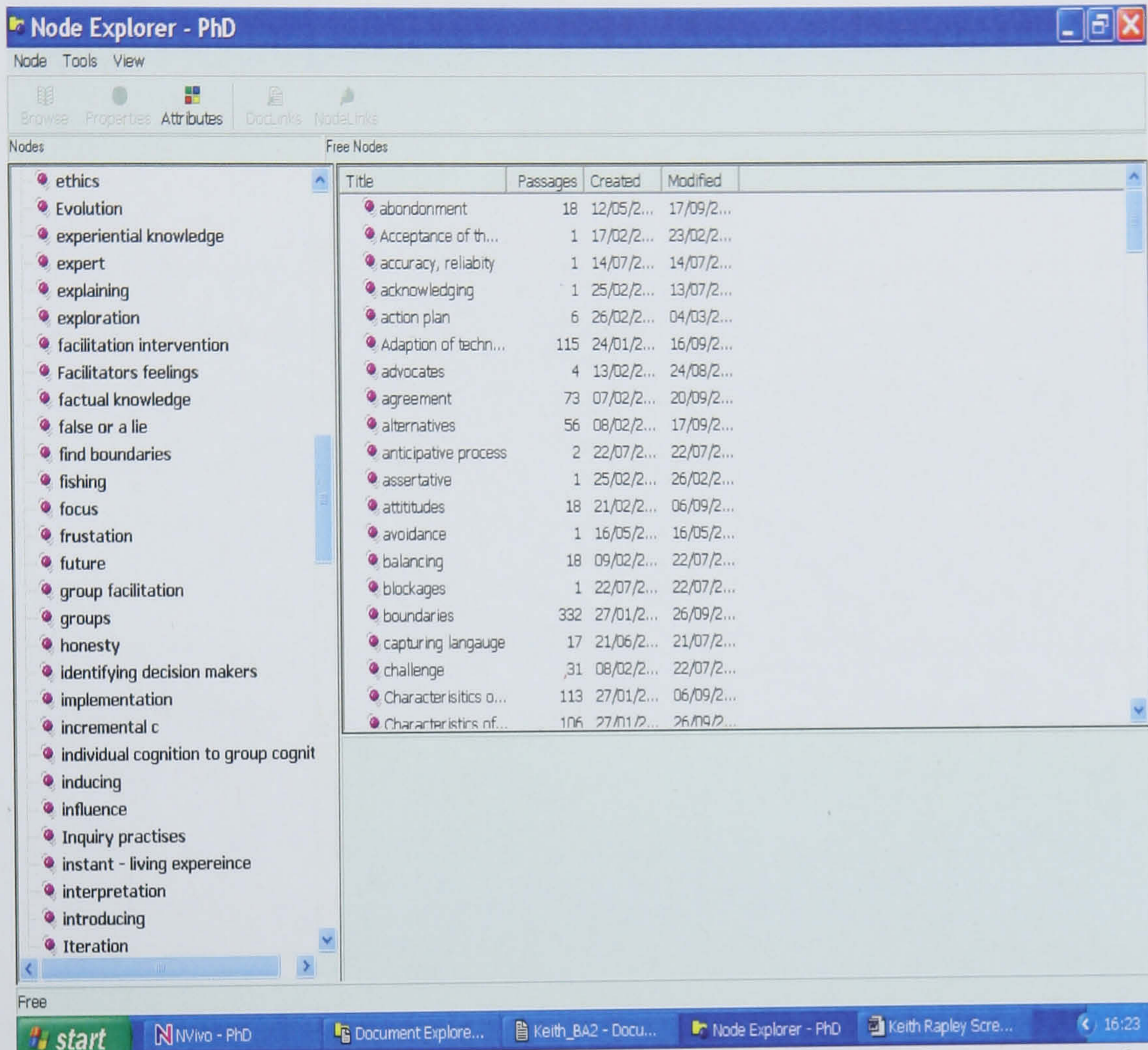


Figure 3.8 Nvivo: Free Nodes

The free nodes of 'facilitation' and 'modelling' captured a lot of script. Further reading and iteration, allowed the Bricoluer to breakdown the concepts into further nodes. These nodes included the actions of 'exploration', 'abandonment', 'adaptation', 'iteration', 'boundaries', 'linking' and 'congruence'. These nodes described what the facilitator did when working with models, clients and groups.

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When searching for a collective explanation of these nodes, an idea emerged from around the theme of 'metacognition'. Metacognition was about the automatic and intuitive behaviour of the facilitator.

This idea emerged several times in the Keith Rapley interview, as highlighted in the following passage:

KEITH:

*Yeah, yeah, I, sort of catch 22. There is em, there is a certain air of contradiction in what I am saying. Which is em, this is one of the reasons I am strongly opposed for the operations research becoming a closed professional body. Because, I think of it as a very cylvic subject. Not have boundaries drawn around it. Because, the whole process of trying to make interventions. Involves a whole series of dimensions. From, and the different dimensions have different professional disciplines. From which we can draw great value. **One of the things that distinguishes OR, is that we are great parasites. If somebody comes up with a great idea, we are very good at adopting it. And using it, and taking it over.** On the other hand, at some stage you have to define this, em, a natural extension to this, You have to say, what is an operational researcher. **A jack of all trades. I do feel a need to define it and delimit at some stage.** But my preference, is to delimit it at a **meta-level**. You know, hence the talk is about modelling. Hence, modelling is common to all of OR in my experience.*

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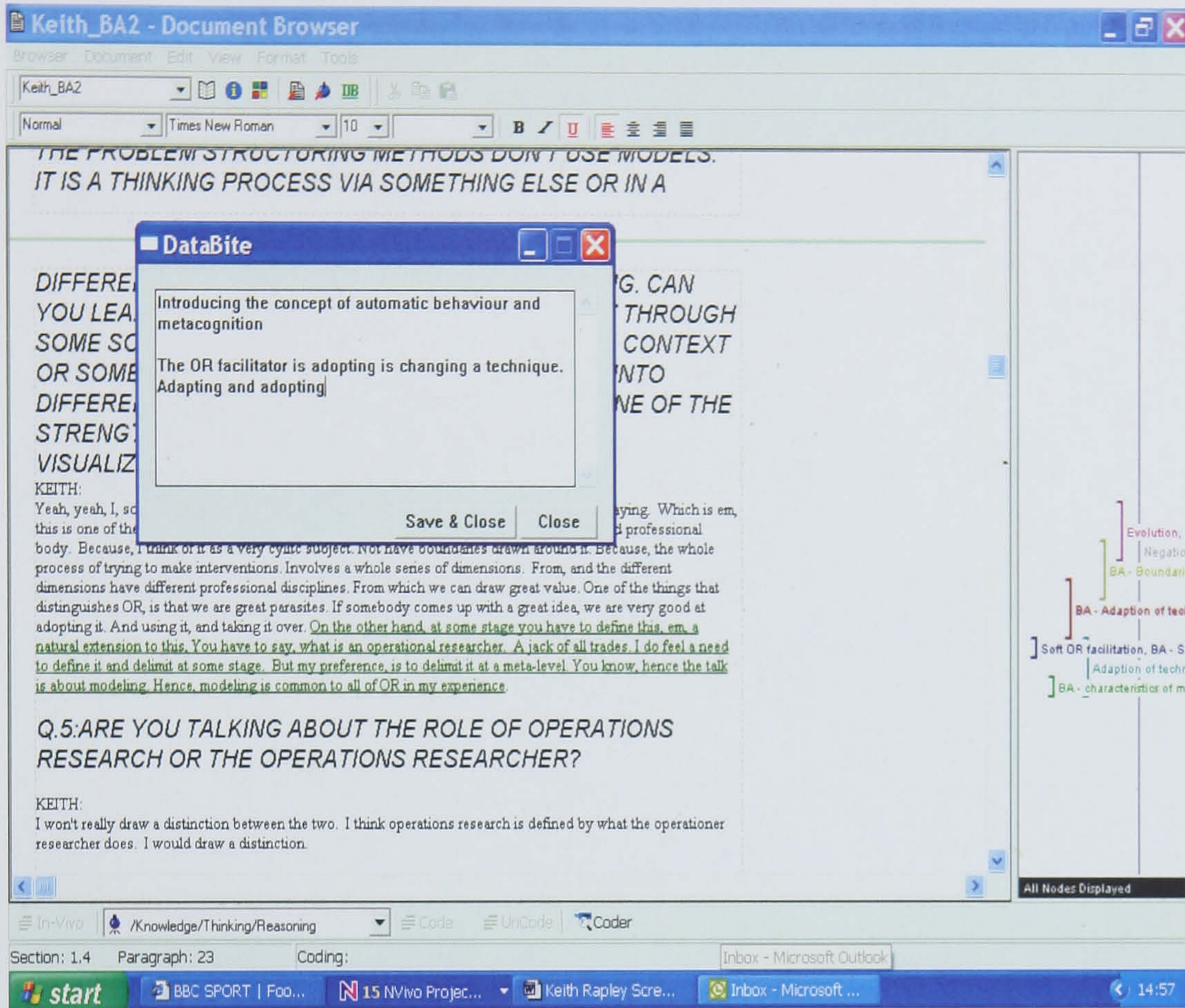


Figure 3.9 Keith Rapley - Changing and Adapting a Technique

Figure 3.9 highlights how the Bricoluer creates a databite, based upon the evidence of adapting Soft OR techniques, when Keith Rapley is talking about modelling.

The emergence of these nodes, that together describes the concept of 'metacognition' is further cross-checked with other transcripts from the BA case, through a Boolean search (figure 3.10)

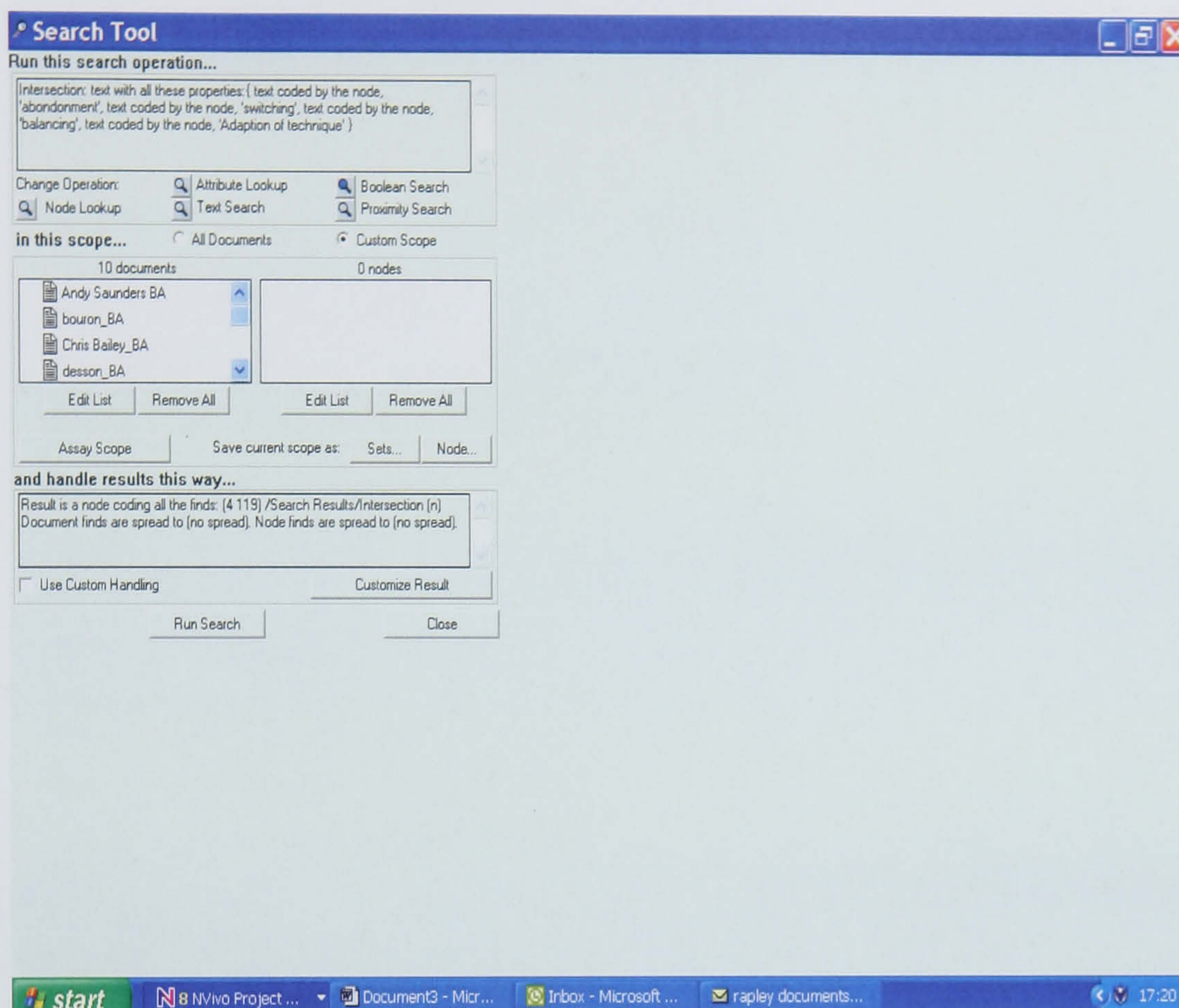


Figure 3.10 Boolean Search to Identify Metacognition

Such a search, from all of the transcripts within the BA case for the free nodes of 'adaption', 'switching', 'abandonment' and 'balancing' generated a report that highlights a number of passages in the BA case, as identified in *figure 3.11*.

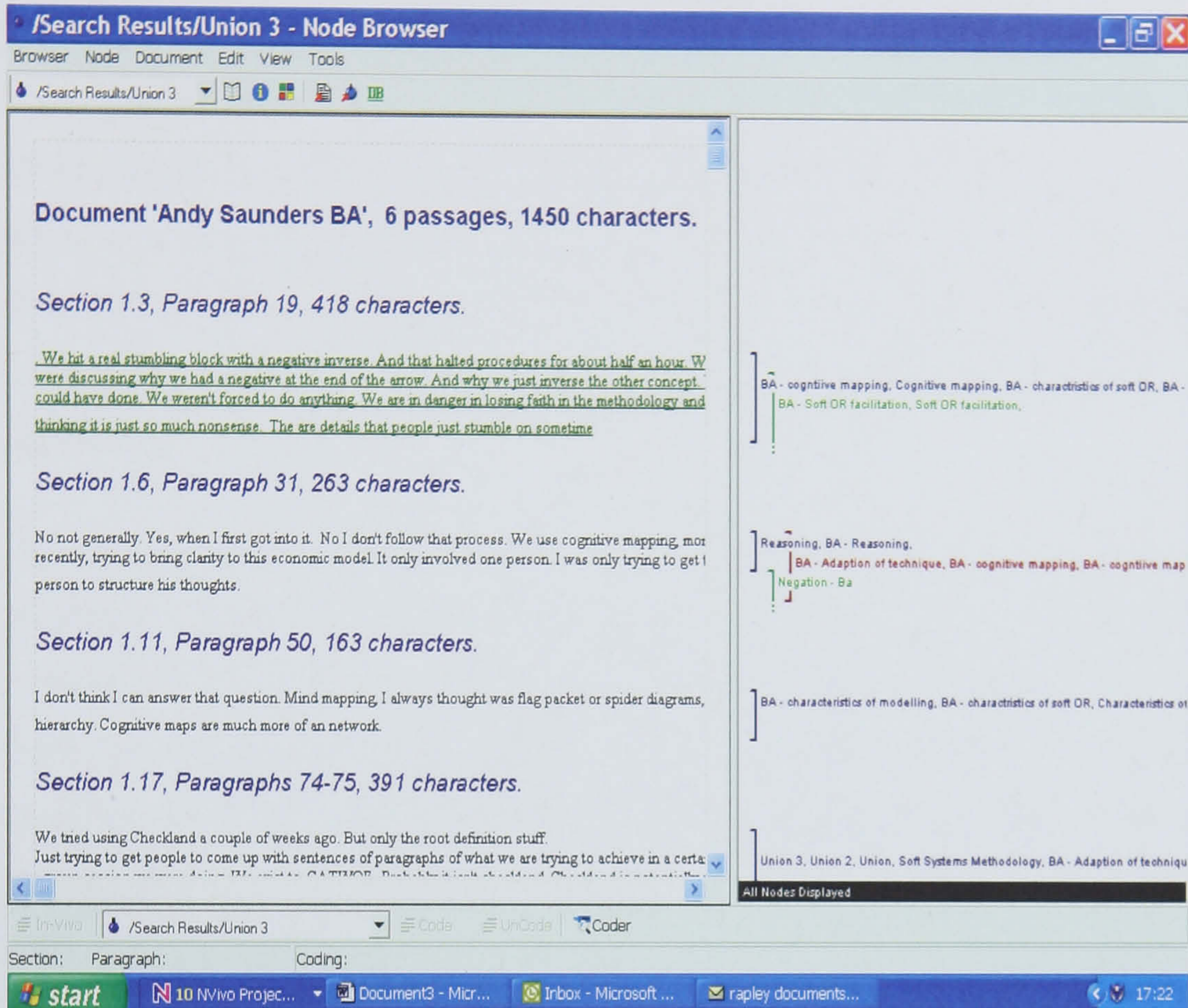


Figure 3.11 Metacognition Passages.

This search, allowed the Bricoluer to look at all of the transcripts through a range of nodes. Individual free nodes can be examined for their properties, through creating a node report. Figure 3.11 shows such report.

Nvivo allowed the Bricoluer to ‘search’, ‘explore’, ‘iterate’, ‘construct’ and ‘deconstruct’ the variety of knowledge found in the transcripts. Nvivo was not used as conservation analysis tool, in which words and paragraphs were countered, but as a means to make sense of the transcripts, in which a ‘voice’ emerged that made sense to the Bricoluer. Once a point of theoretical saturation had been reached, the nodes became the concepts in the Decision Explore maps.

3.3.5 *Step 5: Decision Explorer – Construction of a Conceptual Map of Soft OR*

Constructing a map of Soft OR through Decision Explorer (DE) is as much an art as a science, as this involves a large degree of subjective judgement by the Bricoleur. There is no starting or finishing point, it is a process of searching, feeling, interpretation, construction, and reconstruction to a point of theoretical saturation.

The first stage of construction involved putting the concepts from Nvivo and RepGrid into DE. This involved re-reading all of the Nvivo and RepGrid reports and transcripts. It was easy to attribute a range of concepts for each Soft OR methodology and technique. Using the DE set management facility, concepts were first attributed from the RepGrid reports for each technique or methodology i.e. Strategic Choice. Secondly, further concepts were added from the Nvivo transcripts.

Figure 3.12 identifies all of the concepts from the BA RepGrid reports and the Nvivo transcripts. Sets were created for both the RepGrid reports and the Nvivo transcripts.

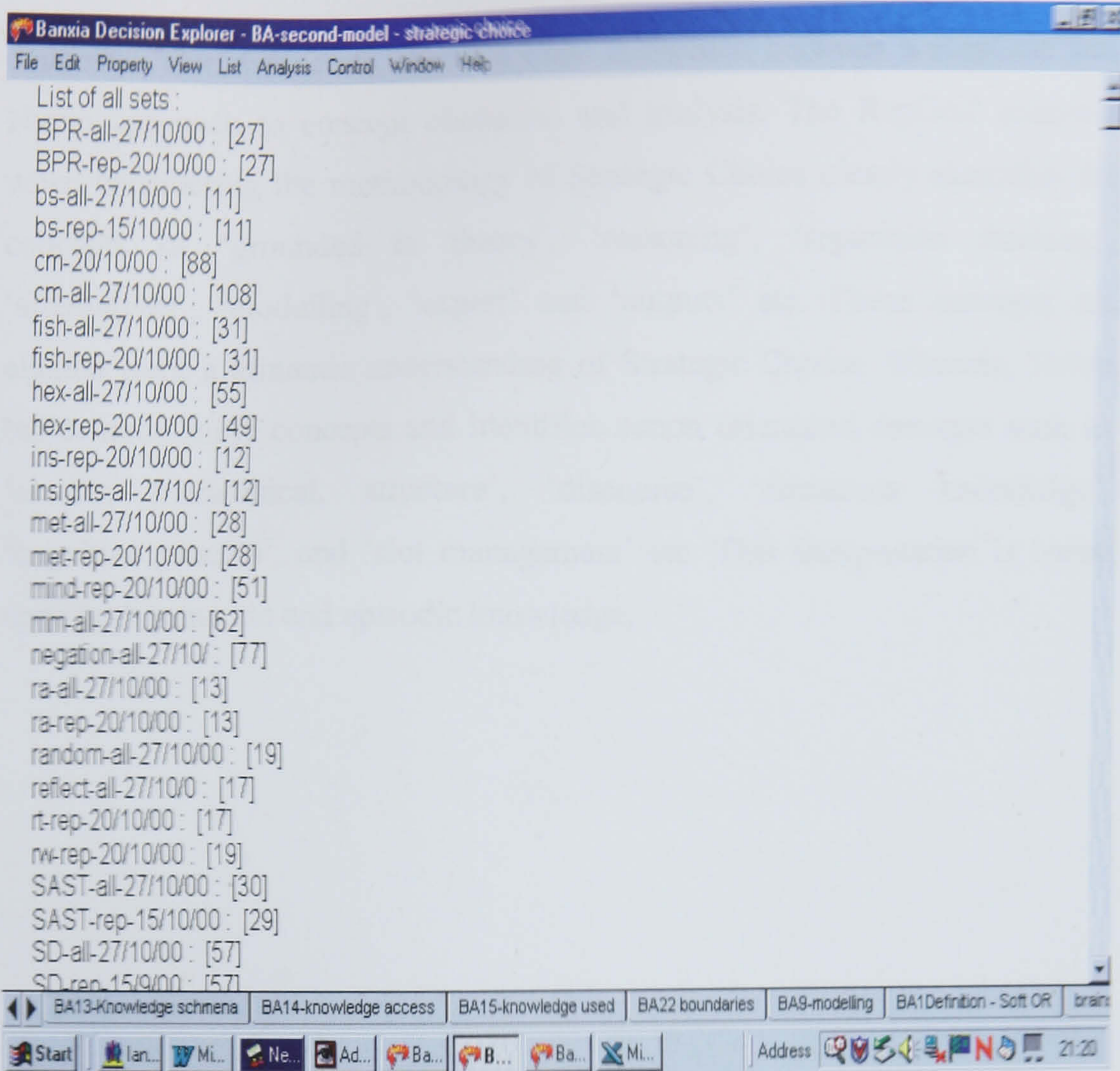


Figure 3.12 BA Sets

3.3.5.1 Using Set Manager to Get Started

Figure 3.12 has been compiled through DE's set management facility which allowed the Bricoleur to cluster concepts into a range of groupings or sets. The individual composition of a set for Strategic Choice is highlighted in figures 3.13 and 3.14.

Figure 3.13 shows the concepts that have been attributed from the RepGrid report and figure 3.14 shows the concepts that have been added from the Nvivo transcripts. Figure 3.13 identifies 17 concepts, and figure 3.14 shows 25

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concepts. This distinction shows a clear difference between a RepGrid and Nvivo approach to concept elicitation and analysis. The RepGrid analysis, when considering the methodology of Strategic Choice clearly identifies the concepts of 'grounded in theory', 'reasoning', 'separation thinking', 'alternatives', 'modelling', 'expert' and 'outputs' etc. These concepts are elicited from a semantic understanding of Strategic Choice. Whereas, Nvivo builds upon these concepts and identifies action orientated concepts such as 'cluster, hierarchical, structure', 'discourse', 'conscious knowledge', 'cognitive process', and 'slot management' etc. This interpretation is based upon both semantic and episodic knowledge.

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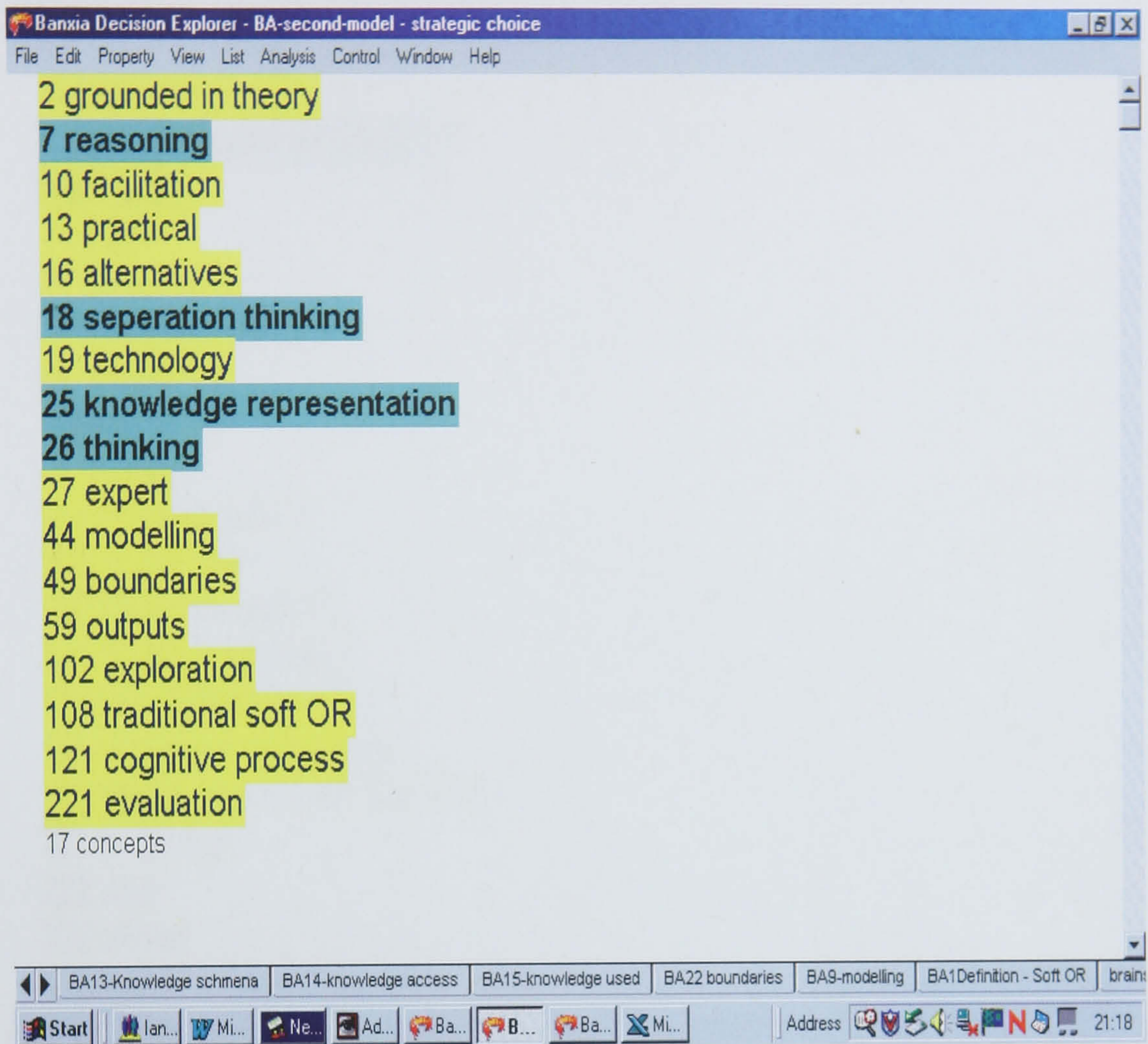


Figure 3.13 BA Strategic Choice RepGrid

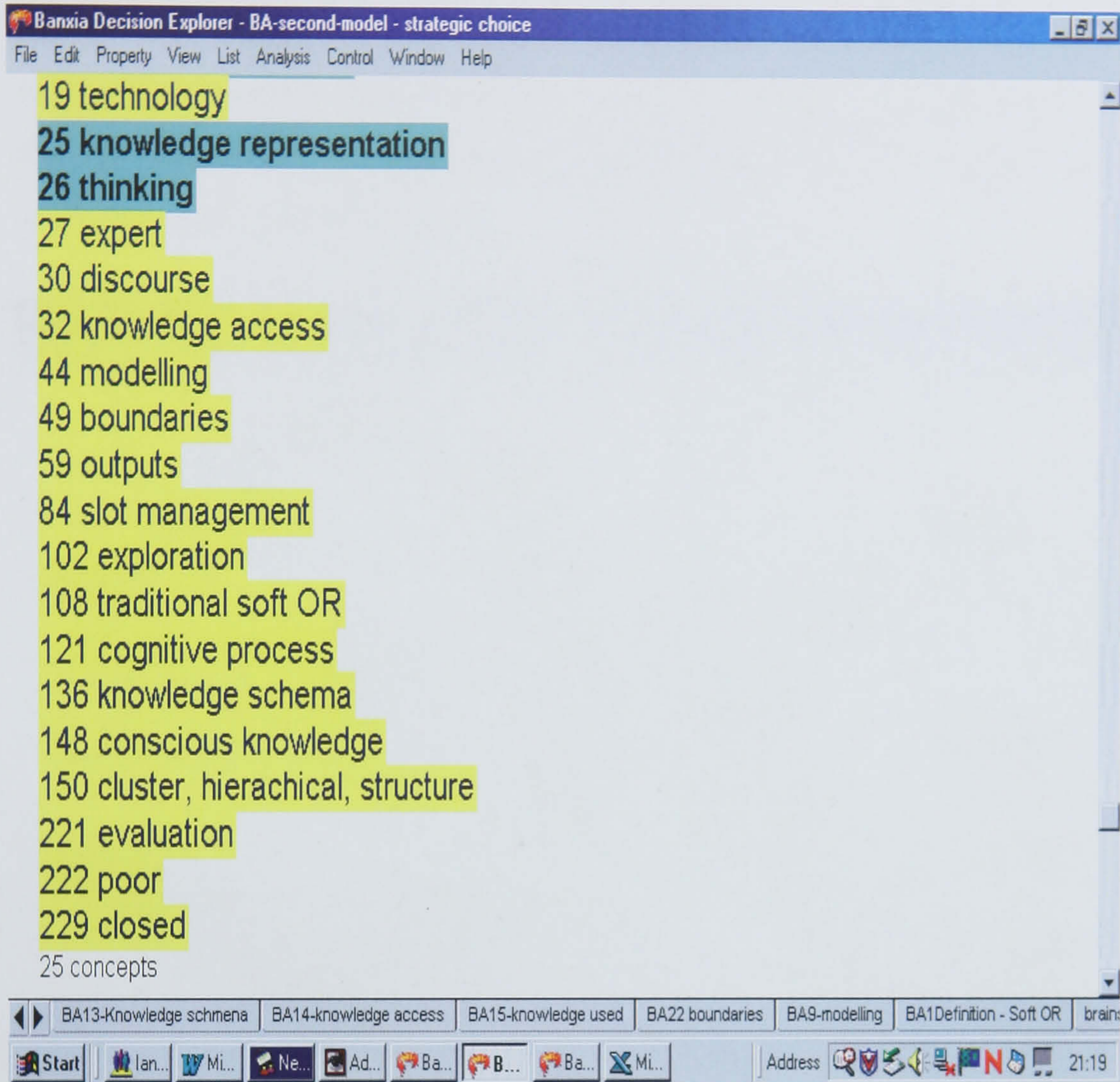


Figure 3.14 BA Strategic Choice All

3.3.5.2 Map Views

There are a number of ways to construct models within Decision Explorer, but an obvious starting point within this thesis can be determined from the question 'how would you define Soft OR? As this was the first question in the semi-structured interviews. Figure 3.15 shows a number of concepts which are clustered and inter-connected through the concepts of 'traditional Soft OR', 'OR traditional approach' and 'non-traditional Soft OR techniques'. It was very easy from the Nvivo transcripts and RepGrid reports to identify the characteristics that surround each of these concepts. From figure 3.15 the

was required to use many of the Soft OR approaches. The concept of ‘non-traditional Soft OR techniques’ has a strong connection to ‘introducing’ as many techniques such as ‘six thinking hats’ or ‘brain-storming’, were used at the beginning of an intervention process in order to generate alternatives etc.

Decision Explorer uses an automatic numbering system to label each concept. As a concept is input into a cognitive map, that concept automatically receives a number. For example, ‘traditional Soft OR’ has the number 108, and ‘non-traditional Soft OR techniques’ has the number of 290. Once a construction within the British Airways DE map was started, it was saved using the command of ‘map view’. As the British Airways DE map had over 287 concepts, the ‘map view’ allows the Bricoleur to explore a number of concepts that were constructed from the question of ‘defining Soft OR’? The ‘map view’ command was also used in conjunction with the command ‘fit to view’, in which the whole visual presentation of the map could be seen on the screen. This allowed the Bricoleur to make judgements, such as whether to breakdown or focus on specific concepts and create new viewpoints.

3.3.5.3 Using ‘Map View’ to Construct Maps

In order to find out which concepts are more important than other concepts, the commands ‘domain’ and ‘central’ are significant. The ‘domain’ command performs a hierarchical domain analysis which lists each concept in descending order of linked density around that concept. Those concepts with the higher link density were listed first. The importance of the ‘domain’ command highlights the importance of the closeness of the local links between concepts. Figure 3.16 shows a domain analysis for the BA case study.

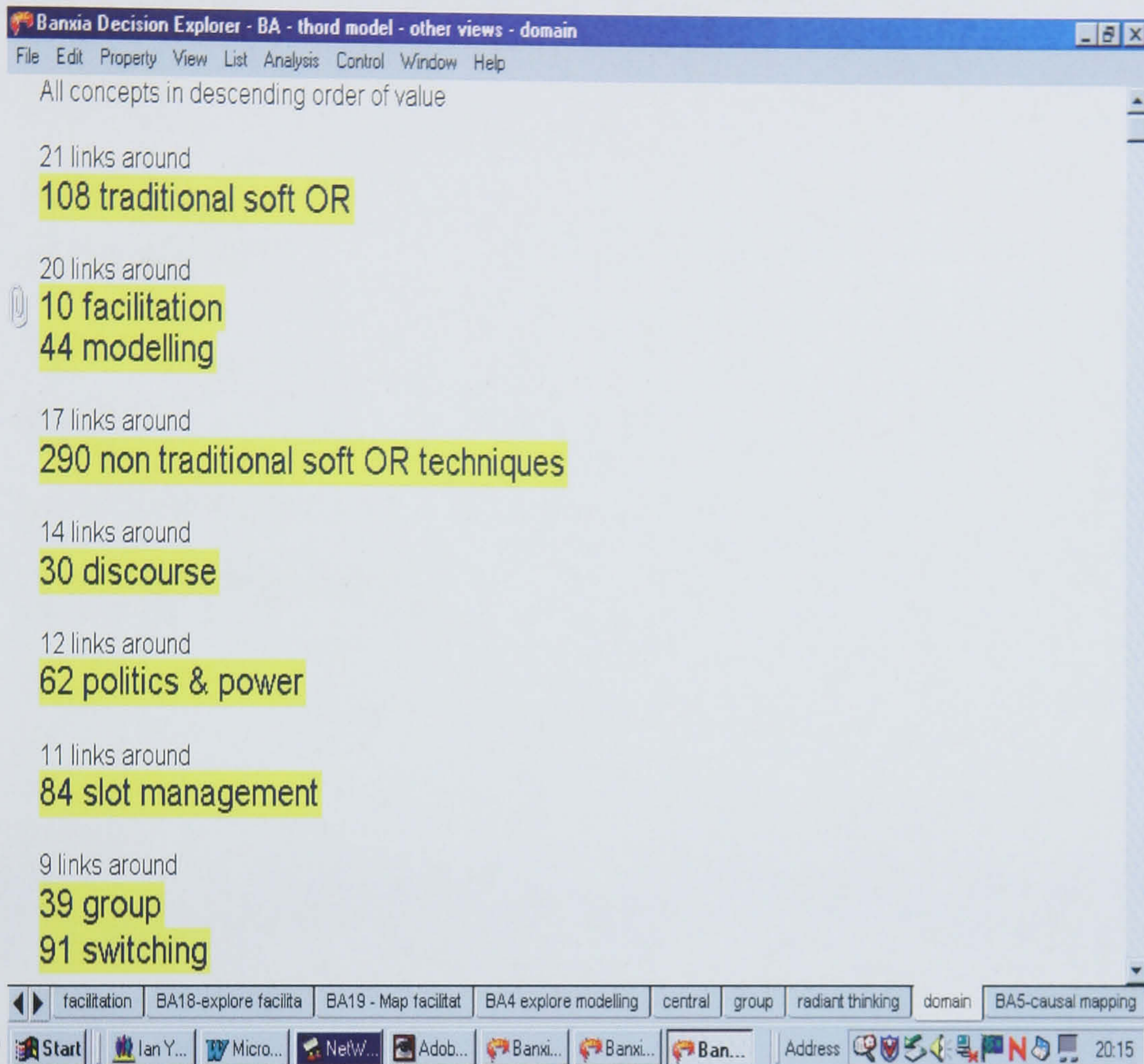


Figure 3.16 BA Domain Analysis

The 'central' command looks at specified band levels which are connected to the concepts. This allows the Bricoleur to look at the importance of the length of linkage between concepts. Each concept is weighted according to how many concepts are traversed in each band level. Fundamentally, the central command shows how many concepts are dependent upon one concept. Figure 3.17 shows the 'Central Command' score for the BA Case Study.

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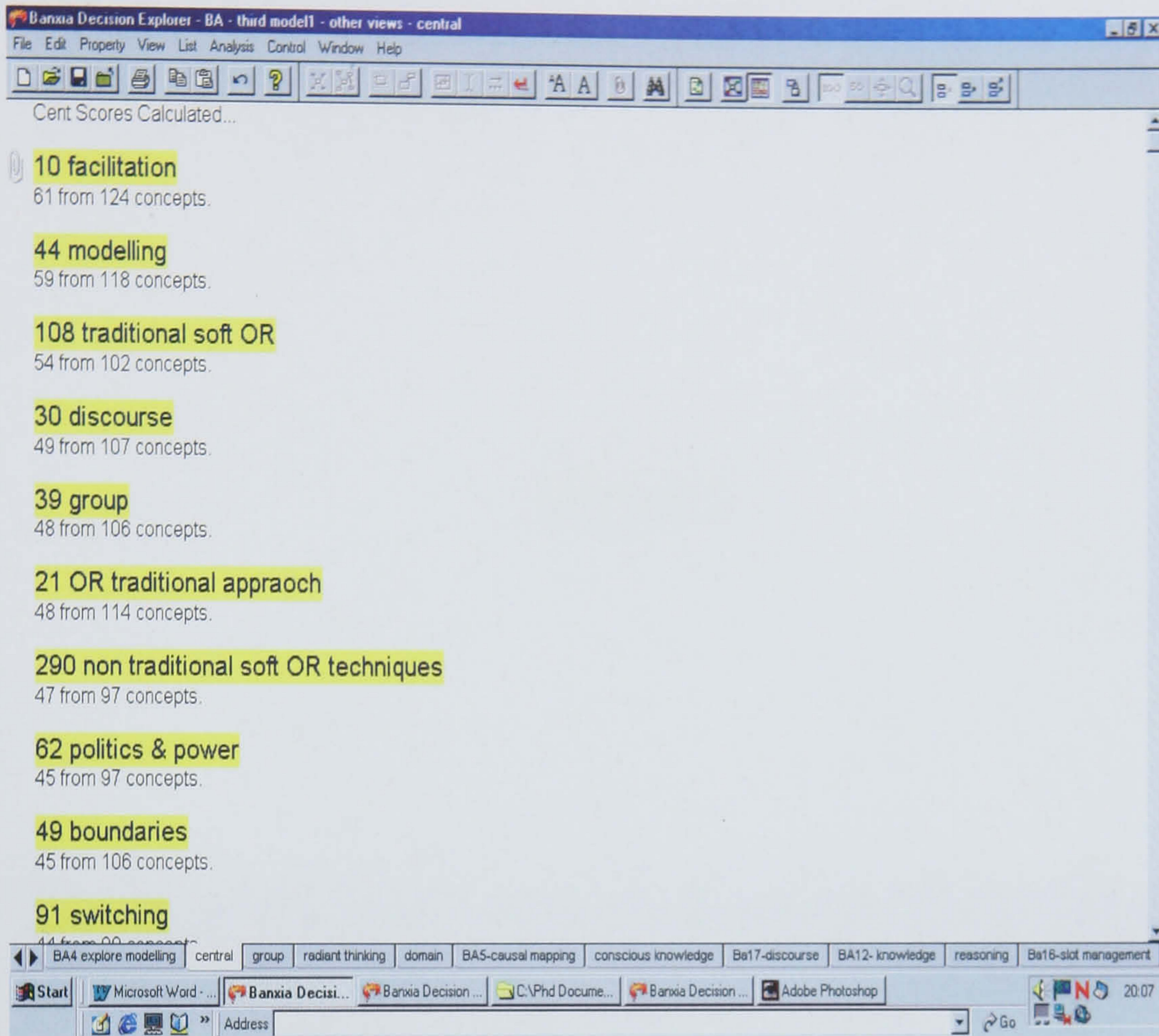


Figure 3.17 BA Central Scores

The Bricoleur used both the 'central' and 'domain' commands as a means to identify the most important concepts in order to explore and construct maps. Both the 'central' and 'domain' commands identify 'modelling' and 'facilitation' as key concepts within the BA case studies. The Bricoleur makes a judgement to construct and explore these concepts further while holding them as the central view.

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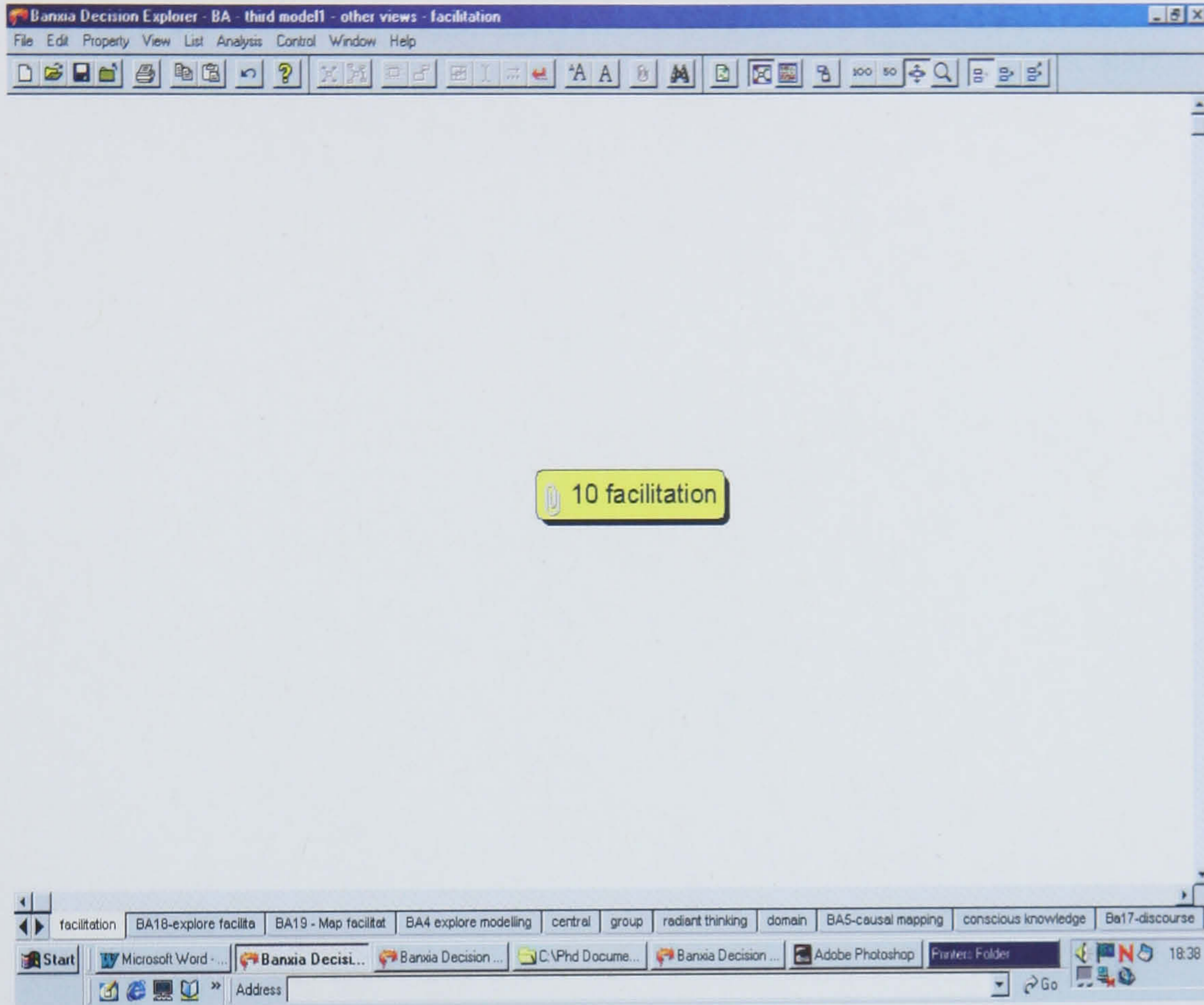


Figure 3.18 BA Facilitation Concept

Figure 3.18, shows a DE screen with the 'facilitation' concept. By using the command 'show unseen links', the Bricoleur is able to draw upon the concepts that surround the concept of facilitation, as seen in figure 3.19.

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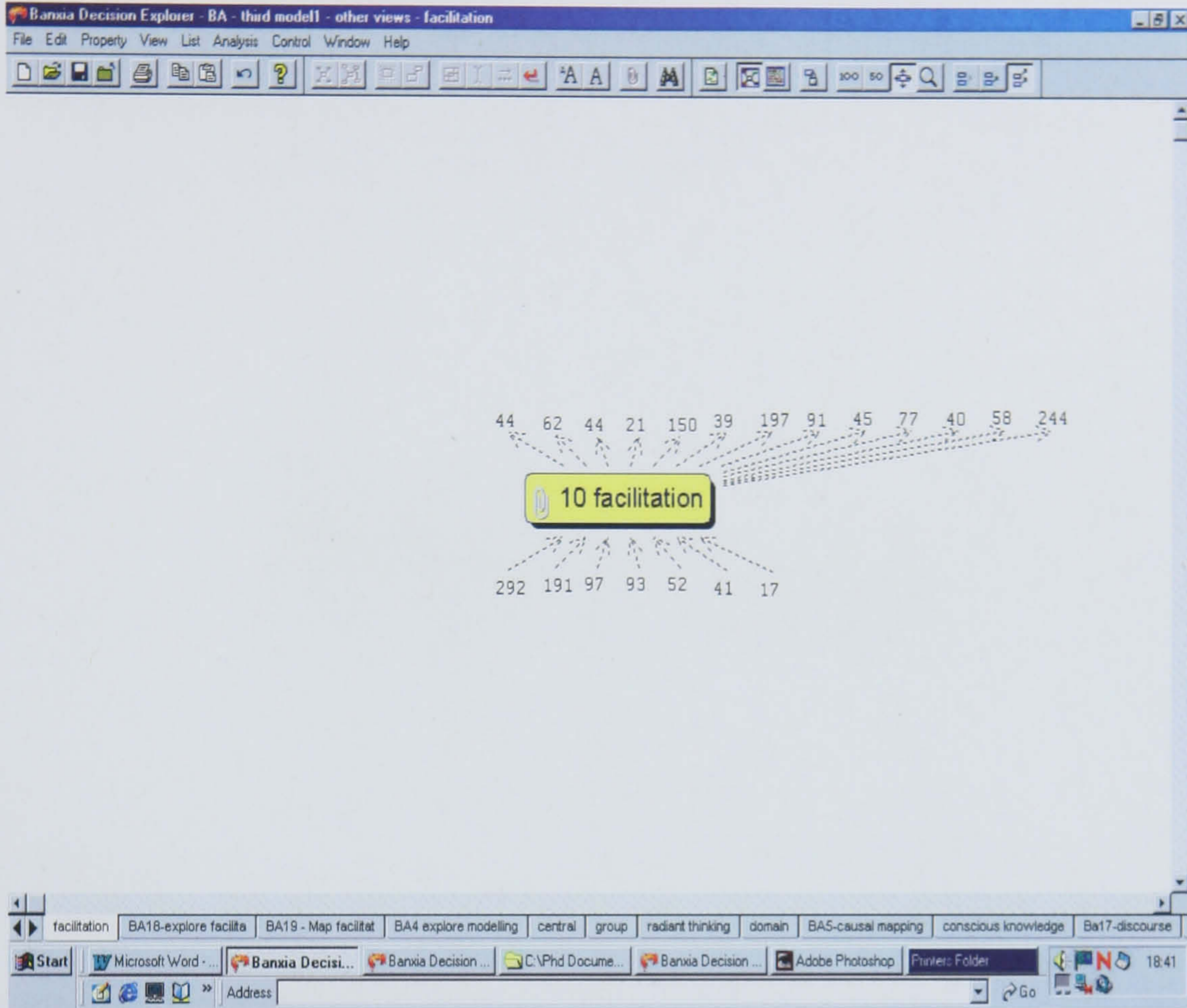


Figure 3.19 BA Facilitation Concept with Unseen Links

To find the connection between facilitation and modelling, the Bricoleur uses the command 'find' to search for the concept of modelling, bringing the concept of 'modelling' into view.

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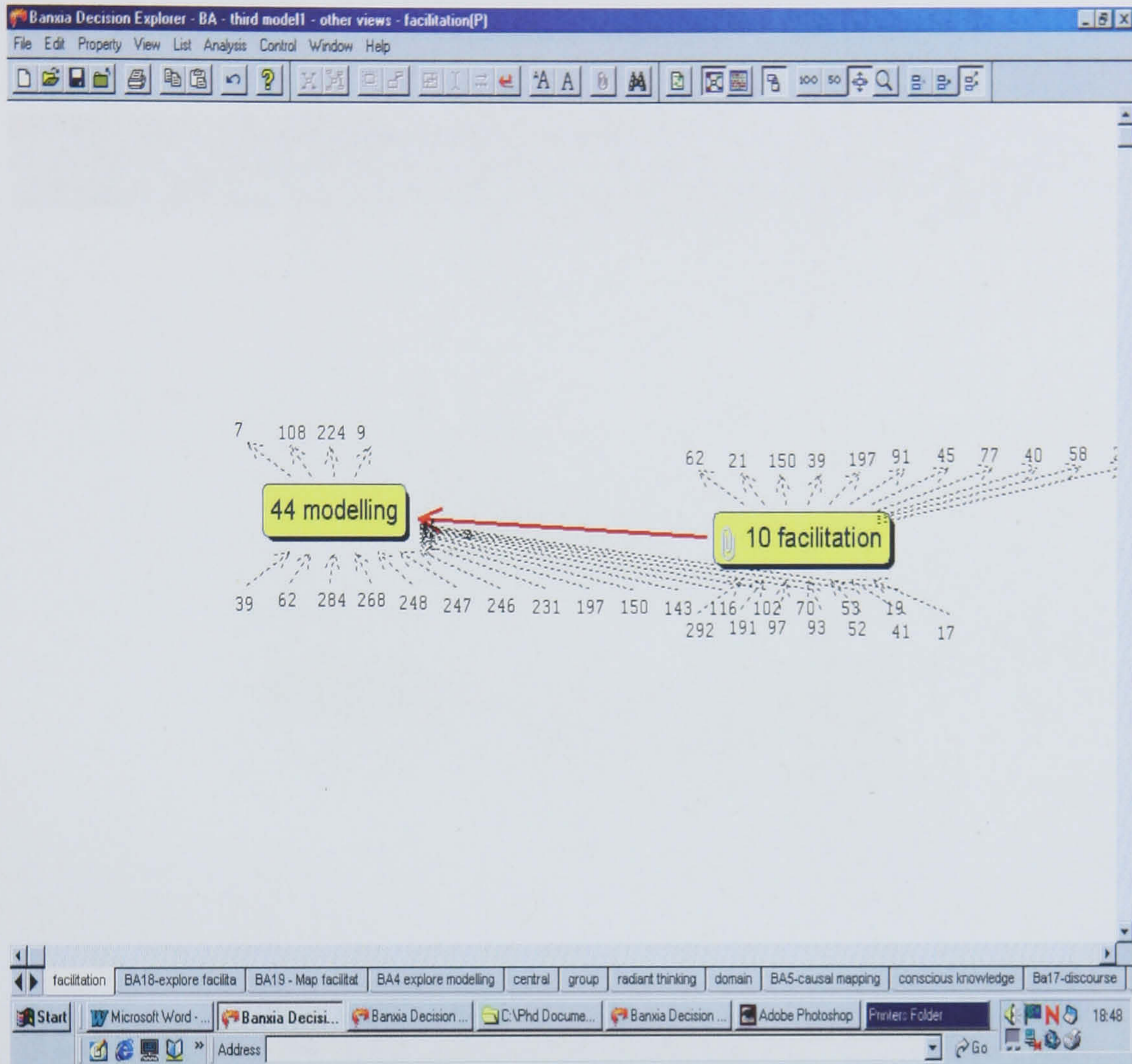


Figure 3.20 BA Modelling and Facilitation Concepts

Figure 3.20 shows that the concepts ‘modelling’ and ‘facilitation’ are connected by a red arrow, which is a strong link. It is a strong link because the Nvivo transcripts and RepGrid reports, suggested that the practice of Soft OR facilitation occurs through the use of models. The numbers that are highlighted in Figure 3.20, are the numbers that have been attributed to the concepts by Decision Explorer. Now, the Bricoleur can recall each number individually to start constructing a ‘view point’ around the concepts of ‘modelling’ and ‘facilitation’.

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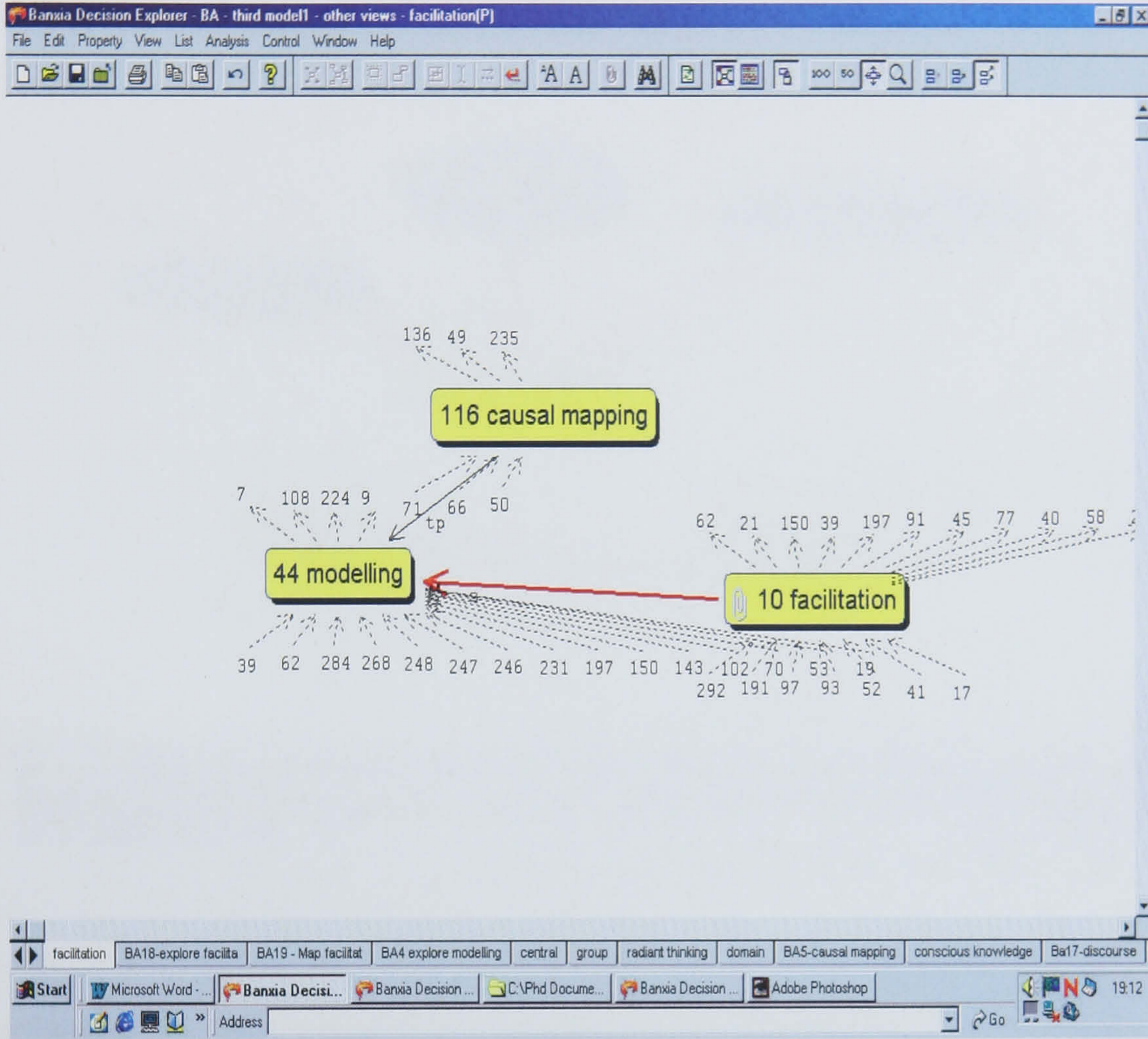


Figure 3.21 BA Facilitation + Modelling + Causal Mapping

Figure 3.21 shows the recall of the concept number 116, 'Causal Mapping' being added to the view point.

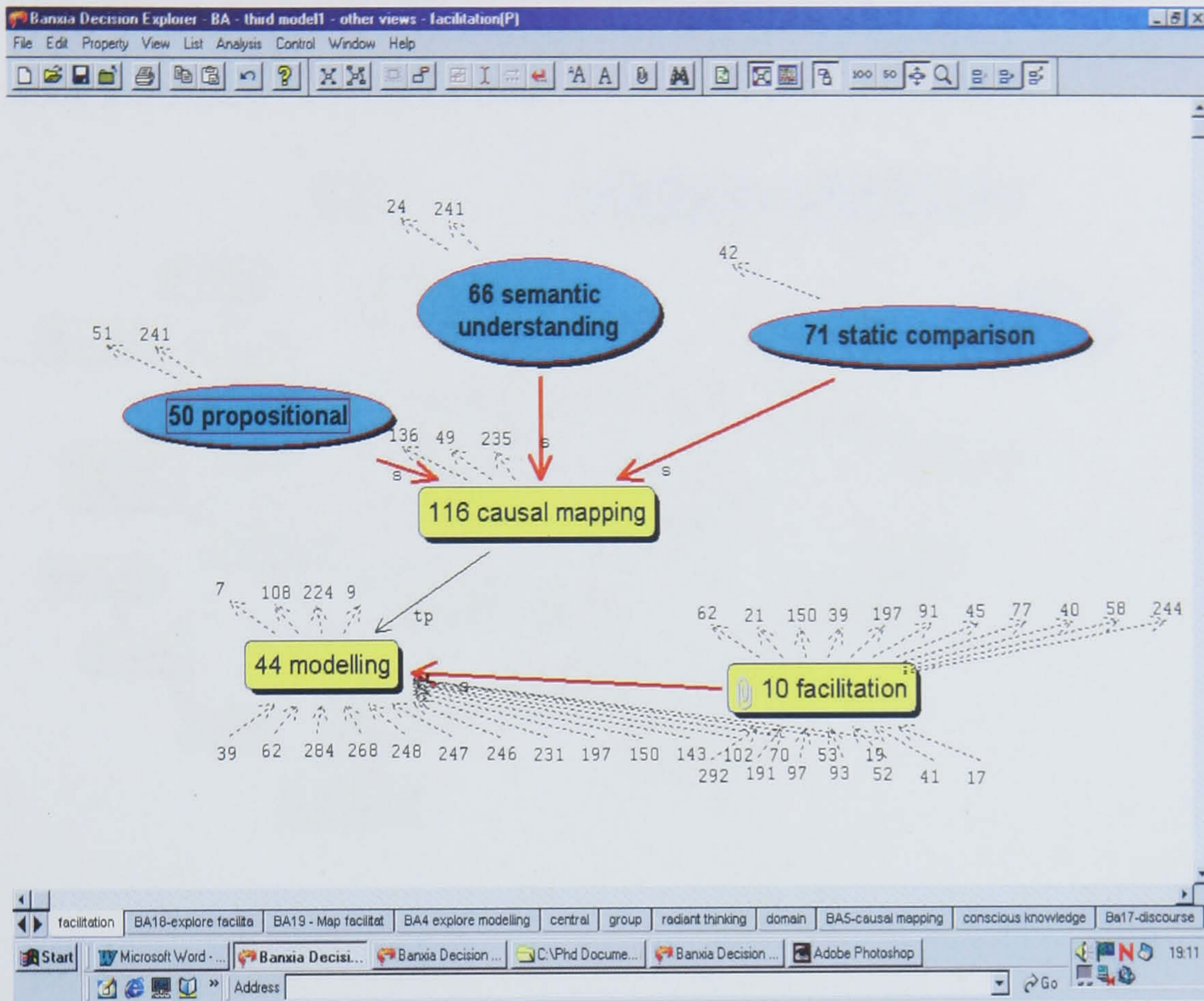


Figure 3.22 BA Causal Mapping + Reasoning Concepts

Figure 3.22 shows the recall of concepts 50, 66 and 71 that surrounds the concept of ‘Causal Mapping’. All three of these links, are strong links, as the Nvivo transcripts and RepGrid reports show a high correlation between ‘Causal Mapping’ and the concepts of ‘propositional thought’, ‘semantic understanding’ and ‘static comparison’. These concepts are colour coded light blue to emphasise the tree nodes taken from the Nvivo transcripts which represent Sparrow’s (1998) knowledge equation. The Bricoleur undertakes a series of iterations and explorations with the unseen concepts, until it makes some sort of sense.

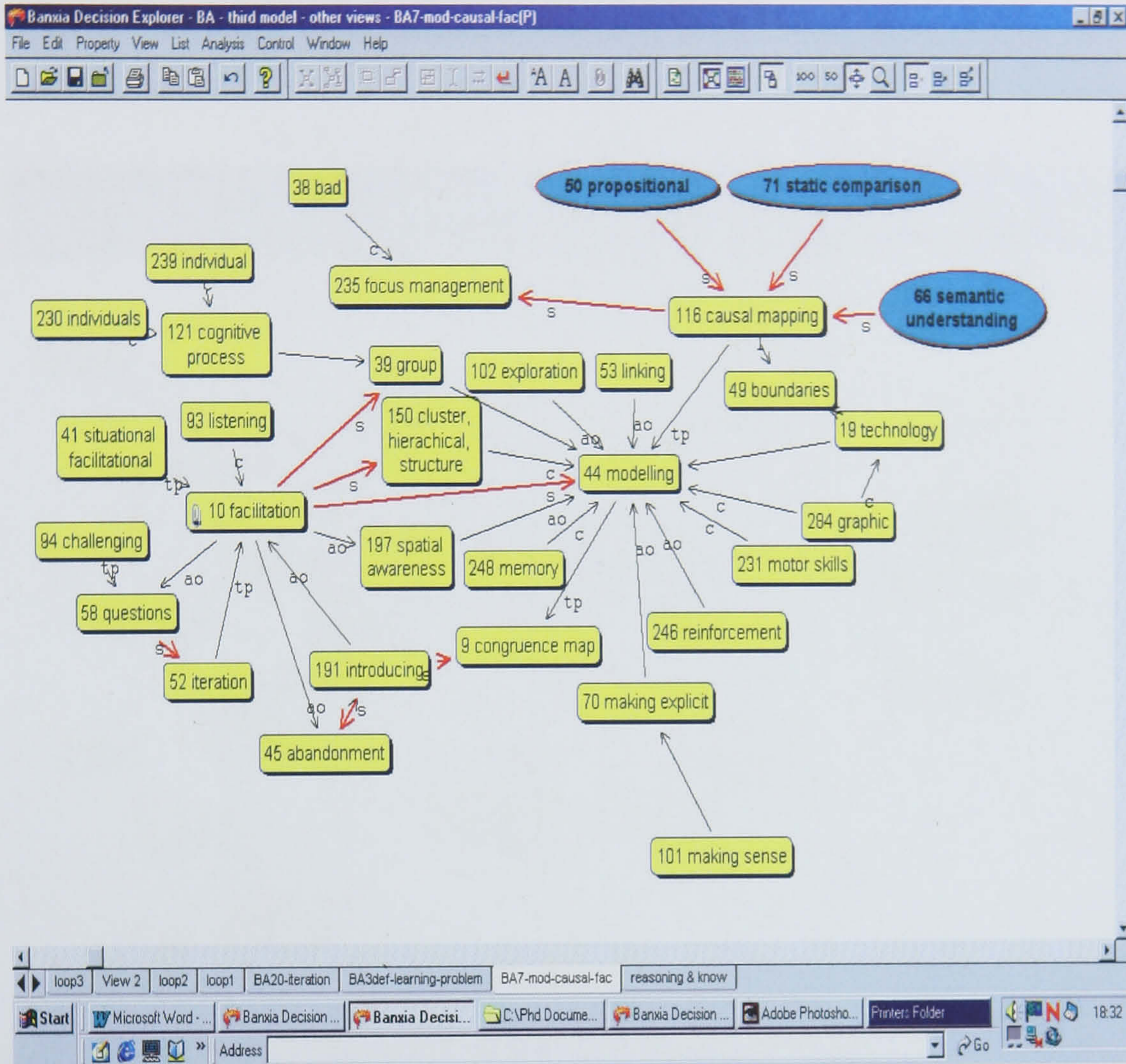


Figure 3.23 BA Causality Mapping

Figure 3.23 shows the final iteration through the concepts of facilitation and modelling which has been saved as the viewpoint ‘Causality Mapping’ to represent how the Soft OR facilitator works with models through causality thinking.

Other commands within DE can be used to recall multiple concepts that surround the concept of ‘facilitation’. The ‘explore’ command generates a new view based upon a given concept. This map, consists of all the concepts that are connected to that one concept. Figure 3.24 highlights how the

‘explore’ command has been used to generate a new map view of the concept ‘facilitation’.

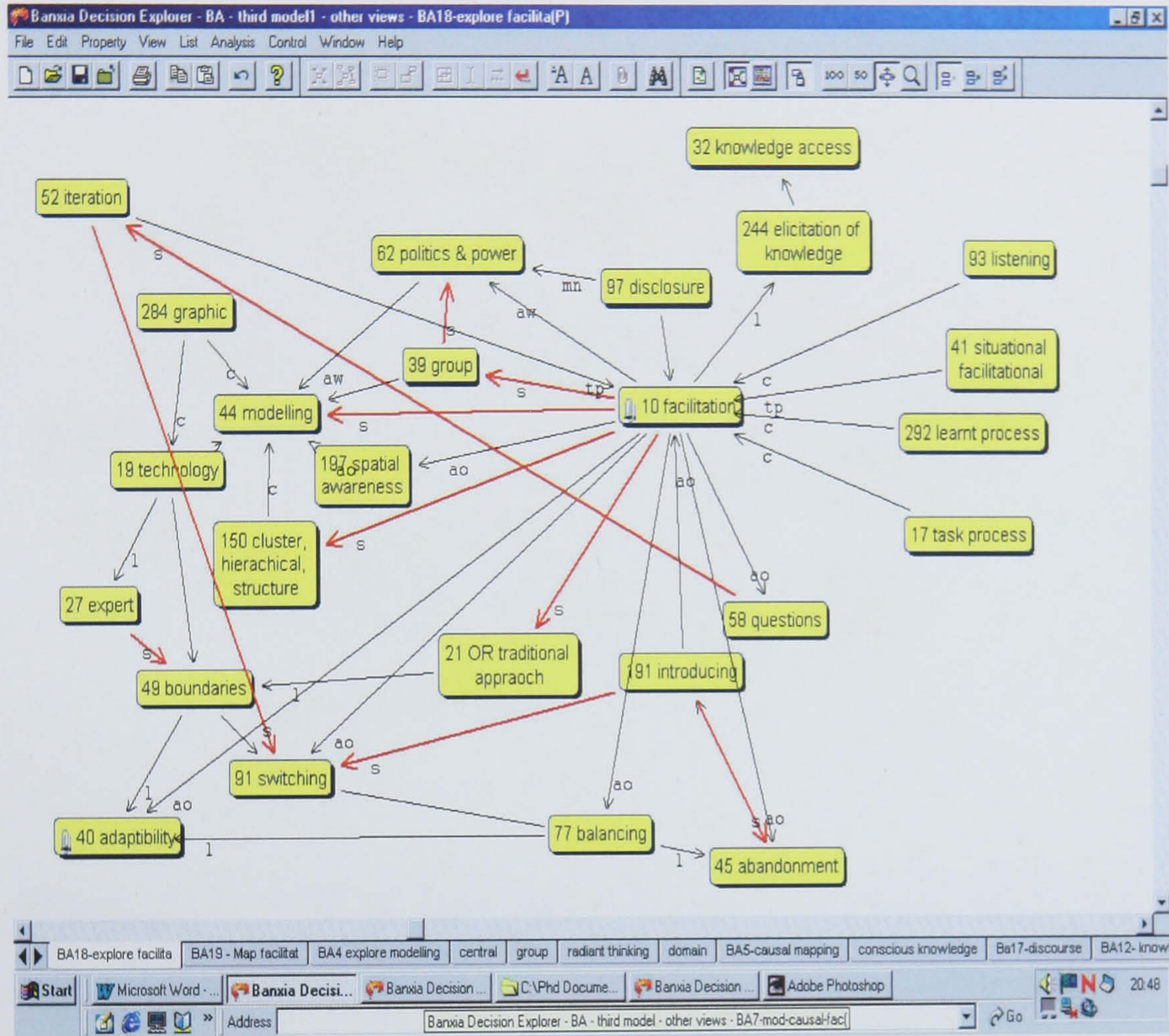


Figure 3.24 BA Explore Facilitation

The command ‘map’ generates a new view point that surrounds a given concept. This is based upon an algorithm that is set by DE. DE generates a random map with up to 70 concepts in either a hierarchical or tree format. Figure 3.25 provides an alternative view of the concept ‘facilitation’, through the map command.

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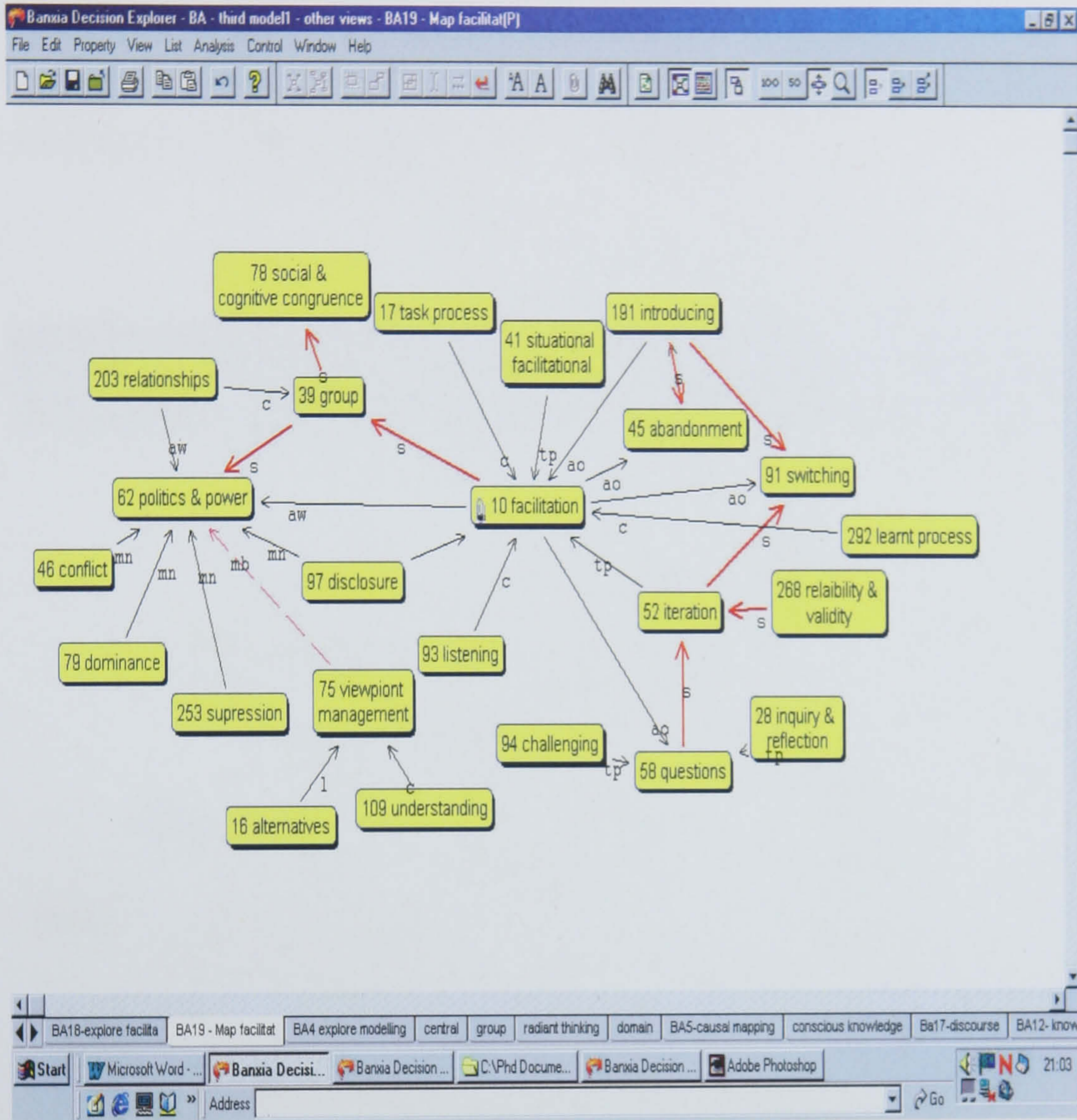


Figure 3.25 BA Map Facilitation

Both the ‘map’ and ‘explore’ commands allow the Bricoleur to gain a useful insight from a multiple view perspective that enables a rich understanding of the concept ‘facilitation’. Further, by using the ‘unseen links’ command, further concepts can be added or deleted to the map view. Such a construction only stops when the Bricoleur reaches the point of theoretical saturation.

This iterative process of constructing views through DE, allowed the Bricoluer to construct multiple views within the BA map of Soft OR practice. 50 map

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views were constructed through a range of concepts identified through the commands within DE. Examples of map views included; figures 3.26 BA Modelling; 3.27 BA Iteration and 3.28 BA Metacognition.

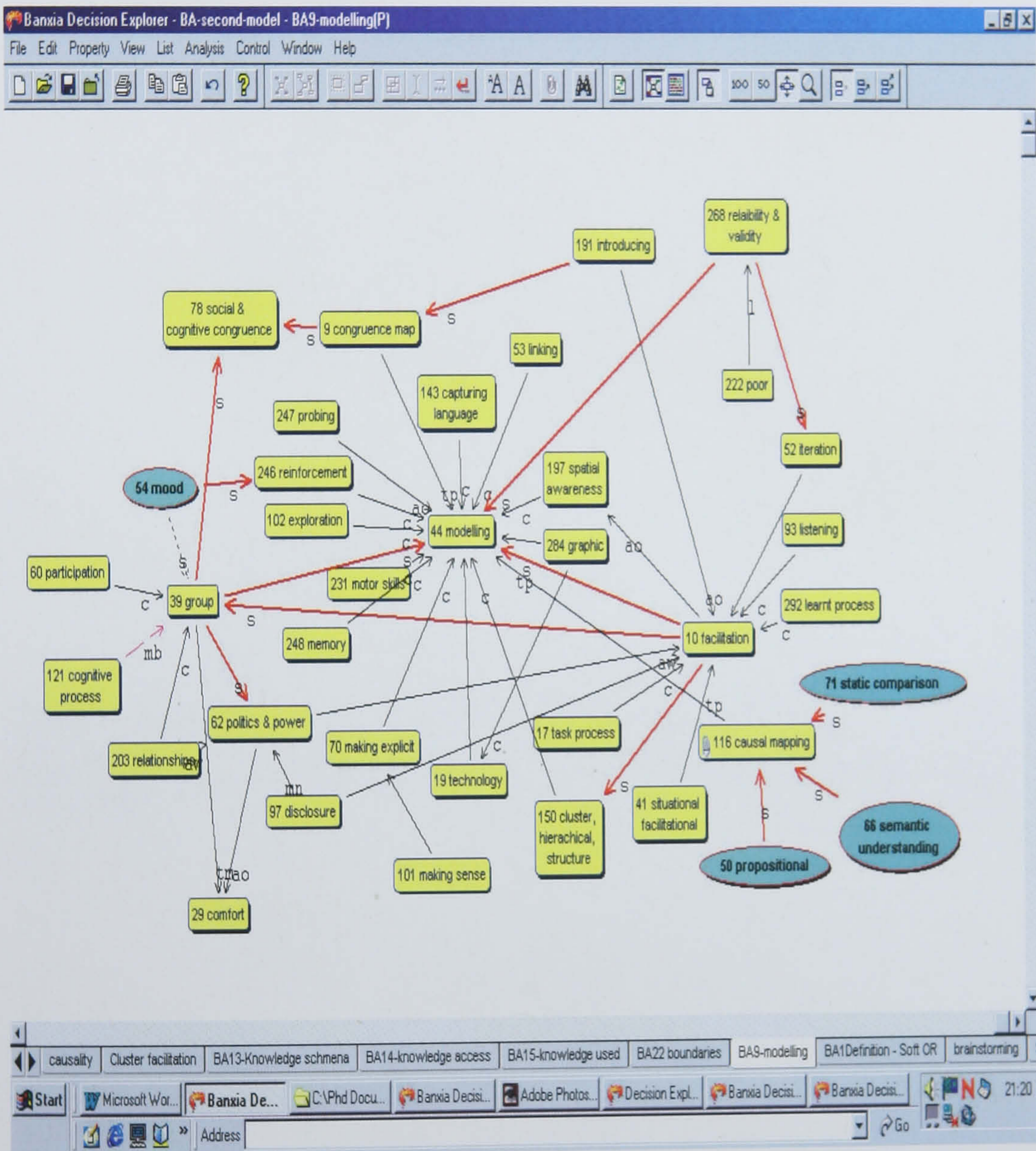


Figure 3.26 BA Modelling

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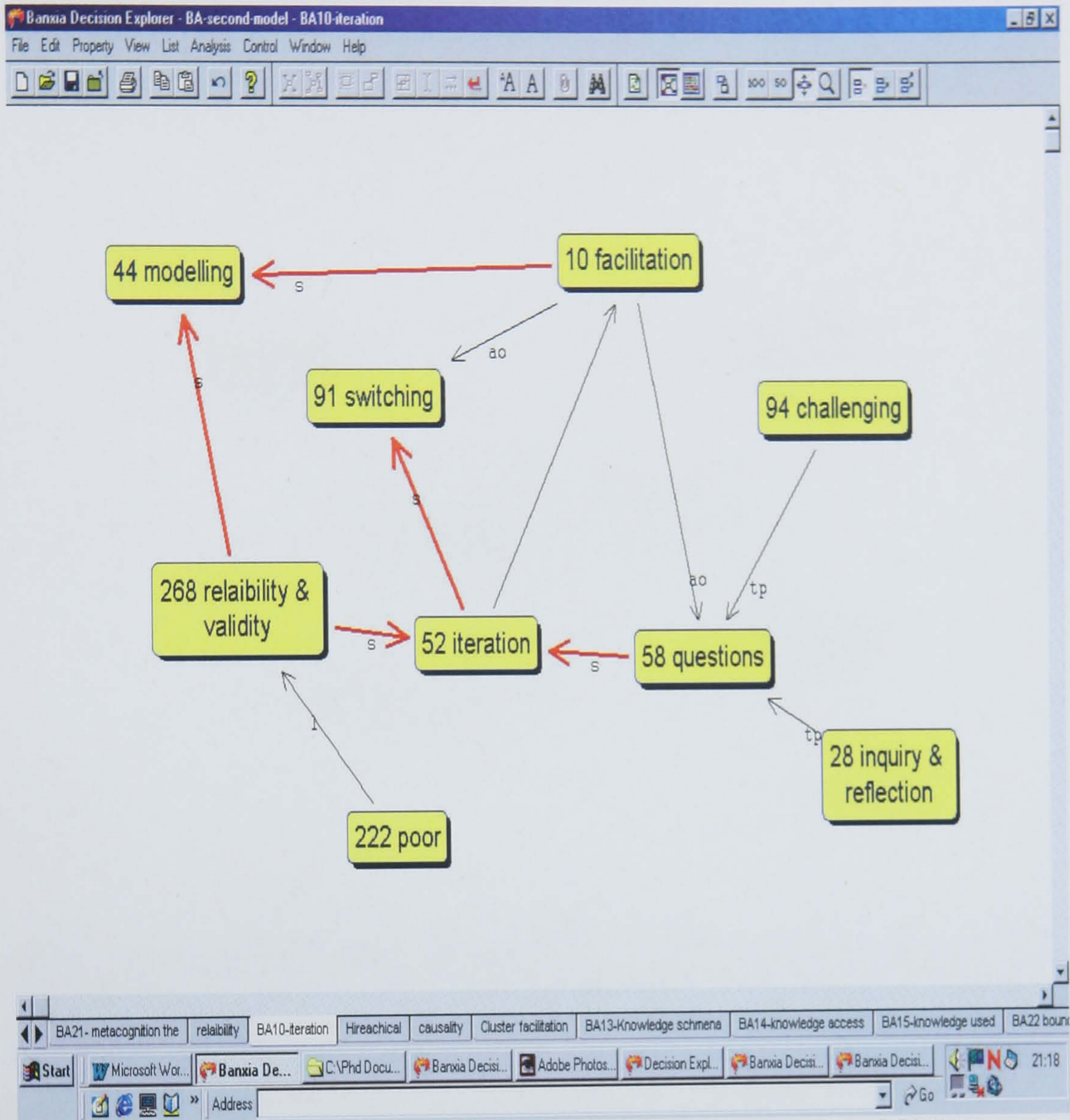


Figure 3.27 BA Iteration

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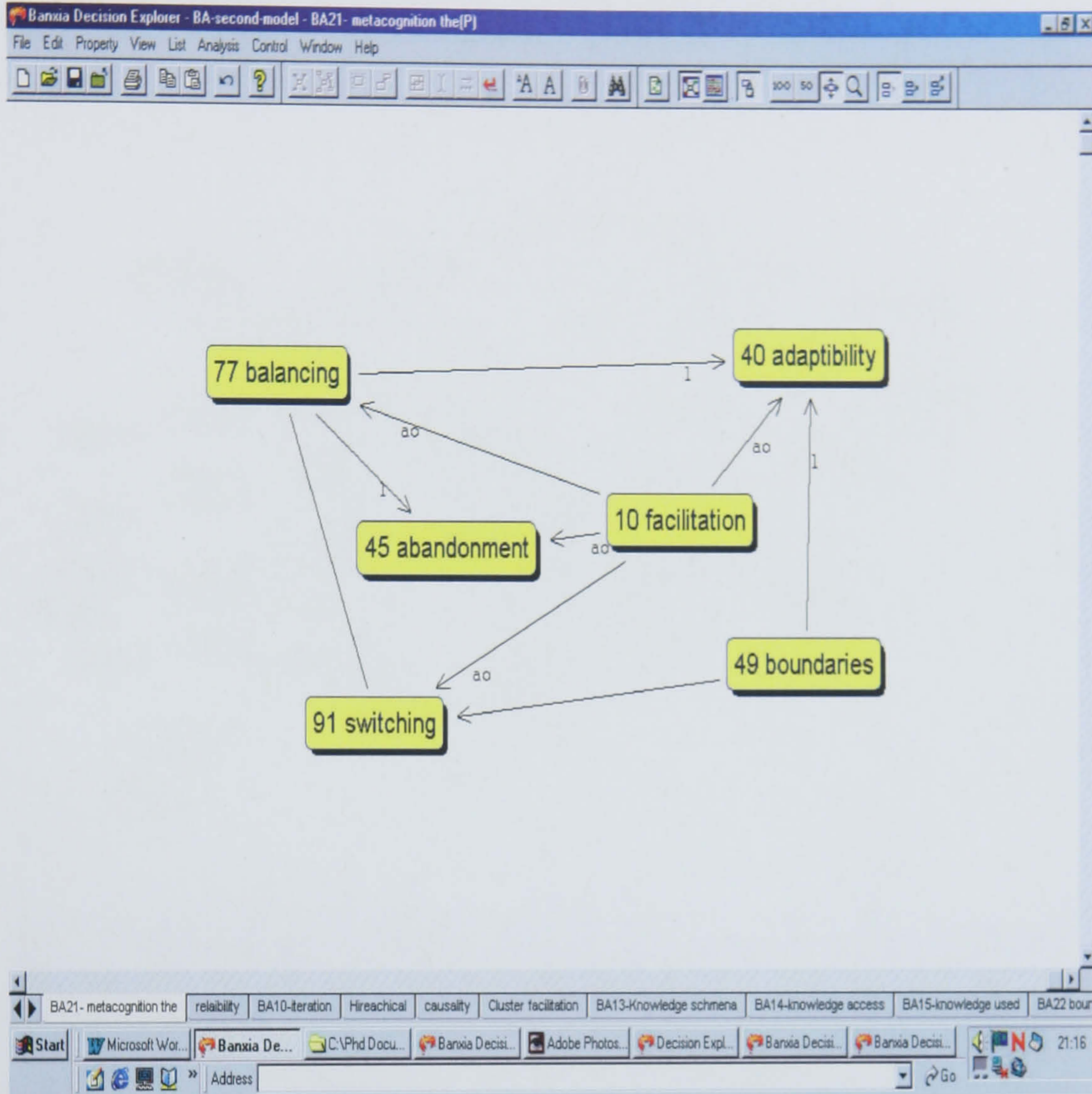


Figure 3.28 BA Metacognition

There were many iterations through searching and exploring the maps in DE. Double checking Repgrid reports and Nvivo transcripts to create new maps and concepts. But it got to the stage, where the Bricoluer felt that theoretical saturation had been achieved and no further iterations were necessary. At this stage the clusters and map views were brought together into one DE map, that represented a conceptual map of Soft OR practice at BA (figure 3.29)

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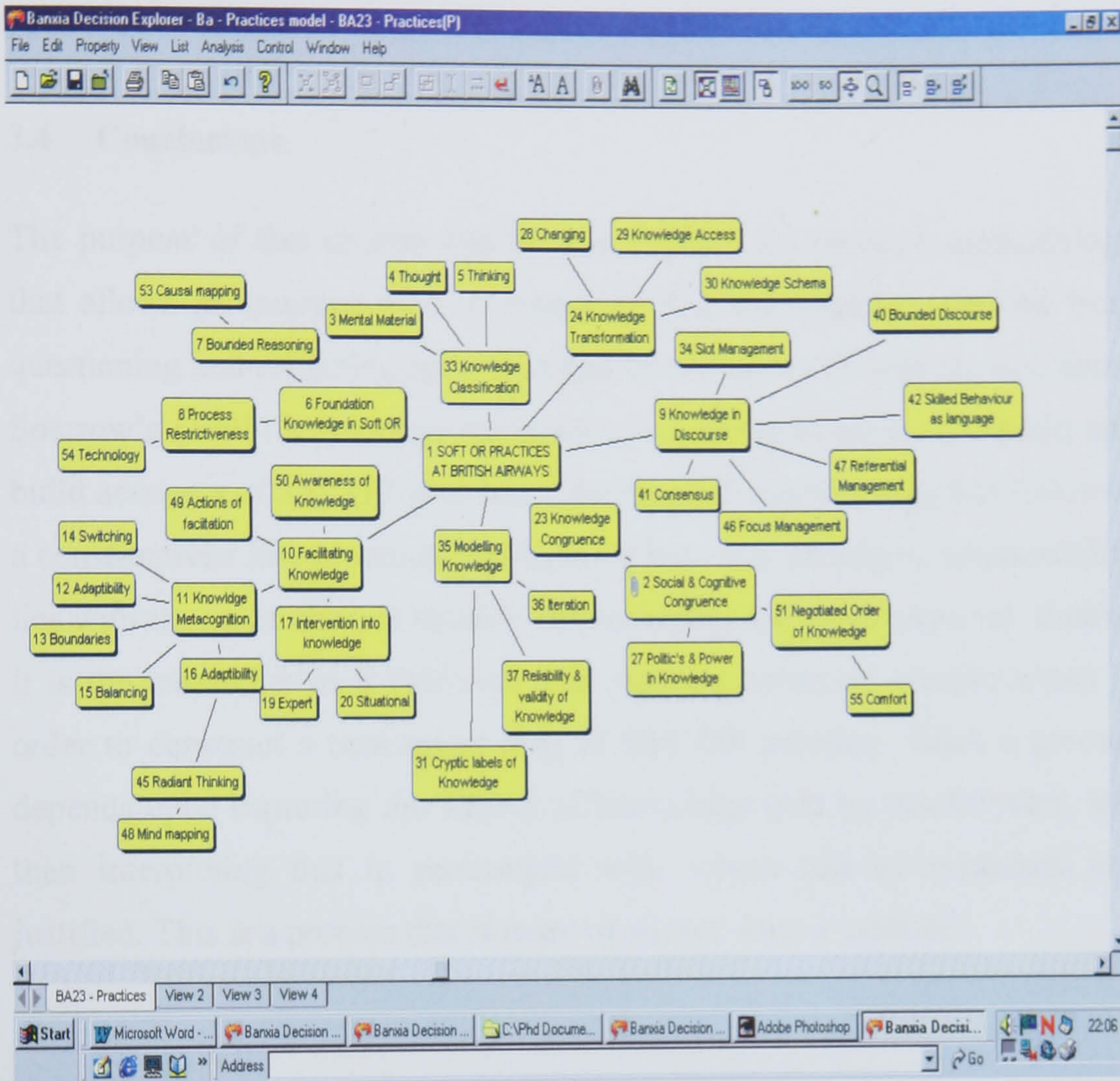


Figure 3.29 Conceptual Map of Soft OR Practice at British Airways

Further iterations and refinements took place to check the content of the British Airways map. The final stage of construction, brought together the DE maps from the Shell International, Academic Consultants and British Airways into one final conceptual map, that represented how Soft OR is practised.

3.4 Conclusions

The purpose of this chapter has been to explain the research methodology that allows an interpretation of emerging Soft OR practice, derived from questioning and reflecting upon findings from a series of case studies, using Sparrow's (1998) knowledge management equation to explore, explain and build accounts of Soft OR practice. The research methodology has followed a constructivist interpretation paradigm. Within this paradigm, responsibility lies with the researcher, as validity and reliability are never captured. Rather, it is the researcher as a Bricoluer that makes a series of interpretations in order to construct a conceptual map of Soft OR practice. Such a process depends upon capturing the variety of knowledge held by practitioners, and then interpreting this in meaningful way, which can be explained and justified. This is a process that is more of an 'art' than a 'science'.

PRESENTATION OF RESULTS

4 Introduction

How a conceptual map of Soft OR was constructed is explained in this chapter. Such a construction is the final stage of the research methodology in which the data has already been analysed through Nvivo and RepGrid. Chapter 4 is the presentation of results in which the interpretation deals with validity through the researcher making sense of the phenomena. Argumentative analysis is the process of sense making that follows a process of ‘tracing’ that is fundamental to constructivism (Saratakos 1998). In this chapter, cognitive maps (Eden & Ackermann 1998) are used to present the results to the reader, using a software package called DECISION EXPLORER (DE) (Banxia 2001).

The chapter starts with a comparative analysis of the purposeful cases where the main points of each case are highlighted in Table 4.1. These points are then clustered, which forms the foundation of a conceptual map of Soft OR practice. A cross section of examples or viewpoints from the cases highlights how they were interpreted and constructed. The use of ‘viewpoints’ or examples is a purposeful way to convey the essence of the cognitive maps in this research. These viewpoints are snapshots or best examples from the research, as all of the cognitive maps could not be conveyed due to the multiplicity of the subject and large number of concepts in the maps. These viewpoints represent the commonalities of the research. If the reader of this thesis, needs reminding of how the maps were constructed and interpreted, the reader is referred back the Research Methodology chapter (Step 5: Page 105 to 126), which acts as a useful

Chapter 4

roadmap. The chapter concludes with the conceptual map of Soft OR practice.

4.1 Development of a Conceptual Model of Soft OR Practice

The most obvious conclusion from table 4.1, is the high degree of similarity in OR practice between British Airways, Shell International and the Academic Consultants. It is not that the methodologies and techniques of Soft OR are different but the ‘how’ they are practised. By looking for an explanation of how, a range of common themes emerge across the purposeful cases. These themes evolve around ‘collective definitions of Soft OR’, ‘modelling’, ‘power & politics’, ‘knowledge’, ‘discourse’ and ‘facilitation’.

Table 4.1 Comparative Analysis of Soft OR Purposeful Cases

British Airways		Shell International		Academic Case	
<p>Collective Definition of Soft OR</p> <p>A grounded pragmatic process of knowledge construction, which enables participants to understand and learn about problems, primarily through models.</p>	<p>A practice used by consultants as part of the facilitation process so that they can talk about the problems through a range of tools.</p>	<p>Soft OR is a pragmatic grounded theory, which predominantly uses models to structure and / or explain problems. The process draws upon the development of traditional OR, and carries those characteristics from a 'process restriction' platform. Soft OR fundamentally evolves around the concepts of 'facilitation', 'consensus', 'problems', 'modelling', 'boundaries' and 'reasoning'.</p>	<p>Soft OR is a pragmatic grounded theory, which predominantly uses models to structure and / or explain problems. The process draws upon the development of traditional OR, and carries those characteristics from a 'process restriction' platform. Soft OR fundamentally evolves around the concepts of 'facilitation', 'consensus', 'problems', 'modelling', 'boundaries' and 'reasoning'.</p>	<p>Soft OR is a pragmatic grounded theory, which predominantly uses models to structure and / or explain problems. The process draws upon the development of traditional OR, and carries those characteristics from a 'process restriction' platform. Soft OR fundamentally evolves around the concepts of 'facilitation', 'consensus', 'problems', 'modelling', 'boundaries' and 'reasoning'.</p>	<p>Soft OR is a pragmatic grounded theory, which predominantly uses models to structure and / or explain problems. The process draws upon the development of traditional OR, and carries those characteristics from a 'process restriction' platform. Soft OR fundamentally evolves around the concepts of 'facilitation', 'consensus', 'problems', 'modelling', 'boundaries' and 'reasoning'.</p>
<p>Modelling</p> <p>Modelling is a series of actions by the facilitator.</p> <p>Characteristics of modelling include 'graphic representation', 'cluster', 'hierarchical', 'structure' and 'memory'.</p> <p>Types of modelling include 'causal mapping' and 'congruence modelling'.</p> <p>The actions of modelling include 'capturing language', 'exploration', 'making explicit', 'probing' and 'reinforcement'.</p> <p>Models are maps.</p> <p>Causal maps are linked to 'static comparison', 'propositional' and 'semantic understanding', which is labelled 'bounded reasoning'.</p> <p>Causal maps have characteristics of 'cluster, hierarchical, structure'. They act as a focus and reference for participants.</p> <p>Causal maps are about 'conscious' and 'explicit' knowledge.</p> <p>The facilitator when using causal maps is concerned with reliability and validity through iteration.</p> <p>Where causal maps do not work the concept of metacognition and pragmatism emerges.</p>	<p>The facilitator is a modeller. This activity refers to the concepts of 'trying to capture language', 'linking', 'making explicit' and 'explaining'.</p> <p>Due to the influence of systems thinking, the facilitator is 'questioning' the content of the model through the process of 'iteration' and 'reflection'.</p> <p>Models bring 'focus' and 'capture language'. Enabling the facilitator to 'keep track of events' and the model acting as a 'group memory'.</p> <p>The model is a congruence map of knowledge</p> <p>Congruence mapping links to 'power & politics'.</p> <p>Causality and clustering infers a 'referencing, structured and hierarchical' representation.</p> <p>Causality is represented by 'reasoned thinking', 'propositional thought' and 'semantic understanding'. These concepts are labelled 'bounded reasoning', a mechanism for learning and 'understanding' problems.</p>	<p>Modelling is an activity in which 'making explicit', 'making sense', and 'instant – now recall' are the concepts of physical representation.</p> <p>'Actions of the modeller include 'laddering', 'linking', 'investigation' and 'capturing language'.</p> <p>Causality modelling is linked to 'semantic understanding', 'static comparison', and 'propositional thought'. This has the characteristics of 'hierarchical', 'cluster' and 'structure'.</p> <p>Strathclyde University is linked to the concept of 'laddering' and 'regression analysis'. A type of 'conscious knowledge', 'shallow representation', 'linear' and 'static knowledge'. This is recognised as a boundary of causality.</p> <p>Congruence maps are cryptic labels of knowledge for reasons of 'negotiation' and 'consensus'. This is driven by the facilitator balancing 'social and cognitive congruence'.</p> <p>Congruence modelling is a combination of 'facilitation', 'discourse' and 'knowledge'.</p> <p>'Social knowledge' and 'social discourse' are linked to congruence modelling through the socialisation of knowledge.</p> <p>Congruence modelling highlights 'adaptability' in order to access a fluid flow of knowledge.</p> <p>Fluid knowledge 'changes' the knowledge schema.</p>	<p>Modelling is an activity in which 'making explicit', 'making sense', and 'instant – now recall' are the concepts of physical representation.</p> <p>'Actions of the modeller include 'laddering', 'linking', 'investigation' and 'capturing language'.</p> <p>Causality modelling is linked to 'semantic understanding', 'static comparison', and 'propositional thought'. This has the characteristics of 'hierarchical', 'cluster' and 'structure'.</p> <p>Strathclyde University is linked to the concept of 'laddering' and 'regression analysis'. A type of 'conscious knowledge', 'shallow representation', 'linear' and 'static knowledge'. This is recognised as a boundary of causality.</p> <p>Congruence maps are cryptic labels of knowledge for reasons of 'negotiation' and 'consensus'. This is driven by the facilitator balancing 'social and cognitive congruence'.</p> <p>Congruence modelling is a combination of 'facilitation', 'discourse' and 'knowledge'.</p> <p>'Social knowledge' and 'social discourse' are linked to congruence modelling through the socialisation of knowledge.</p> <p>Congruence modelling highlights 'adaptability' in order to access a fluid flow of knowledge.</p> <p>Fluid knowledge 'changes' the knowledge schema.</p>		

Pragmatic theory links to congruence mapping, in which maps are cryptic labels of knowledge.
 Congruence maps are a mixture of explicit and implicit knowledge.
 The facilitator 'balances' 'cognitive and social congruence'

Power & Politics
 Power & Politics are a range of manifestations which include 'conflict', 'dominance', 'suppression' and 'disclosure'.
 Suppression is related to unconscious interpretation. The facilitator is aware of this and manages this through 'relationships' and 'comfort'.
 Comfort is a strategy to overcome defensive routines.
 Power & politics loops through congruence mapping in order to 'balance' and 'negotiate knowledge'.

'Agreement' is used to find a 'negotiated order of knowledge'.
 'Agreement' is about de-constraining the situation. Facilitators use 'comfort' to de-constrain situations.
 'Negotiated order' is about viewpoints and coalition support.
 'Power & politics' is a range of manifestations including 'spoil', 'threats & worries' and 'conflict points'.
 The facilitator manages viewpoints by 'creating managing space' for participants to contribute and think.
 The connection between 'power & politics' and 'facilitation' is awareness.
 Facilitators use congruence maps because of the presence of unconscious interpretation mental material.

Power & politics are a range of manifestations such as 'manipulation', 'false-lying', 'threats & worries', 'coercion', 'avoidance', 'disclosure' and 'dominance'. All of these manifestations lead to 'defensive routines'.
 The facilitator must 'be aware' of these concepts through observing behaviour.
 Power & politics draws upon 'mood' and 'unconscious' interpretation from Sparrow's knowledge equation.
 Managing power & politics leads to 'comfort', in which the facilitator is 'defusing' the situation.
 Power & politics has an element of 'risk and uncertainty'.
 Consensus and agreement is about 'social & cognitive congruence'.

Knowledge
 Nearly all of Sparrow's knowledge cells are actioned in the British Airways case.
 The facilitator is managing 'knowledge access', 'representing knowledge' and 'changing knowledge schemas'.
 Cognitive mapping is identified with 'bounded

Facilitation is about 'accessing knowledge' cells and 'changing schemas'.
 Changing 'knowledge schemas' is about 'language as skilled behaviour' as everyday language and discourse.
 'Rich knowledge access' is about 'ownership' and

Bounded reasoning represents a knowledge schema of 'reasoning', 'propositional thought' and 'semantic understanding'.
 Causality uses 'static comparison' as a type of reasoned thinking.
 Causality is associated with cognitive mapping at Stratheclyde

British Airways

Shell International

Academic Case

	<p>knowledge’.</p> <p>Bounded reasoning is ‘linear’ and ‘static’ which is associated with conscious knowledge and a limited understanding of the problem.</p> <p>Multiple knowledge access is linked to ‘adaptability’ and ‘metacognition’.</p>	<p>‘episodic memories’.</p> <p>‘Episodic memories’ is used with experiential knowledge which has the characteristics of ‘playing’ and ‘instant recall’ of moments and events.</p> <p>‘Multi-facilitation’ (situational) is key.</p>	<p>University. Causality is about conscious and explicit knowledge, which represents a shallow interpretation of the problem. This is labelled ‘bounded reasoning’.</p> <p>Bounded reasoning and causality help clients make sense of problems through promoting ‘viewpoint management’ which helps participants ‘understand’ alternative perspectives.</p> <p>Systems modelling at Hull University concentrates on ‘static comparison’, ‘systems thinking’ and ‘separation thinking’ as forms of reasoning.</p> <p>Separation thinking is linked to ‘sequencing’, ‘weighting given to values’ and ‘alternatives’. This is linked to Strategic Choice.</p> <p>Decision Conferencing and Robustness Analysis are linked to ‘bounded reasoning’ through ‘unpopular’, ‘technical’, ‘laboratory’ and ‘expert’ which produces an ‘artificial discourse’ and ‘shallow knowledge’.</p> <p>Metacognition is a means to move a knowledge schema away from bounded reasoning.</p>
<p>Discourse</p>	<p>Congruence mapping is about discourse, emphasising skilled behaviour mental material, linked to ‘naturalistic’ and ‘dialogue’ conversation.</p> <p>Naturalistic language surfaces ‘tacit feel’, in an environment of ‘social knowledge’ and ‘social discourse’.</p> <p>Social discourse is an implicit to implicit knowledge transfer process.</p> <p>Social knowledge is emphasised when bounded discourse is not appropriate.</p> <p>Bounded discourse is linked to ‘forced discourse’ and ‘dialectic’ debate.</p>	<p>There is a strong connection between ‘discourse’ and ‘accessing knowledge’ through language as ‘skilled behaviour’.</p> <p>A natural ‘discourse’ assesses more knowledge cells than ‘bounded discourse’.</p> <p>Technology produces ‘bounded discourse’ which has a low slot management.</p> <p>A ‘bounded discourse’ has characteristics of process restrictiveness and prior learning which links to ‘technology’.</p> <p>‘Process restrictiveness’ is about tasks and solutions rather than discussion.</p>	<p>Discourse is about ‘agreement’, ‘consensus’, ‘bounded discourse’, ‘slot management’, ‘multiple knowledge access’ and ‘skilled behaviour’ as discourse.</p> <p>Skilled behaviour as discourse draws upon skilled behaviour from Sparrow’s equation, driven by ‘social discourse’ and ‘social and cognitive congruence’.</p> <p>Social discourse is linked to the concept of ‘non-formal naturalistic process’. Such a discourse leads to ‘multiple knowledge access’, linked to the concepts of ‘inter-active’ process, ‘participation’ and ‘understanding’.</p> <p>Social discourse links to ‘stories’ and ‘episodic memories’. Participants that ‘personalise’ the experience results in ‘multiple knowledge access’.</p>

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 Bounded reasoning is 'linear' and 'static' which is associated with conscious knowledge and a limited understanding of the problem.
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 Systems modelling at Hull University concentrates on 'static comparison', 'systems thinking' and 'separation thinking' as forms of reasoning.

Separation thinking is linked to 'sequencing', 'weighting given to values' and 'alternatives'. This is linked to Strategic Choice.

Decision Conferencing and Robustness Analysis are linked to 'bounded reasoning' through 'unpopular', 'technical', 'laboratory' and 'expert' which produces an 'artificial discourse' and 'shallow knowledge'.

Metacognition is a means to move a knowledge schema away from bounded reasoning.

Metacognition is a means to move a knowledge schema away from bounded reasoning.

Discourse

Congruence mapping is about discourse, emphasising skilled behaviour mental material, linked to 'naturalistic' and 'dialogue' conversation.
 Naturalistic language surfaces 'tacit feel', in an environment of 'social knowledge' and 'social discourse'.
 Social discourse is an implicit to implicit knowledge transfer process.
 Social knowledge is emphasised when bounded discourse is not appropriate.
 Bounded discourse is linked to 'forced discourse' and 'dialectic' debate.

There is a strong connection between 'discourse' and 'accessing knowledge' through language as 'skilled behaviour'.
 A natural 'discourse' assesses more knowledge cells than 'bounded discourse'.
 Technology produces 'bounded discourse' which has a low 'slot management'.
 A 'bounded discourse' has characteristics of process restrictiveness and prior learning which links to 'technology'.
 'Process restrictiveness' is about tasks and solutions rather than discussion.

Discourse is about 'agreement', 'consensus', 'bounded discourse', 'slot management', 'multiple knowledge access' and 'skilled behaviour' as discourse.
 Skilled behaviour as discourse draws upon skilled behaviour from Sparrow's equation, driven by 'social discourse' and 'social and cognitive congruence'.
 Social discourse is linked to the concept of 'non-formal naturalistic process'. Such a discourse leads to 'multiple knowledge access', linked to the concepts of 'inter-active process', 'participation' and 'understanding'.
 Social discourse links to 'stories' and 'episodic memories'. Participants that 'personalise' the experience results in 'multiple knowledge access'.

British Airways

Bounded discourse has 'poor slot management', especially when used with 'technology'.

Bounded reasoning produces a 'good slot management' when associated with 'considered responses'

Shell International

'Hierarchical facilitation' and 'poor slot management' have similar meanings.

'Bounded reasoning' can lead to 'fluid reasoning'.

'Discourse' and 'agreement' are about making knowledge explicit through 'managing knowledge', 'reliability & validity' and 'negotiated order'.

Academic Case

Bounded discourse is about 'less interaction', 'technology', 'clinical language' and 'expert'.

Technology impinges on the natural flow of conversation.

Discourse in Soft OR is characterised by agreement, which is about 'accommodation', 'consensus', and 'resolution'. The facilitator uses 'agreement' to 'balance' and 'negotiate' knowledge through 'social & cognitive congruence'.

Agreement draws upon 'viewpoint management' and the 'power & politics' of situations.

Facilitation is about 'awareness of' and 'actions of'.

Awareness is about 'body language', 'withdrawal', 'mood' and 'power & politics'. These are observational situations, where the facilitator is watching for signals and cues in order to decide what actions to take.

Actions include 'questions', 'doing something implicitly', 'defusing' and 'negotiation'. Metacognition is considered the most important concept.

Types of facilitation include 'iteration', 'expert', 'hierarchical', 'passive', 'situational' and 'conservative'.

Expert facilitation is strongly linked to technology, for example, 'Decision Conferencing' and 'Robustness Analysis'.

Expert facilitation is seen as 'technical', 'unpopular' and 'backroom', producing knowledge that is 'static', 'linear' and 'shallow'.

'Expert facilitation' and 'hierarchical facilitation' are non-distinguishable.

Passive facilitation is 'letting the group get on with it', producing 'high ownership' of the problem.

Iteration is about 'reliability' and 'validity' of content.

Facilitation is about 'actions', 'awareness', 'types of' and 'leads to'.

Facilitation is predominantly about 'actions' which include 'inducement', 'keeping track of events', 'sequencing', 'guiding', 'balancing' 'iteration' and 'negotiation'.

Awareness is about 'time', 'power & politics' and 'groups'.

Types of facilitation include 'hierarchical facilitation', 'expert facilitation', 'balancing advocacy with inquiry' and 'multi-facilitation (situational)'.

Hierarchical facilitation is concerned with 'causality models', 'task and solutions', 'technology' and 'expertise'.

Expert facilitation links to 'bounded discourse' and 'bounded reasoning'.

Expert facilitation is 'technical'.

Multi-facilitation (situational) is about 'adaptability', which produces a rich and changing knowledge schema.

'Balancing advocacy with inquiry' is particular to

Facilitation is about actions and types.

Facilitation is the centre of activity in which the 'actions of' the facilitator include 'questions', 'abandonment', 'balancing', 'adaptability' and 'spatial awareness'.

Iteration is a 'type of' facilitation in which the facilitator is checking the validity and reliability of the model, as if the model was used as an engagement process.

Iteration strongly links to 'questions' through 'inquiry and reflection'.

Situational facilitation is used to deal with the complex issues of managing 'groups'.

'Groups' and 'power & politics' are strongly linked.

The concept of metacognition emerges from 'groups' and 'situational facilitation'.

Metacognition is identified with the concepts 'abandonment', 'switching' 'adaptability', 'balancing' and 'boundaries'.

Switching is linked to 'mixed mode modelling'.

Adaptability is the changing of methodologies.

British Airways

Shell International

Academic Case

	<p>Balancing is linked to congruence maps.</p>	<p>Systems Thinking. Multi-facilitation (situational) connects to metacognition. Metacognition is 'adaptability', 'boundaries', 'switching', 'abandonment' and 'balancing'.</p>	<p>Iteration focuses on 'reflection & inquiry', 'challenging' and 'assumptions'. Situational facilitation links to metacognition.</p>
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Comparing the three purposeful cases, the following conclusions can be drawn

- Consultants at Shell International have difficulty defining Soft OR, as the concepts have similar meaning. The consultants see facilitation, consultancy and modelling as one continuum. A process in which tools are used to talk about problems. Soft OR in all the cases is seen as a grounded pragmatic theory that has developed from practice and action. Common to all the definitions is the use of models to 'talk about' and 'facilitate' problem structuring.
- Modelling is an action process; in fact, the facilitator is a modeller. This comes across very strongly in all the case studies. In modelling, the facilitator uses actions including, 'linking', 'trying to capture', 'making explicit' and 'explaining'. Two types of modelling emerge from the case studies, namely 'bounded reasoning' and 'congruence'. Causality mapping and systems thinking represent bounded reasoning. At British Airways, causality mapping is represented by cognitive mapping, which is the main Soft OR tool used in the organisation. Casual maps are classified as static comparison, propositional thought and semantic understanding from Sparrow's (1998) knowledge equation. Whereas, Systems Thinking (Senge 1994) is used at Shell International, where static comparison is replaced by separation or systems thinking¹.
- Casual maps have characteristics of clustering, hierarchy and structure, which are used to bring focus and reference to problem interventions. Casual maps use a reasoned knowledge schema to structure conversation in which conscious and explicit knowledge is evident.

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- When using Systems Thinking at Shell International, facilitators use questions to challenge the assumptions and knowledge found in Soft OR models. The facilitator is constantly iterating with participants in order to check the validity and reliability of the model. Similar interpretations are drawn from the other case studies.
- When knowledge is implicit, facilitators tend to use Soft OR models as maps. The map becomes a cryptic label or holding device of knowledge. These cryptic labels are a device for consensus or negotiation.
- A key attribute of congruence mapping is the use of social discourse and social knowledge in which everyday language or skilled behaviour (Sparrow 1998) is prominent.
- The full spectrum of knowledge cells is evident from Sparrow's equation when Soft OR models are used in congruence. All the case studies suggest that congruence maps are a mixture of explicit and implicit knowledge.
- The concepts of 'abandonment', 'switching', 'adaptability', 'balancing' and 'boundaries' are identified as metacognitive attributes of facilitation in modelling. These are the automatic behaviours of facilitators that make Soft OR work.
- Power and politics is identified in all of the case studies, in which a series of manifestations such as 'conflict', 'dominance', 'suppression' and 'disclosure' is evident.

¹ It is easy to get confused between Systems Thinking (Senge 1994) and systems thinking (Sparrow 1998). Systems Thinking refers to the authored methodology of Peter Senge, whereas systems thinking refers to the type of thinking as classified by Professor John Sparrow.

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- Facilitators are aware of these concepts, and use ‘agreement’, ‘consensus’ and ‘comfort zones’ to manage these manifestations. These concepts are purposeful in order to negotiate the right order of knowledge.
- Across all of the case studies, the facilitator is intent on changing participants’ knowledge schemas. ‘Language as skilled behaviour’, ‘stories’, ‘metacognition’ and ‘congruence mapping’ are key concepts in producing a richer knowledge schema compared to bounded discourse and reasoning.
- The Academic Consultants identified clear semantic differences in the Soft OR methodologies compared to the Shell International and British Airways cases. The interviewees could clearly recognise distinguishing differences between approaches. For example, Strategic Choice (Friend 1989) is about ‘sequencing’, ‘weighting given to values’ and ‘alternatives’. Whereas, Decision Conferencing (McCartt & Rohrbough 1989) and Robustness Analysis (Rosenhead 1989b) were seen to be linked to ‘bounded reasoning’, ‘unpopular’, ‘technical’ and ‘expert’. The practitioners in the British Airways and Shell International cases saw a higher degree of commonality between the methodologies, due to the influence of pragmatism. But, underlying concepts of facilitation and modelling were very similar across all of the cases.
- Technology across all the cases impinged on the natural flow of conversation. Technology was associated with ‘expertise’ and ‘hierarchical structures’.
- In all of the cases, facilitation had a number of ‘actions’, ‘awarenesses’ and ‘types’. Actions included ‘inducement’, ‘keeping track of events’, ‘guiding’, ‘sequencing’ and ‘negotiation’. Awareness related to the

issues of ‘groups’ and ‘power and politics’. Types of facilitation included ‘hierarchical’ and ‘multi-facilitation (situational)’. Systems Thinking at Shell International produced a localism of ‘balancing advocacy with inquiry’.

To summarise, the degree of commonality between each of the cases leads to a range of clusters. These clusters represent ‘how’ facilitators use Soft OR methodologies, tools and techniques. Each cluster can be explained in the following manner:

- *Knowledge in Soft OR* is identified through the boundary concepts of ‘process restrictiveness’ and ‘bounded reasoning’. Emerging from these concepts, is the theme of ‘grounded pragmatic theory’ as an explanation of how the practice of Soft OR has developed.
- *Knowledge in Discourse* is about the facilitator using discourse in the facilitation process to manage and represent knowledge. This uses ‘skilled behaviour in language’, ‘bounded discourse’, ‘contribution’ and ‘consensus and agreement’.
- *Knowledge Metacognition*. The concepts of ‘balancing’, ‘switching’, ‘boundaries’, ‘adaptability’ and ‘abandonment’ are an interpretation of a higher order range of cognitive practices, which represent how facilitators facilitate within Soft OR.
- *Social and Cognitive Congruence* is the balancing of social and cognitive concepts that happen in Soft OR practices. These concepts are concerned with the ‘knowledge in power and politics’, ‘negotiated knowledge’ and ‘comfort’ aspects.
- *Knowledge Transformation* brings together the process of how the facilitator manages knowledge. This is concerned with the shaping of a ‘knowledge schema’, through ‘changing’ and ‘knowledge access’.
- *Facilitating Knowledge* places the facilitator in the centre of the knowledge decision making process. Emerging characteristics include

‘awareness of knowledge’; ‘actions for facilitating knowledge’ and ‘facilitation intervention’

- *Knowledge Congruence* is concerned with how participants use and view maps in Soft OR. In the maps, this is labelled as the ‘congruence effect’. Concepts identified include; ‘cryptic labels of knowledge’; ‘iteration of knowledge’; ‘reliability and validity of knowledge’ and ‘questioning knowledge’.

The next section traces how such clusters were brought together, through a cross section of cognitive maps drawn from all the purposeful cases, demonstrating the construction and interpretation process. When viewing the cognitive maps in the next section, the concepts represent ‘slices’ (Dewery 1958; Lawrence-Lightfoot & Davies 1997) or views (Jones 1993) from a larger cognitive map. These concepts have multiple meanings when constructed and viewed from different angles. Some views are blurred (Geetz 1983; 1988) or have no clear boundaries, as some of the concepts appear in multiple clusters. It is emphasised that the configuration and interpretation of these cognitive maps is a subjective process, as stated in the research methodology chapter.

4.2 Constructing a Conceptual Map of Soft OR Practice

4.2.1 Knowledge in Soft OR

The search for a meaning of Soft OR within the academic community, involved deriving a construction from the question ‘what is Soft OR?’, referring to the terms, definitions and concepts of Soft OR. Such a construction sought differences between ‘Soft OR’ and ‘OR’. Figure 4.1 clearly identifies differences between these concepts. The concepts that surround ‘OR traditional approach’ are ‘quantitative judgements’, ‘weighting given to values’ and a ‘mathematical approach’. This is about decisions through numbers, which are seen as ‘technical’ and ‘expert’. A focus is given to numerical solutions with an emphasis on ‘outputs’.

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Similar assertions are found in figure 4.2, as the 'OR traditional approach' is linked to 'expert', 'technical', 'mathematical process' and 'quantitative judgements'. These concepts reflect the traditional values of OR i.e. solving problems using quantitative models. Figure 4.3 links these concepts to the term 'transferability'. A concept that links to 'explicit' and 'hard' terms, usually codified as 'quantitative'. All these concepts have characteristics of 'modelling', a term that is shared by both traditional OR approaches and Soft OR. In contrast, the model in Soft OR is about 'capturing language' and 'thinking about problems' rather than quantifying problems.

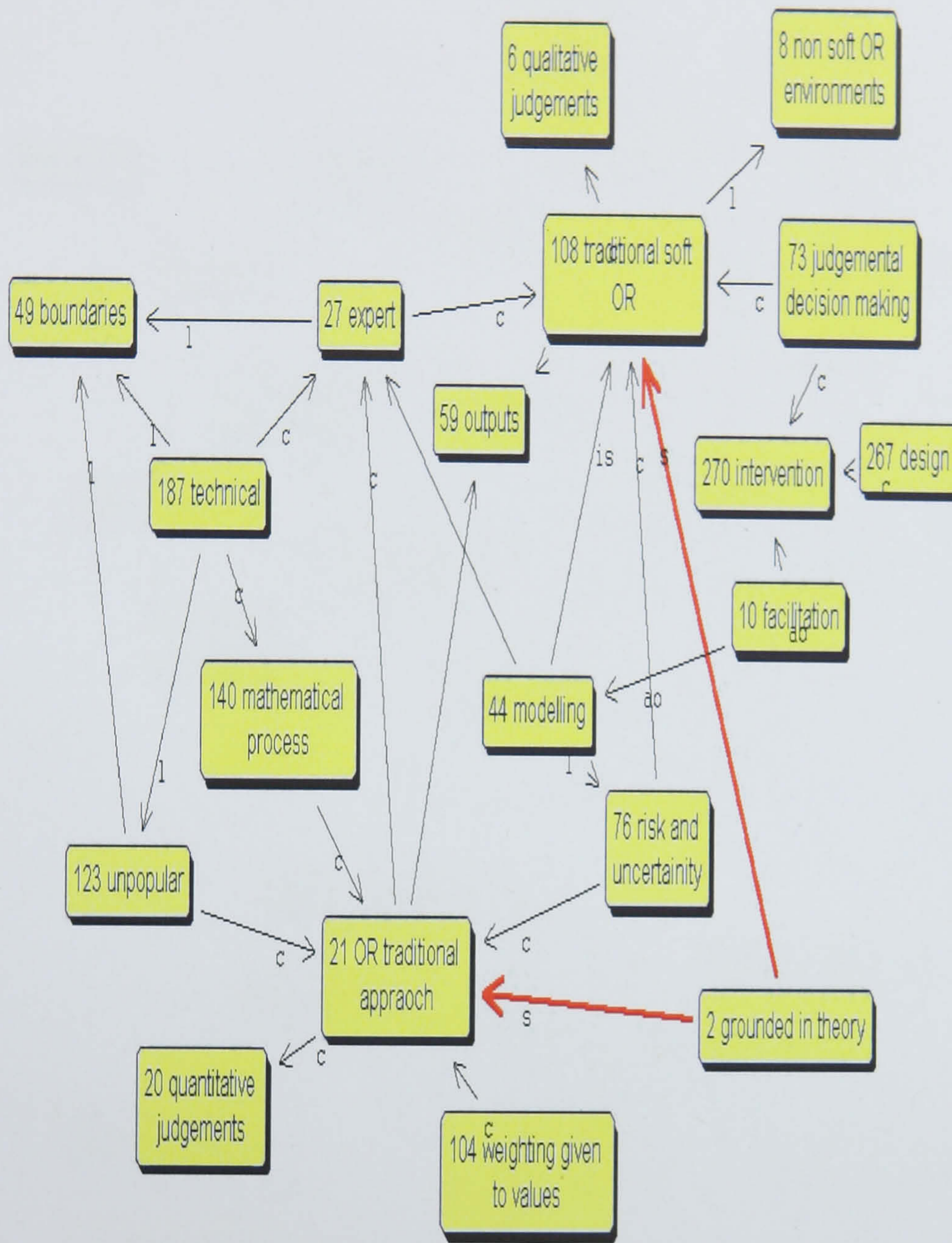


Figure 4.1 The Boundaries & Differences of Soft OR at the London School of Economics

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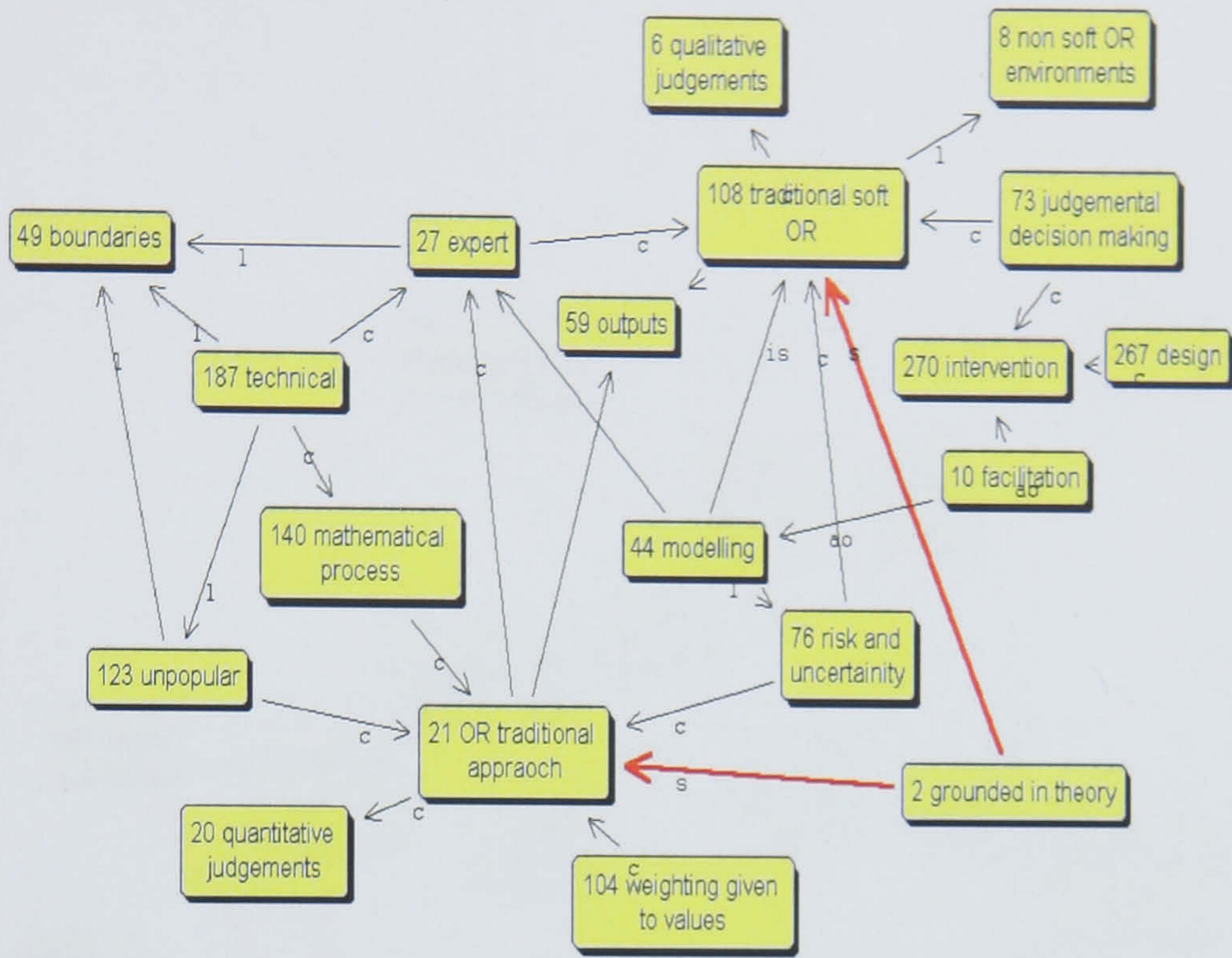


Figure 4.2 Defining Soft OR at South Bank University

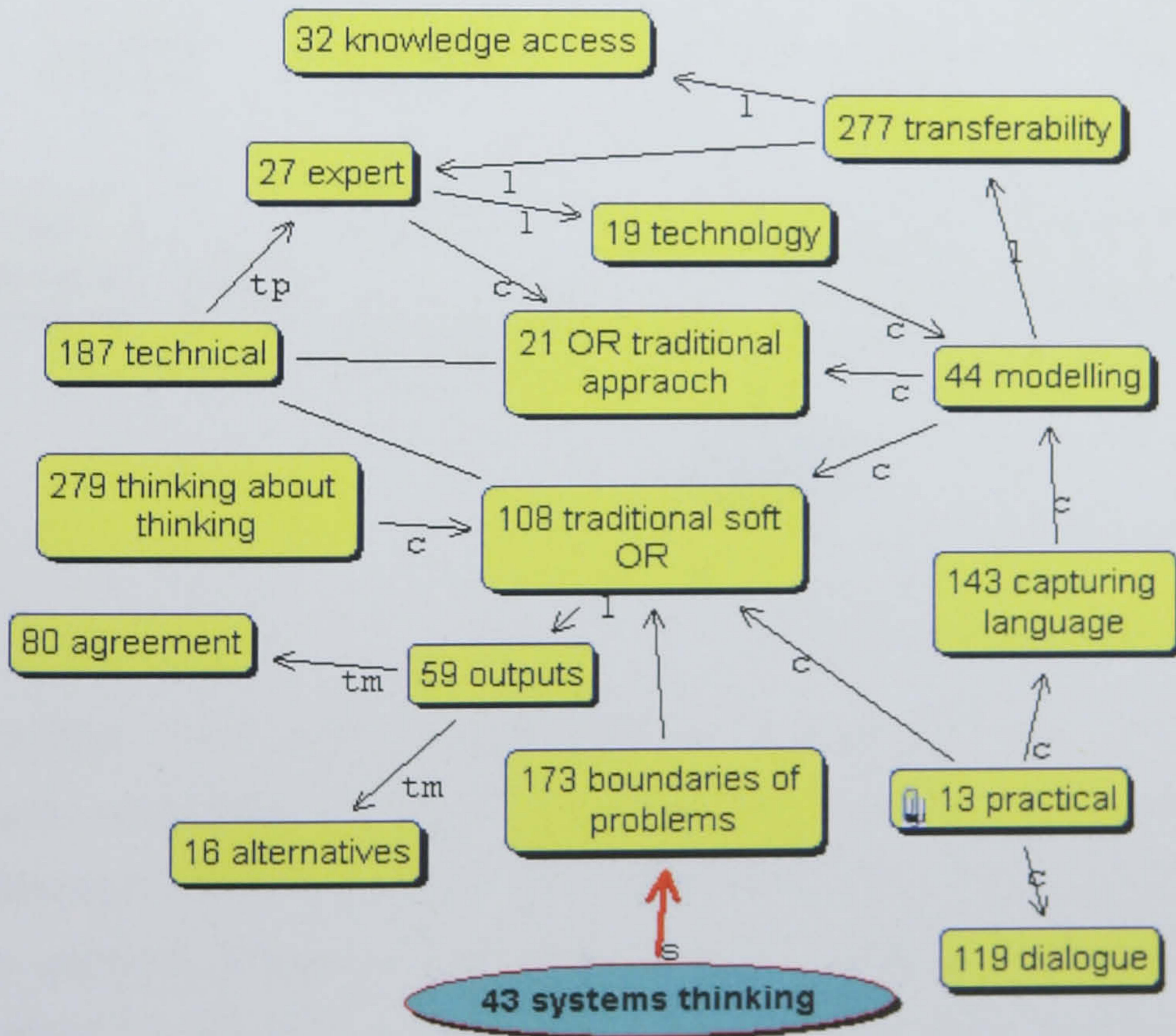


Figure 4.3 Definition of Soft OR at Warwick University

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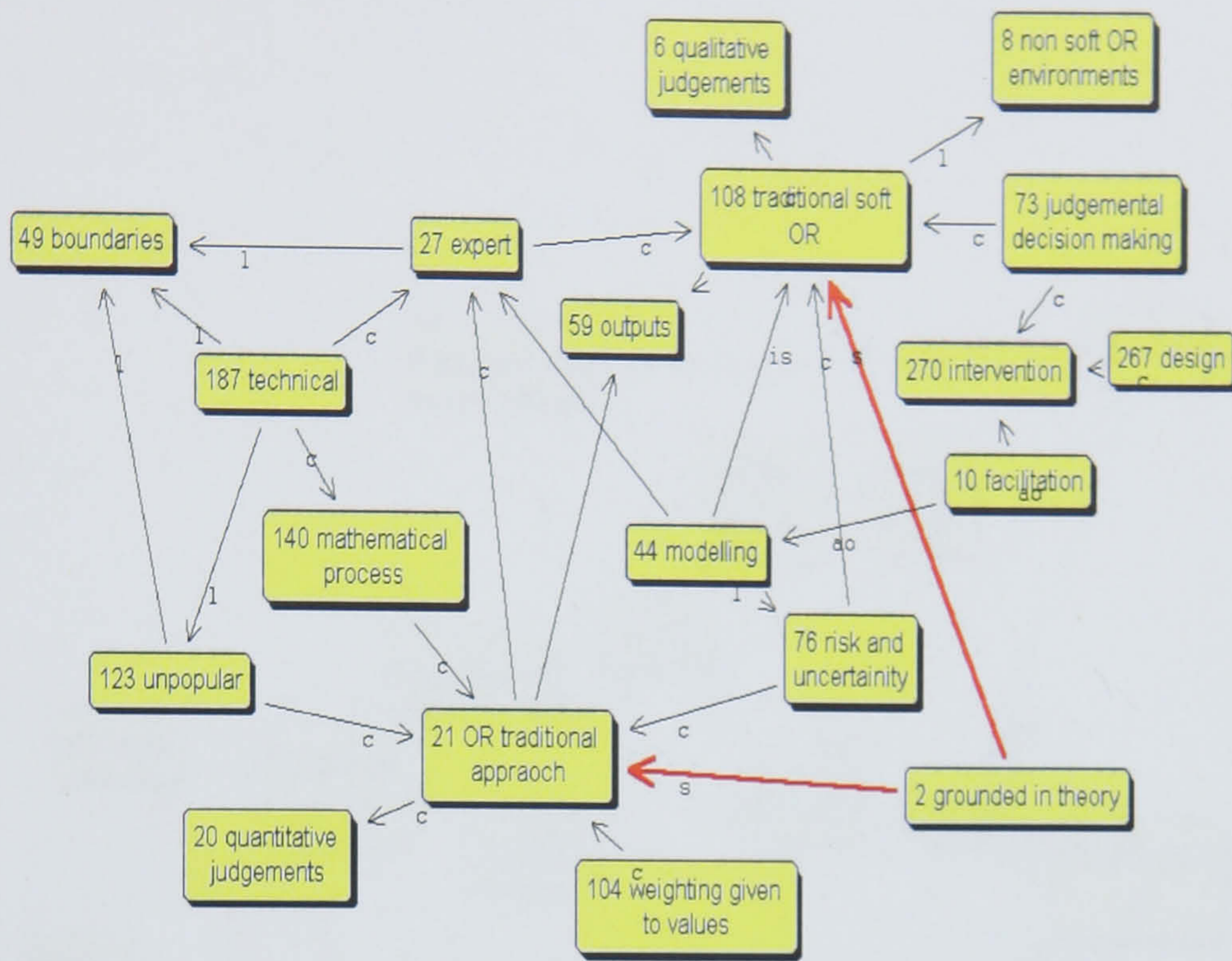


Figure 4.2 Defining Soft OR at South Bank University

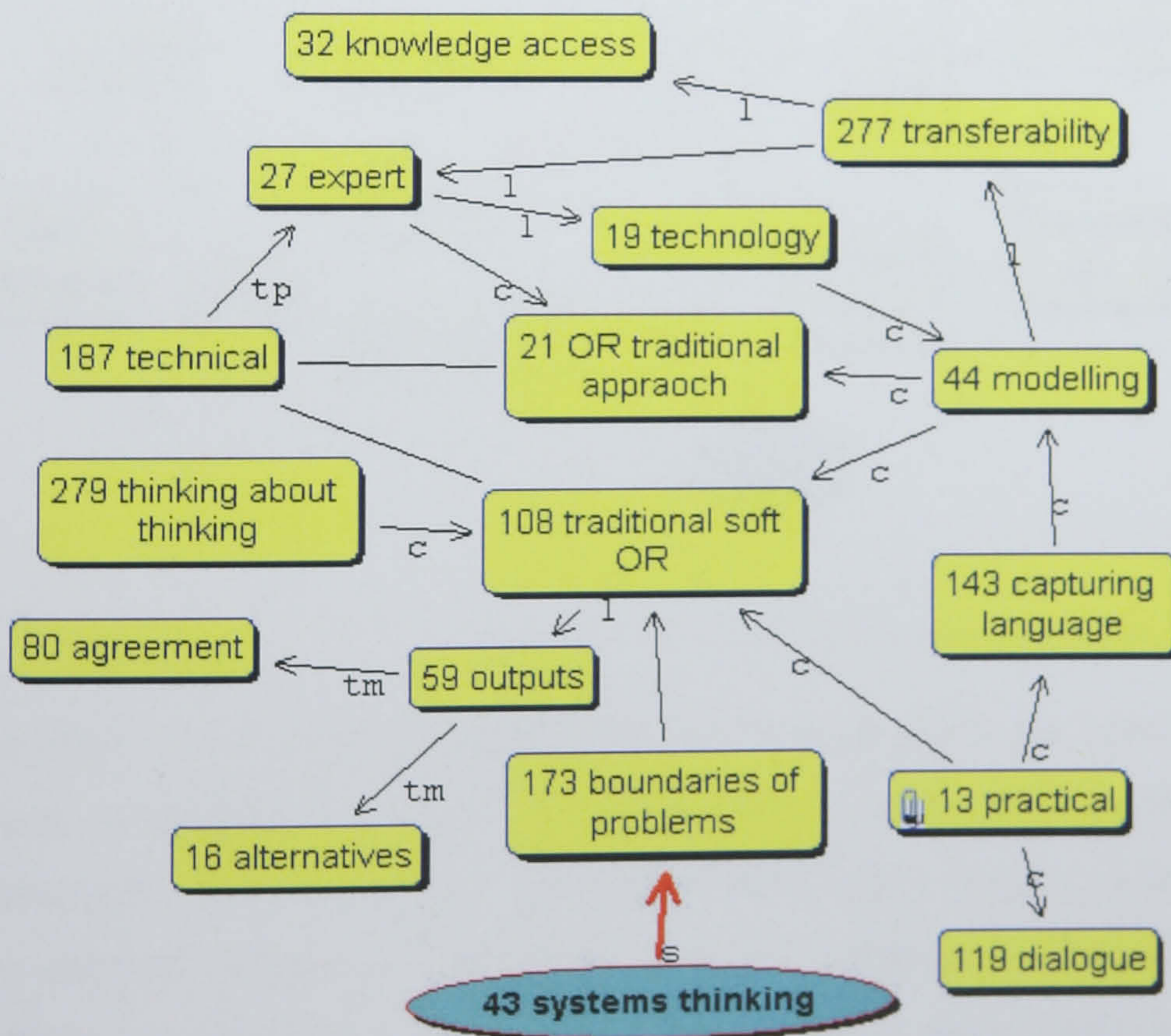


Figure 4.3 Definition of Soft OR at Warwick University

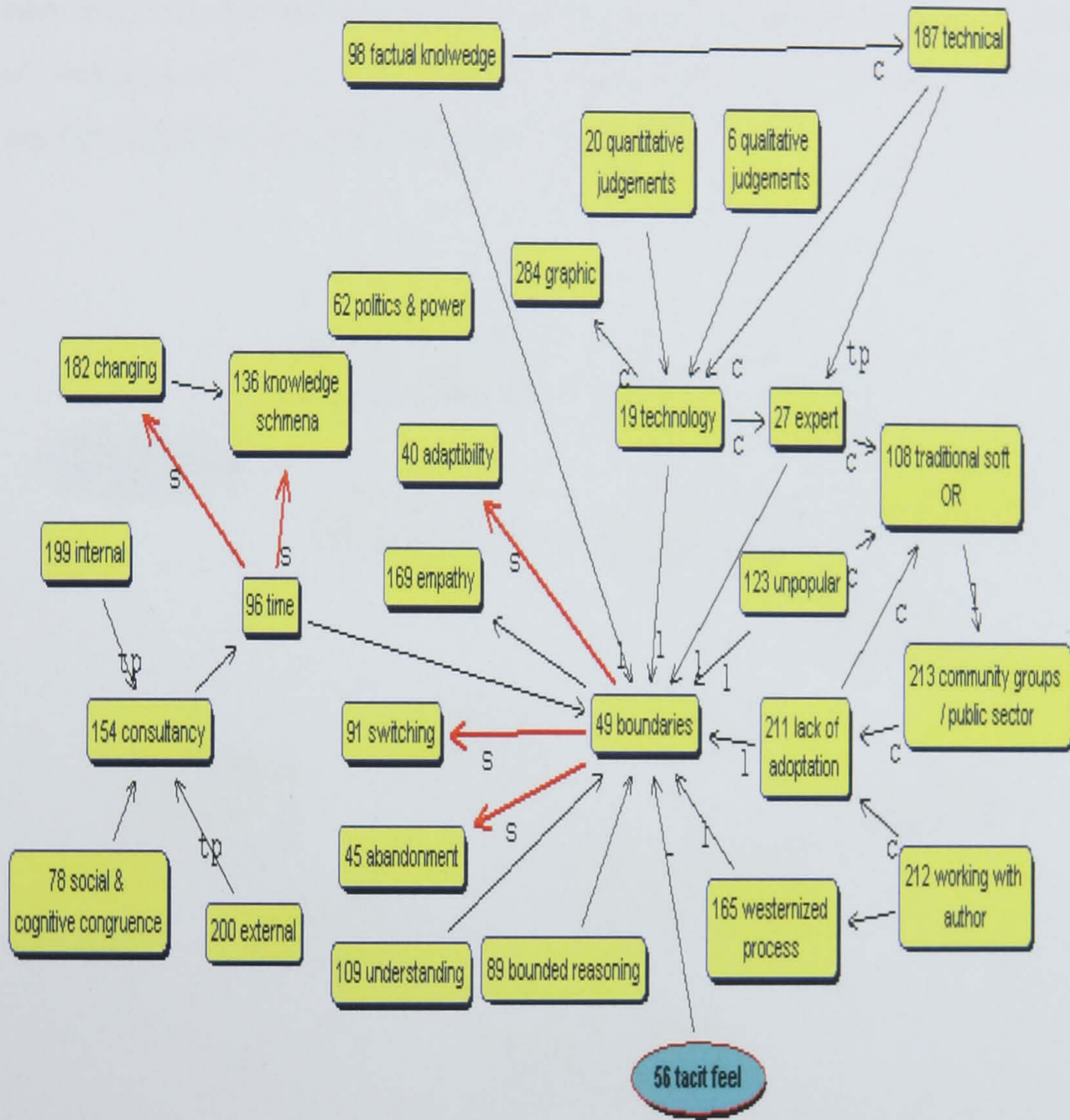


Figure 4.4 Boundaries of Soft OR at Hull University

From figure 4.4, a range of boundaries are identified which are labelled ‘process restrictiveness’. These are the concepts of ‘technical’, ‘expert’, ‘technology’, ‘western process’ and ‘factual knowledge’. ‘Expert’ is seen as a problem, because it produces a local language or ‘bounded discourse’. A language of expertise which, at times, participants find difficult to read and understand. The language is more inaccessible when

associated with ‘technology’, as participants feel they have difficulty making a contribution because of ‘poor slot management’. Their ability to contribute is hindered because of the ‘artificial’ and ‘laboratory’ approaches to discourse. According to figure 4.5, these concepts show how Soft OR can become a barrier to knowledge access. The concepts of ‘conceptual’, ‘bounded discourse’, ‘unpopular’ and ‘dialectic’ debate, are perceived as acting as barriers to ‘learning’.

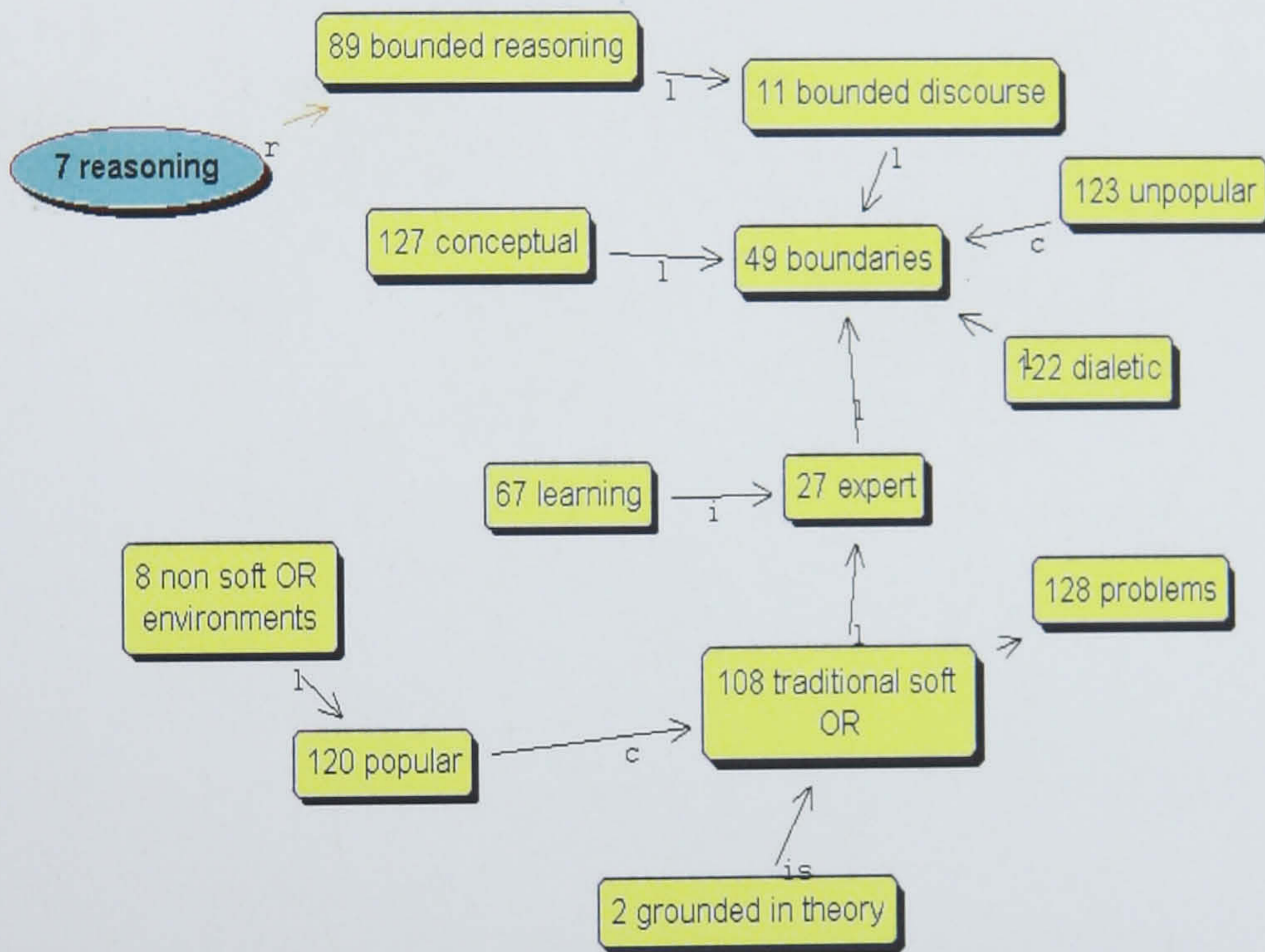


Figure 4.5 Defining Soft OR at Lancaster University

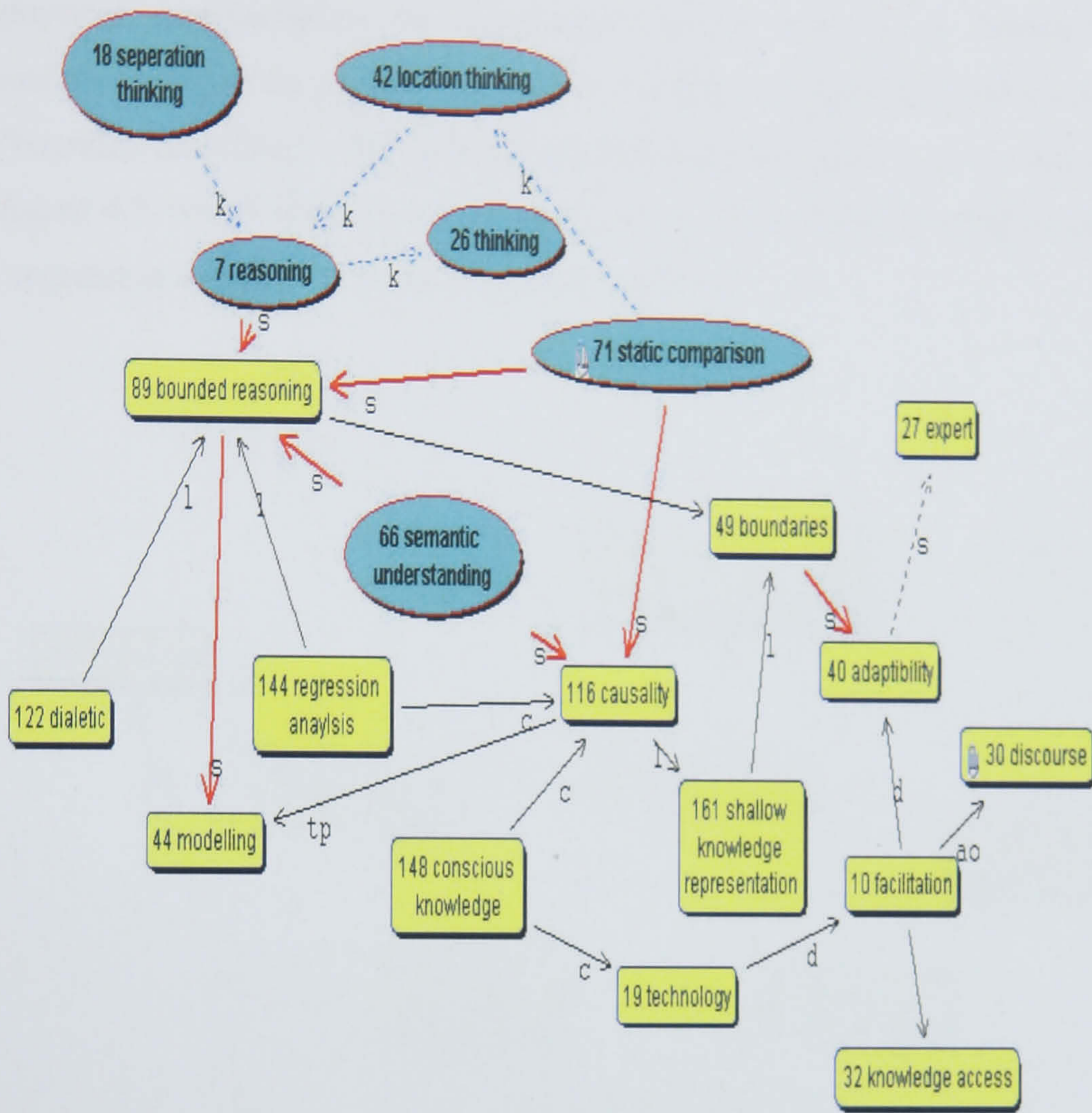


Figure 4.6 Reasoning Map at Strathclyde University

Bounded reasoning represents a knowledge schema that portrays ‘reasoning, propositional thought and semantic understanding’; as emphasised at Strathclyde University (figure 4.6) through the use of causality maps. Causality uses a specific type of reasoning cell from Sparrow’s (1998) knowledge equation, ‘static comparison’, which has a strong link to ‘cluster, hierarchical, structure’. This is a typical characteristic of causality, and the Soft OR tool of cognitive mapping (Eden & Ackermann 1998). Cognitive maps is about ‘conscious knowledge’ i.e., knowledge that is explicit. Cognitive maps use this type of

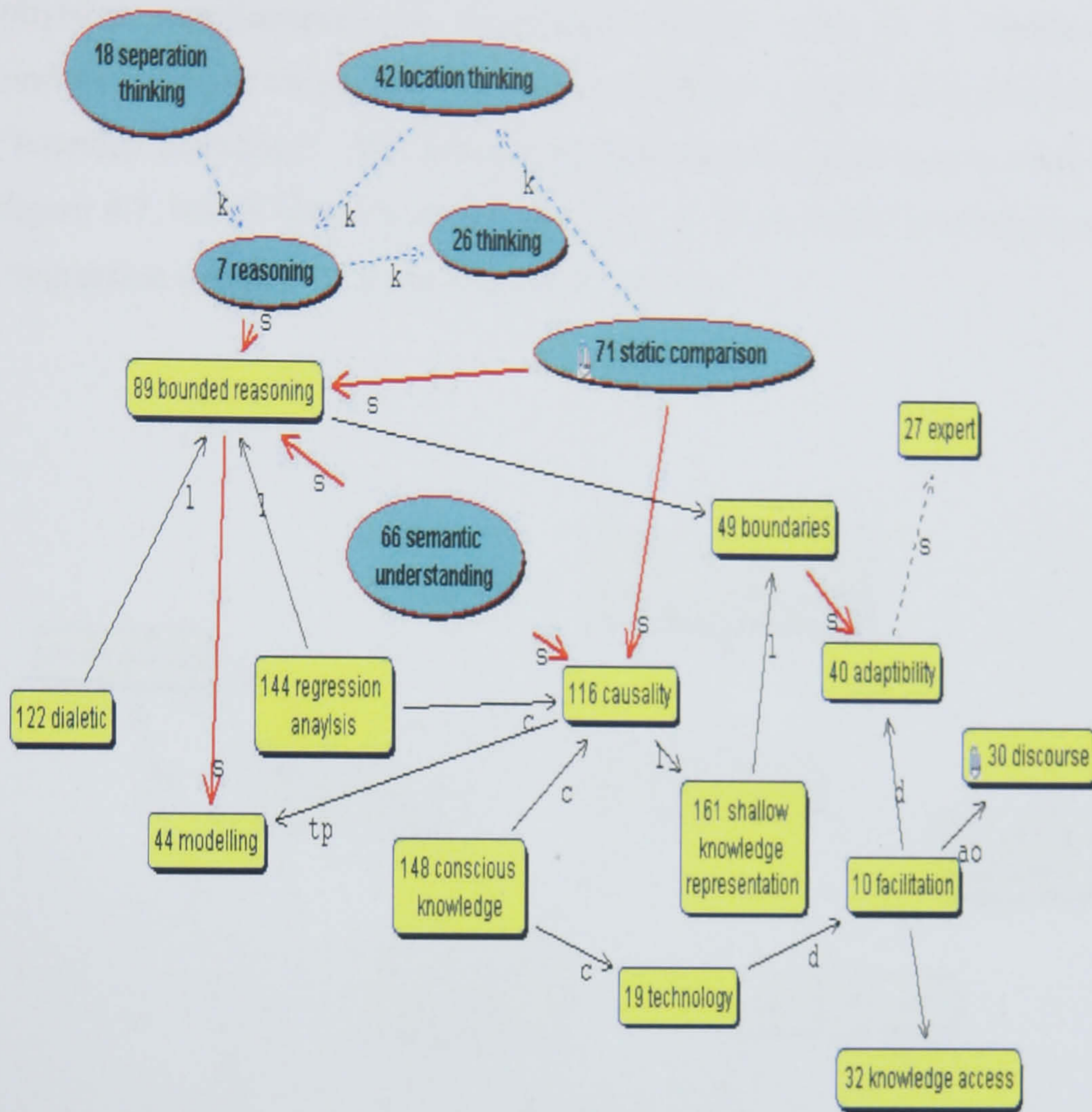


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physical representation of knowledge, which leads to a ‘shallow’ understanding of the problem and poor knowledge transfer, hence the label ‘bounded reasoning’. The use of bounded reasoning models is viewed in figure 4.7, which shows how the facilitator at Strathclyde University uses ‘regression analysis’ to make sense of knowledge.

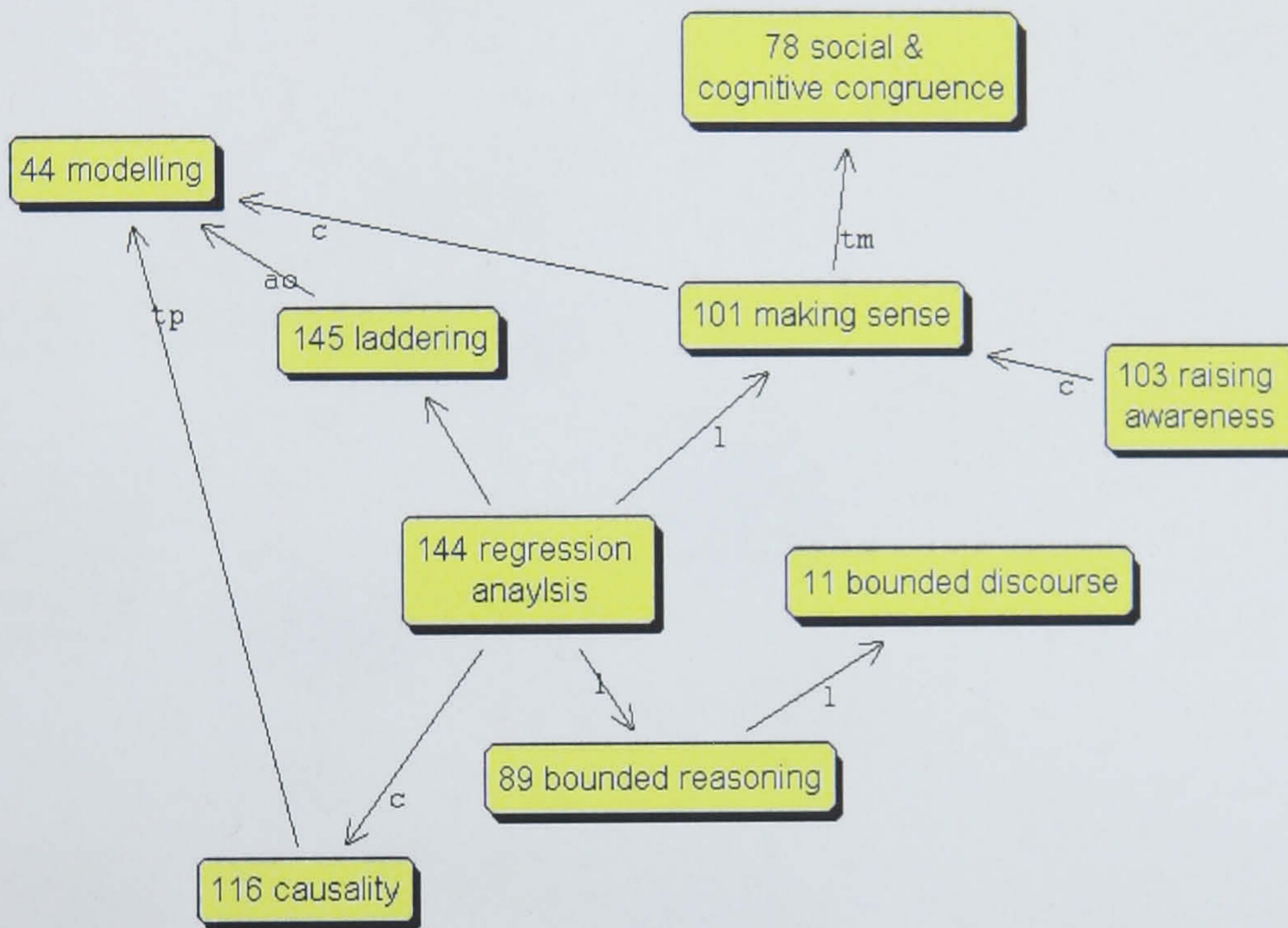


Figure 4.7 Regression Analysis at Strathclyde University

Regression analysis is a process of laddering, by raising awareness and focusing knowledge in a conscious manner. The process concentrates on conscious knowledge and reflexive practice.

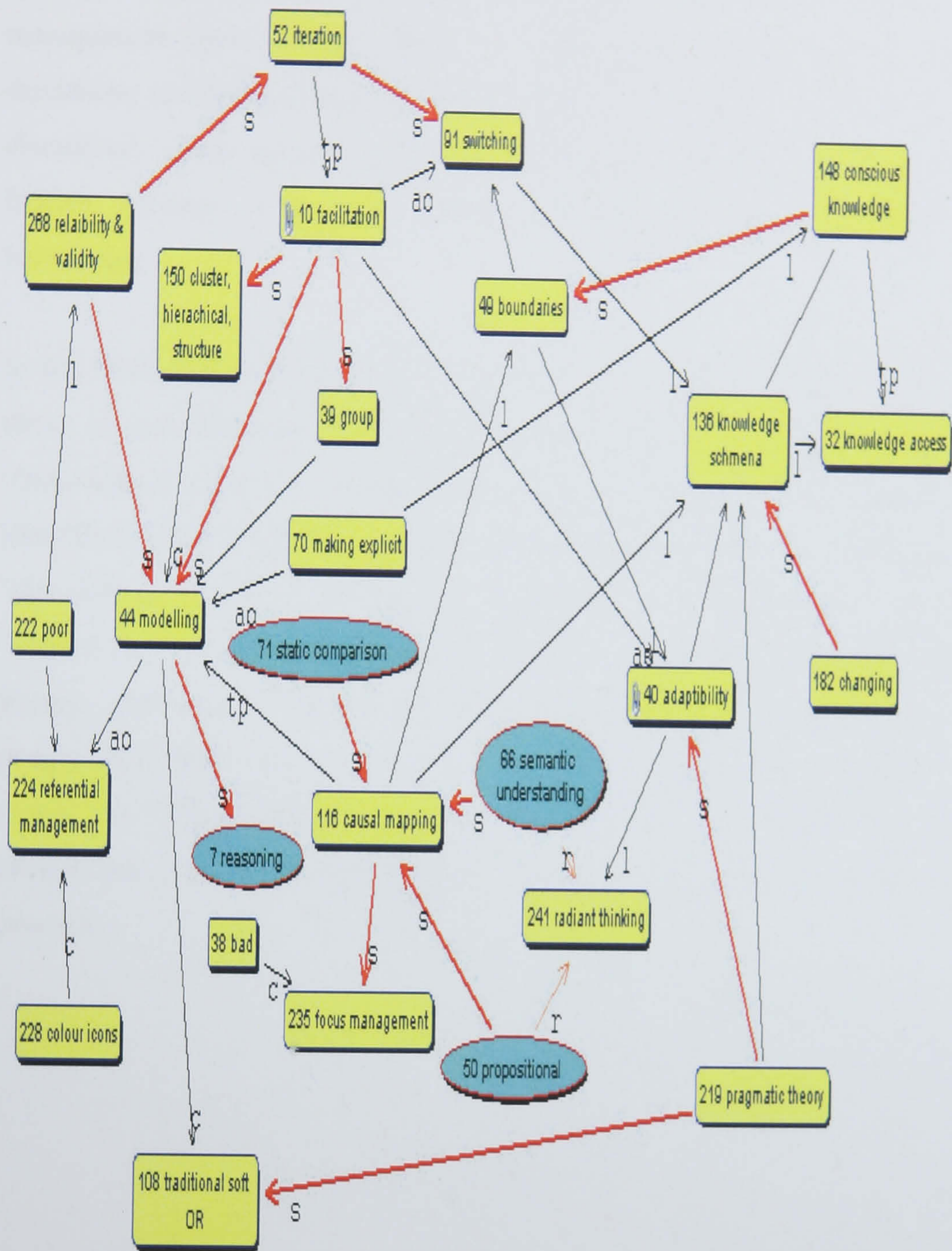


Figure 4.8 Causality at British Airways

An emphasis on causality is seen in figure 4.8, which identifies a strong link of causal mapping to ‘static comparison’, ‘propositional thought’ and

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'semantic understanding'. Soft OR models act as a 'focus' and 'referential' management point (Chafe 1994) for participants. They can see the discussion unfolding around the model, the model becomes the focus for discussion, group memory and a reference point. Causality models at British Airways work with 'conscious', 'explicit' and 'structured' knowledge.

In the Shell International case, the practice of Soft OR was hard to talk about, as consultants could not clearly separate 'Soft OR', 'facilitation' and 'consultancy', they saw them as the same. A range of concepts are identified in figure 4.9 Defining Soft OR at Shell International; 'focusing', 'discourse', 'tools', 'problems', 'adaptability', 'facilitation' and 'consultancy'. The concepts support Soft OR as a grounded pragmatic theory, which has evolved from theory and is adapted in practice, in a pragmatic manner. From figure 4.10, a strong link connects 'pragmatic theory' to 'traditional Soft OR' and 'adaptability'. The importance of pragmatism, depends on 'adaptability', this is what makes Soft OR work in practice.

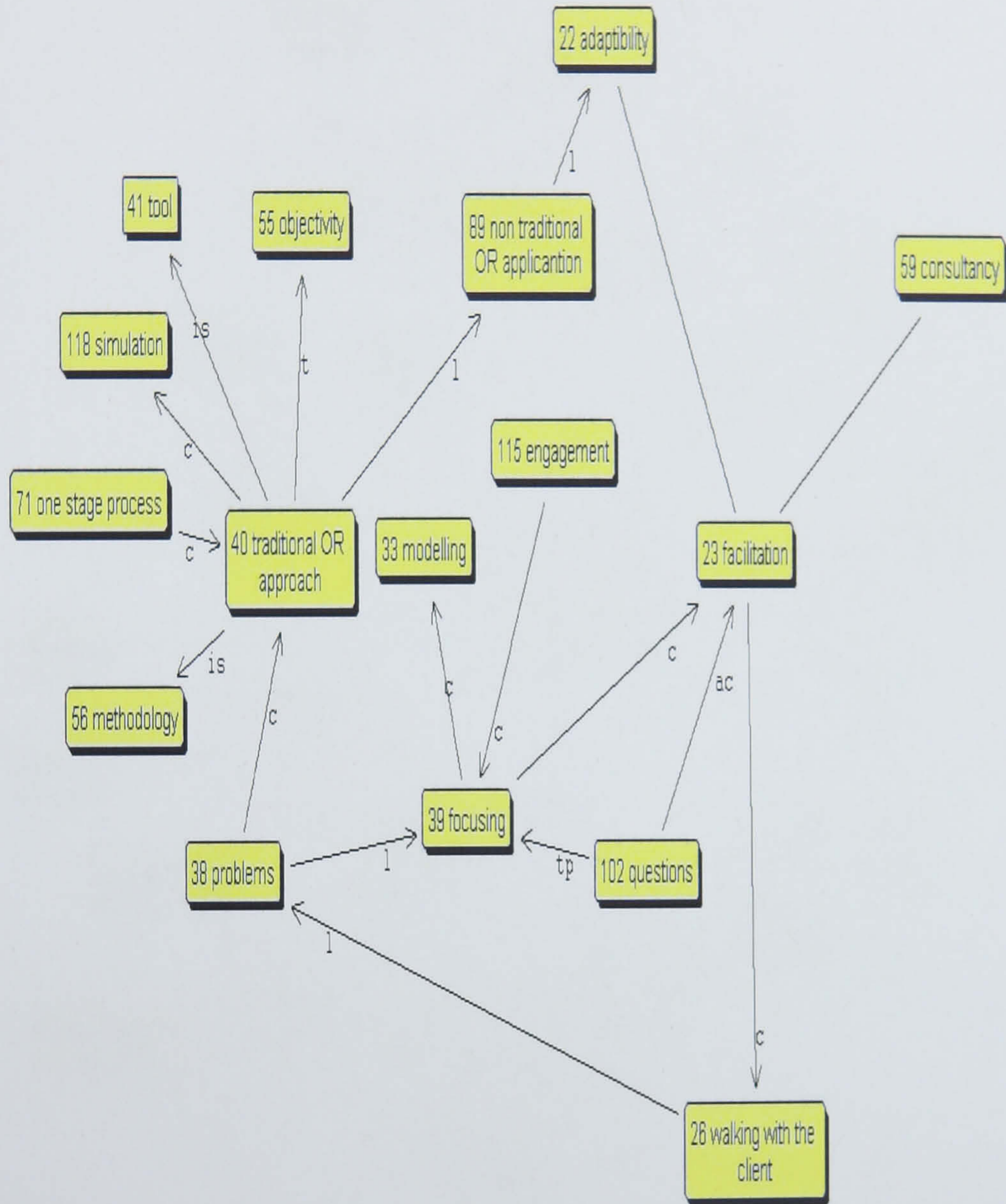


Figure 4.9 Defining Soft OR at Shell International

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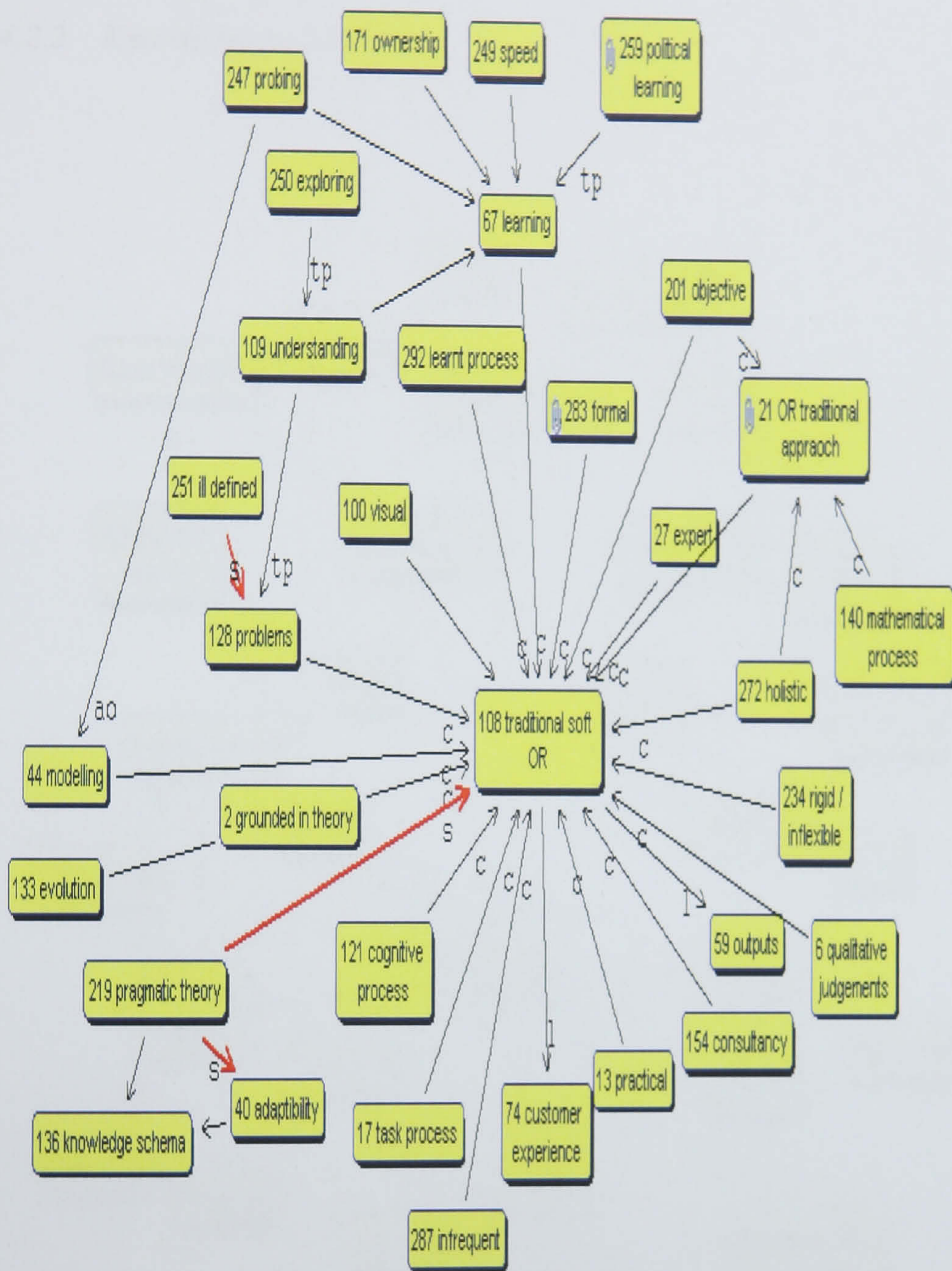


Figure 4.10 Cluster Analysis of Soft OR at British Airways.

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discourse that is taking place around the model. The facilitator emphasises 'skill behaviour' as discourse. The facilitator (figure 4.11) is emphasising the concepts 'naturalistic' and 'dialogue' as a means to surface tacit knowledge in the conversation. The process is about social knowledge and social discourse representing an implicit to explicit knowledge transfer (Nonaka & Toyama 2003). Through emphasising 'skilled behaviour' as language, the facilitator is, in fact, 'abandoning' the use of Soft OR tools and techniques as the tool has now served its purpose. Knowledge is being surfaced that represents 'tacit feel' and 'skilled behaviour'. 'Skilled behaviour' as language emphasises a natural flow of conversation in which the structure and the formality of the conversation is removed.

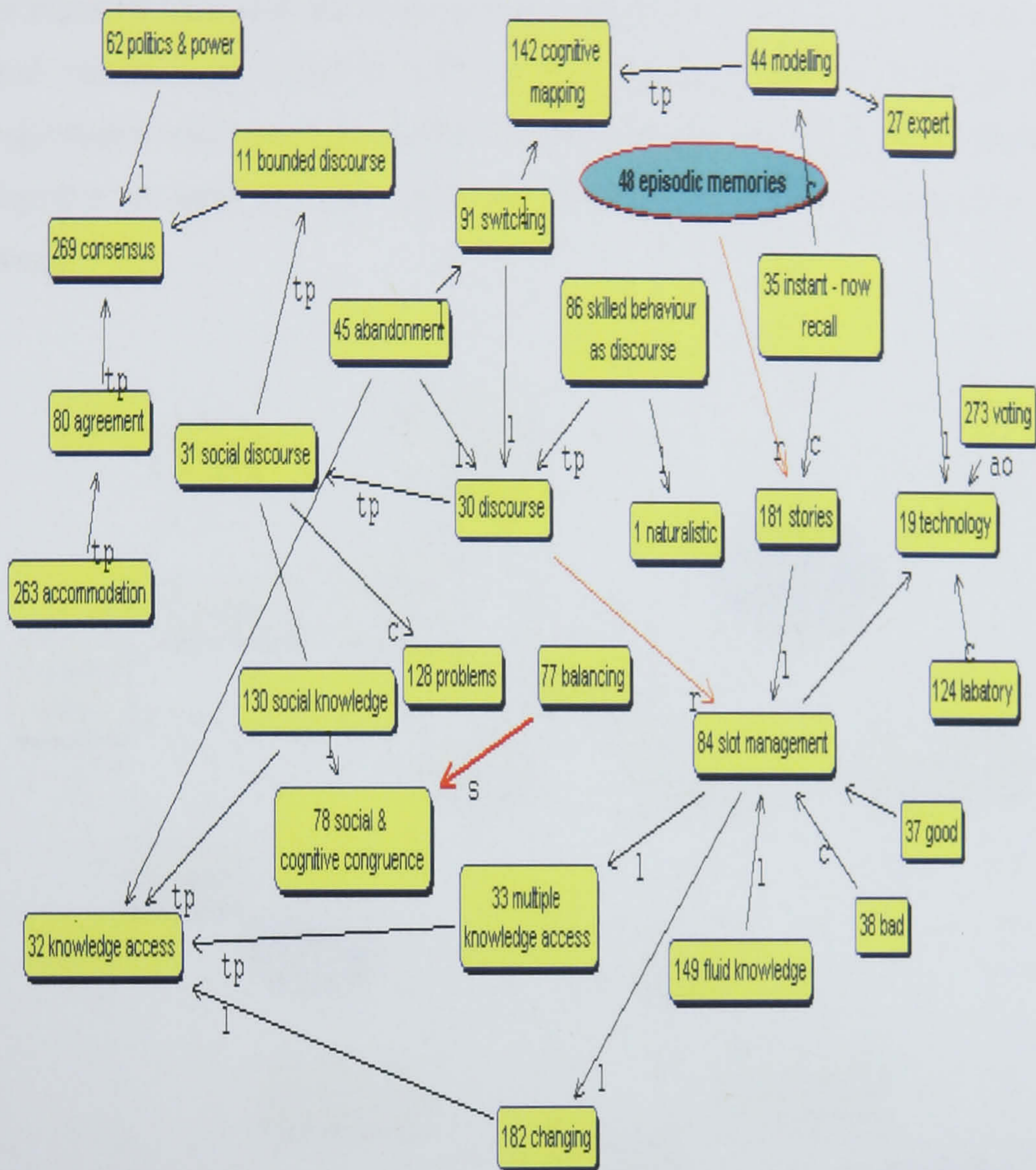


Figure 4.12 Discourse at London School of Economics

‘Skilled behaviour’ as language (Figure 4.13) connects to ‘multiple knowledge access’ through the concepts of ‘interactive process’ and ‘participation’. The participants use ‘stories’ to recall an incident or make a point about a situation. The use of stories draws upon ‘episodic memories’ (Sparrow 1998), where participants are personalising a problem situation through directly relating it to their experience.

In Figure 4.12, one of the characteristics of Soft OR is a concern for output and results. In order to deliver this, the concepts of 'consensus', 'agreement' and 'accommodation' are emphasised. These concepts all link together in order to move discourse forward to achieve an output or a result.

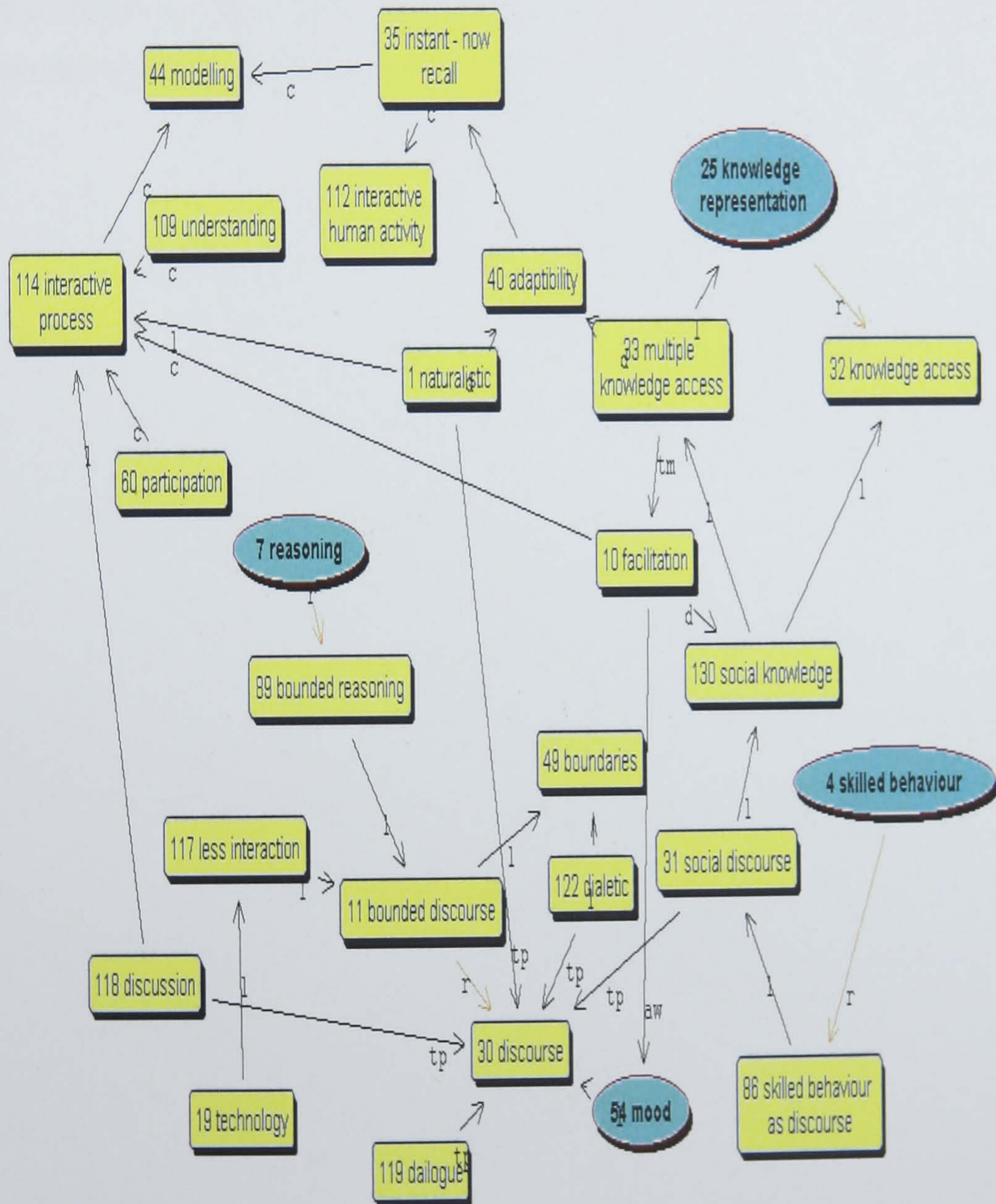


Figure 4.13 Discourse at Lancaster University

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Figures 4.11, 4.12 and 4.13 highlight the term 'bounded discourse'. 'Bounded discourse is about 'less interaction' drawing upon a reasoned knowledge schema. Characteristics of Soft OR that contribute towards this include 'technology', 'clinical language' and 'expert'. The language imposes boundaries and restrictions impinging on the natural flow of 'discourse', where participants embark on a journey of reasoned thinking and reflection. Participants feel that the environment is becoming unreal, moving towards a laboratory or scientific solution to the problem.

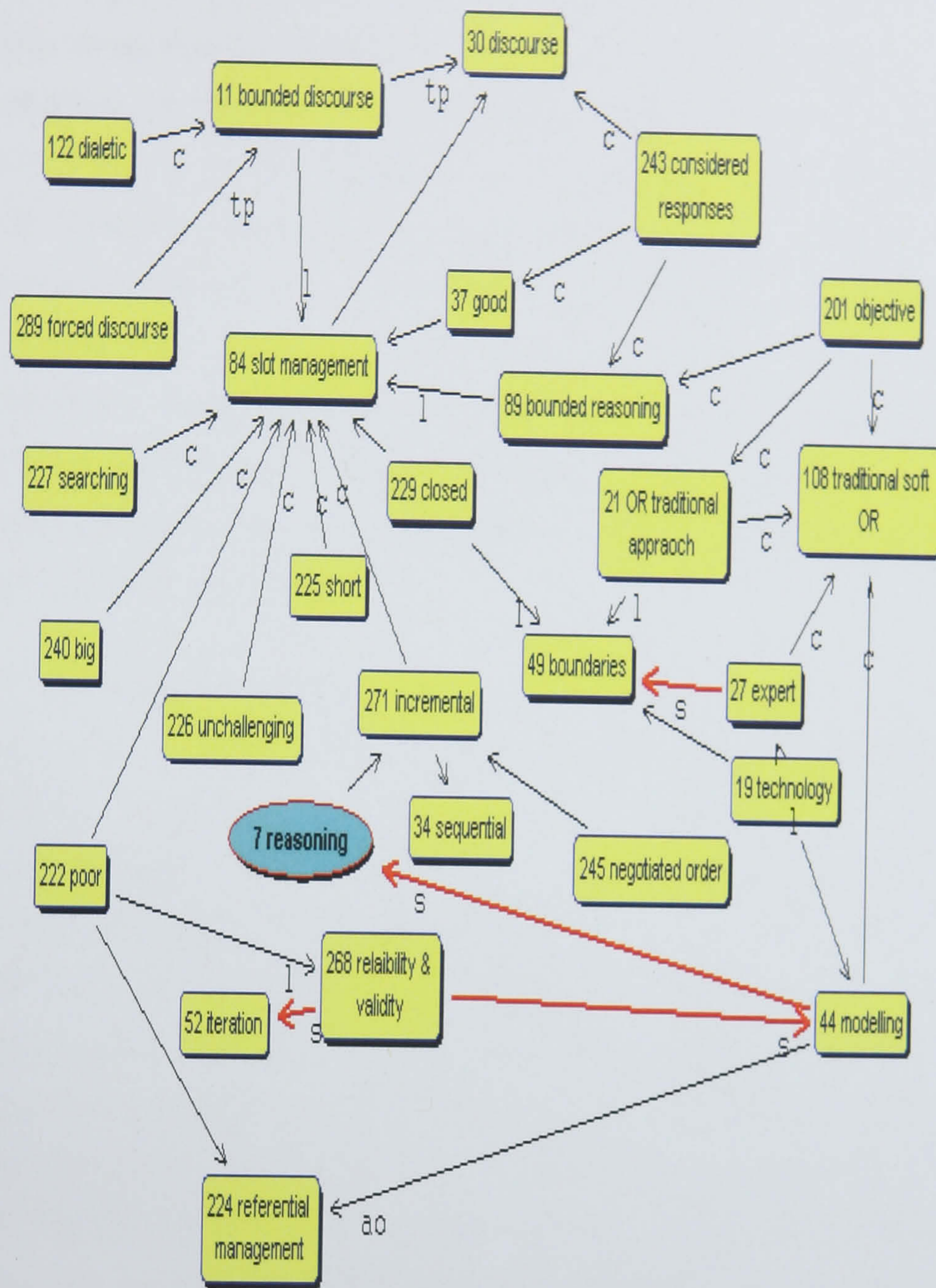


Figure 4.14 Slot Management at British Airways

'Bounded discourse' is about forced discourse or dialectic debate, which links to poor slot management (Figure 4.14). Slot management (Antaki 1994) is the ability to contribute within discourse. Slot management is 'poor' where 'technology' is used, this actually acts as a barrier to the contribution of discourse. The discourse feels managed and unnatural,

emphasising the point that technology can become a hindrance that actually slows down the natural flow of conversation. Technology places an emphasis on discourse that is structured, hierarchical and reasoned which is only a partial representation of knowledge within Sparrow's (1998) knowledge equation. Although within the British Airways case, 'bounded reasoning' was seen as a benefit when connected to the concepts of 'incremental', 'sequential' and 'negotiated order'. This is an interpretation where 'bounded reasoning' is part of the process of knowledge elicitation, rather than an exclusive process, when trying to get participants to reflect and consider points in a problem situation, rationality brings order and conclusion.

4.2.3 Knowledge Metacognition

Metacognition represents the facilitation activities of 'boundaries', 'switching', 'adaptability', 'abandonment' and 'balancing'. These concepts represent a higher order of cognitive activities, that are automatic and explain the actions of the facilitator (Nelson 1999). From Figure 4.15, the facilitator is making a series of 'judgement decisions' based upon the situation that is presented. 'Boundaries' are automatically identified in relation to what a Soft OR tool can do or cannot do. If the facilitator feels that no further progress can be made using that Soft OR tool, the tool may be 'abandoned' altogether or temporarily. These boundaries are identified, because of the 'process restrictiveness' of a particular tool. For example, cognitive mapping produces a knowledge schema of semantic understanding, propositional thought and static comparison. Where the facilitator wants to expand out of this knowledge schema, the facilitator may 'abandon' or adapt the technique. 'Adaptability' is where the facilitator adapts or changes the process to represent their experience or circumstances of the problem intervention. 'Adaptability' of techniques is an important concept that is closely linked to multi (situational) facilitation and improving knowledge access. From Figure 4.15, a route from

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'multiple facilitation' to 'knowledge access' to 'knowledge schema' can be seen. The purpose is to improve and change participants' understanding of the problem by drawing upon more cells from Sparrow's (1998) knowledge equation.

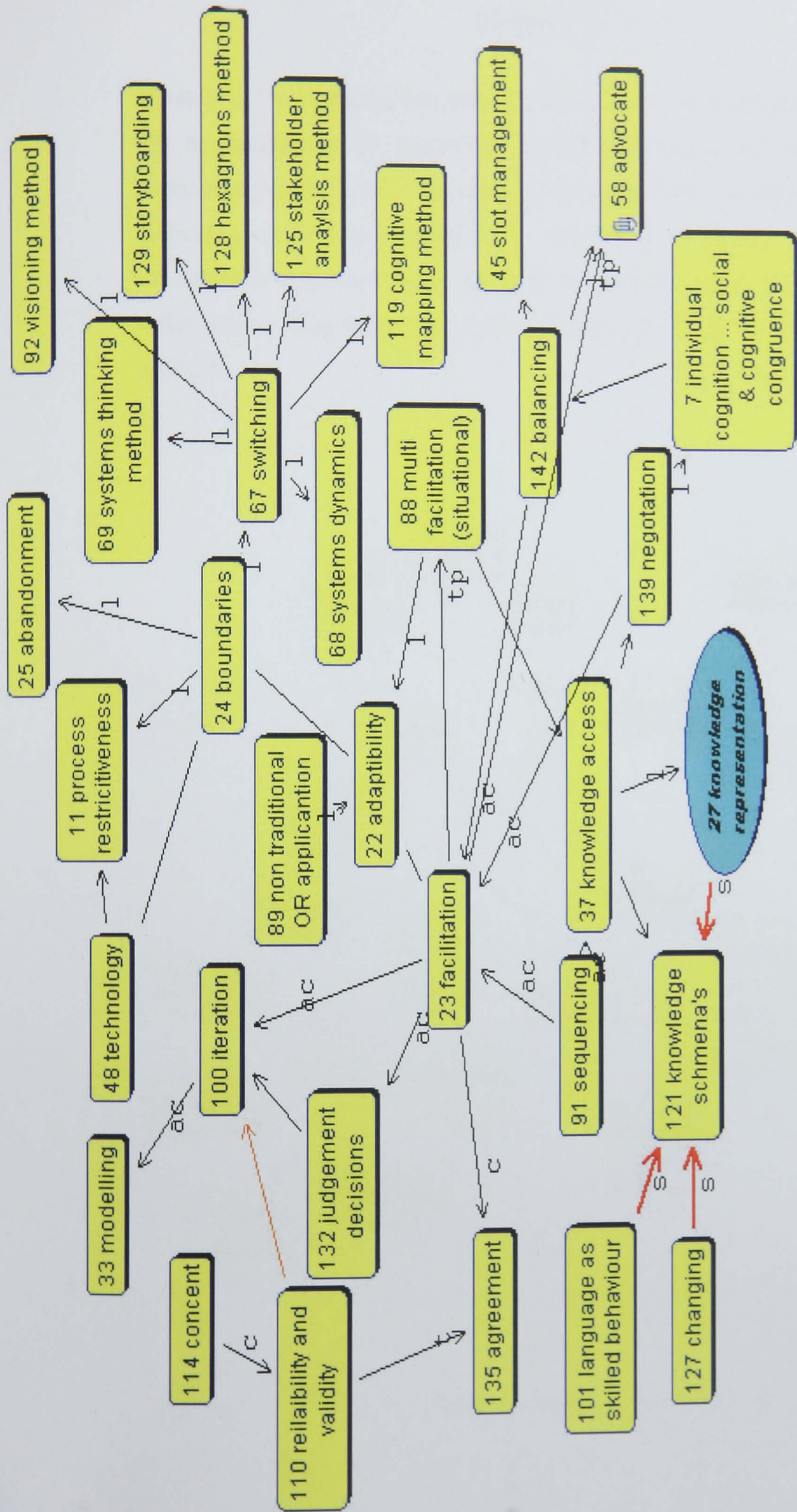


Figure 4.15 Metacognition at Shell International

'Switching' is a process that the facilitators use when boundaries of Soft OR methodologies are identified. Facilitators move between different methodologies, tools and techniques switching between 'systems thinking', 'visioning' and 'systems dynamics'. 'Balancing' is a concept where the facilitator is concerned with the need to balance 'social and cognitive congruence'. This concept puts the facilitator into the centre of activity in Soft OR.

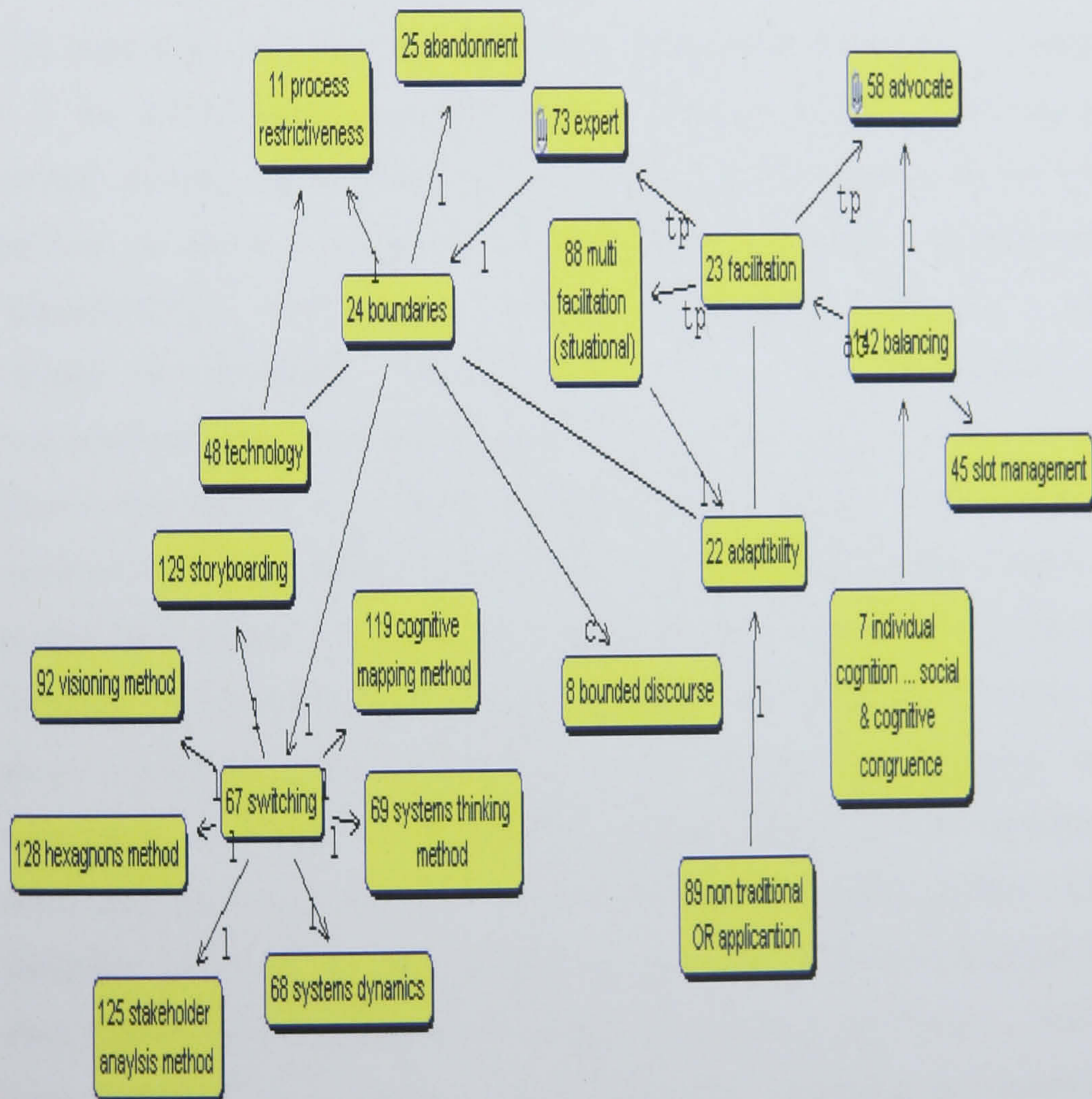


Figure 4.16 Explore Metacognition at Shell International

Figure 4.16 has been constructed from the Explore Command to give a different view of metacognition. 'Technology' is identified as a 'boundary' of Soft OR, based upon the connection to 'process restrictiveness'. Where technology becomes a boundary or hindrance in the process, the facilitator tends to abandon the use of technology or adapt its usage. For example, models that are produced through technology may be used as congruence maps, in which the concepts become cryptic labels of knowledge.

4.2.4 Social & Cognitive Congruence

The importance of power and politics is emphasised in figure 4.17, where it is the second most important concept, scoring 53 from 110 loops at central analysis, surrounded by 16 links at domain analysis. Power and politics is about a range of manifestations, 'conflict', 'withdrawal', 'manipulation', 'consensus', 'dialectic', 'disclosure', 'cohesion', and 'threats and worries'. These concepts have a zonal connection to 'unconscious interpretations'. Central to this relationship is 'facilitation'. This is observed through the 'defensive routine' concept. A connection is made to 'trundling along'. This is a deliberate ploy by the facilitator i.e. seeing how events will unfold. Facilitation also has a strong link to 'comfort', as a means of working with groups. The facilitator is trying to move participants into a comfort zone, as a means of 'defusing' the manifestations associated with 'power and politics'. Another important observation is the link between 'facilitation' and 'power and politics'. The facilitator 'is aware' of the situation, in which he is making a series of observations before taking actions. Actions include 'negotiation', which leads to 'social and cognitive congruence'. The facilitator is concerned with the order of knowledge, in which events and discourse have to unfold in the correct path. Facilitation becomes a process of 'judgemental decision making', balancing 'risk and uncertainty'.

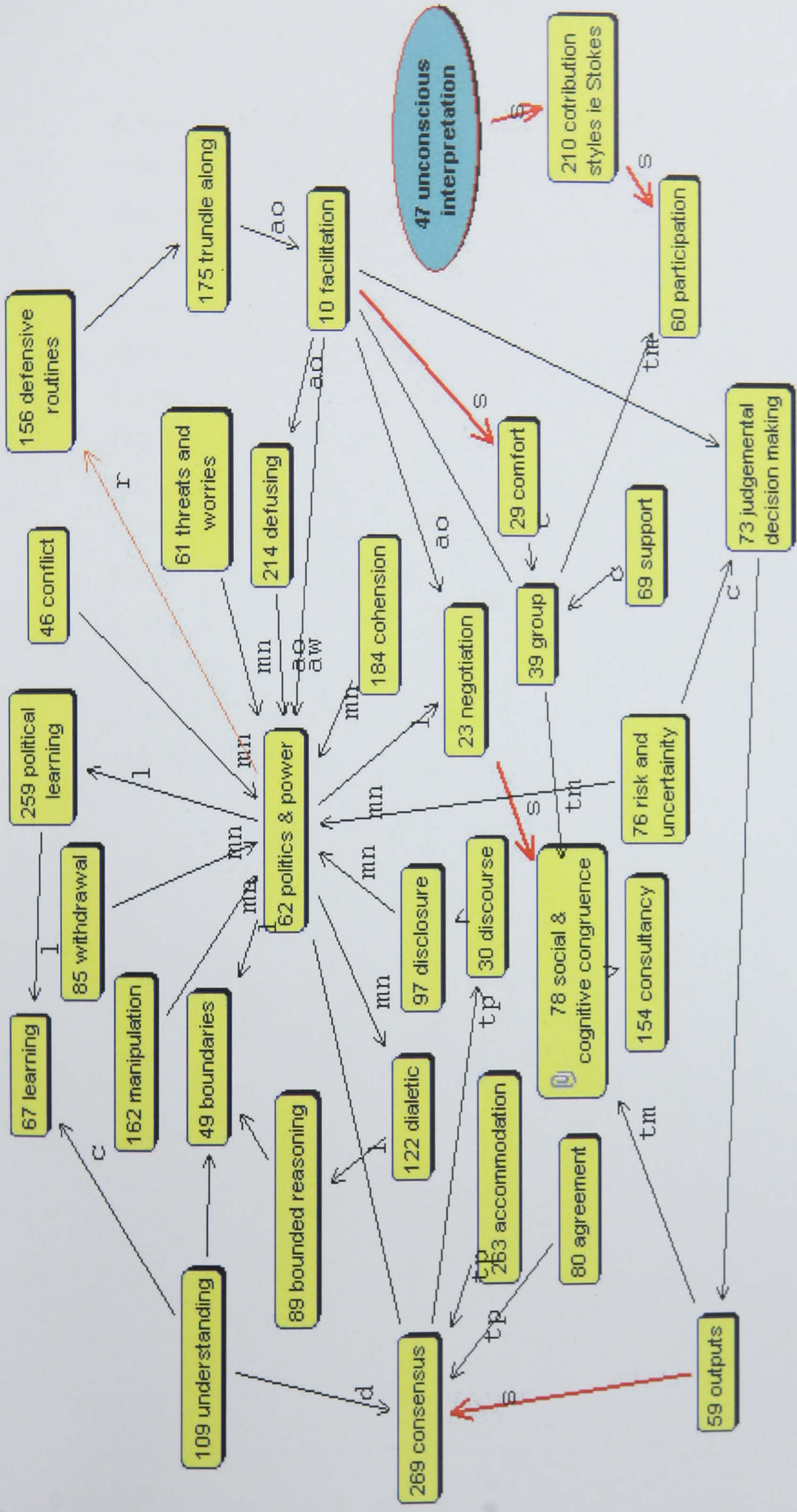


Figure 4.17 Power & Politics at Hull University

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A loop exists from 'political learning' – 'learning' – 'understanding' – 'consensus', suggesting knowledge is managed in a 'consensus' type of discourse in order to change knowledge schemas. Here, the concepts of 'discourse' surface, especially 'agreement' and 'accommodation'. Supporting this interpretation, figure 4.18 explores agreement as being about the facilitator managing 'viewpoints' and gaining 'coalition support'. Participants seek out support from colleagues or observe colleague's behaviour before making a contribution. The facilitator must be careful and deploy the right 'tactics'. This means negotiating the order of knowledge, 'creating space' for participants to think and 'walking with the client'. In this situation, congruence mapping is used rather than causality mapping. This can be seen to allow access to more cells in Sparrow's (1998) equation, in particular 'unconscious interpretation'. Congruence mapping is necessary as participants will use a series of defensive 'mechanisms' such as 'spoiling' the situation.

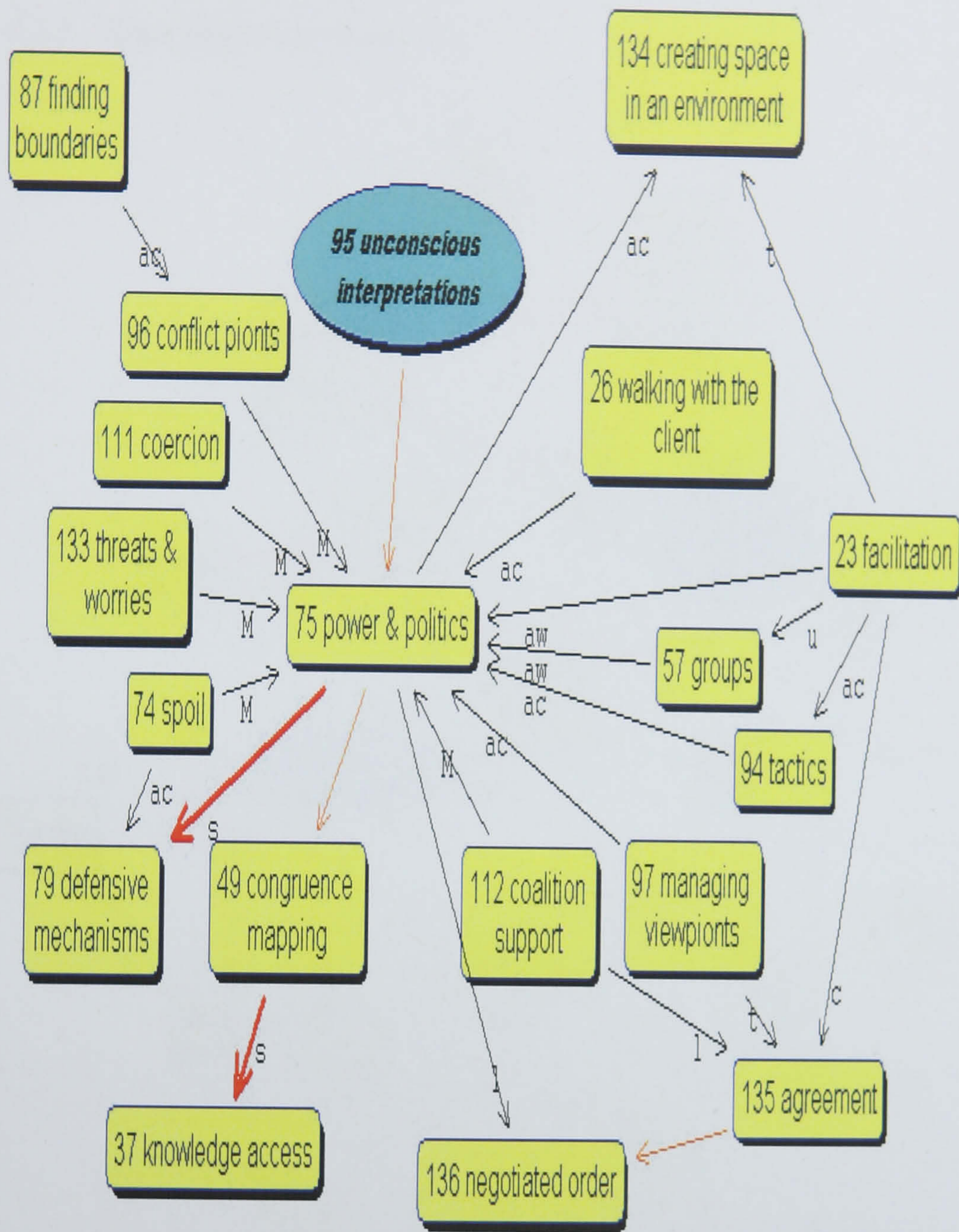


Figure 4.18 Power & Politics at Shell International

4.2.5 Knowledge Transformation

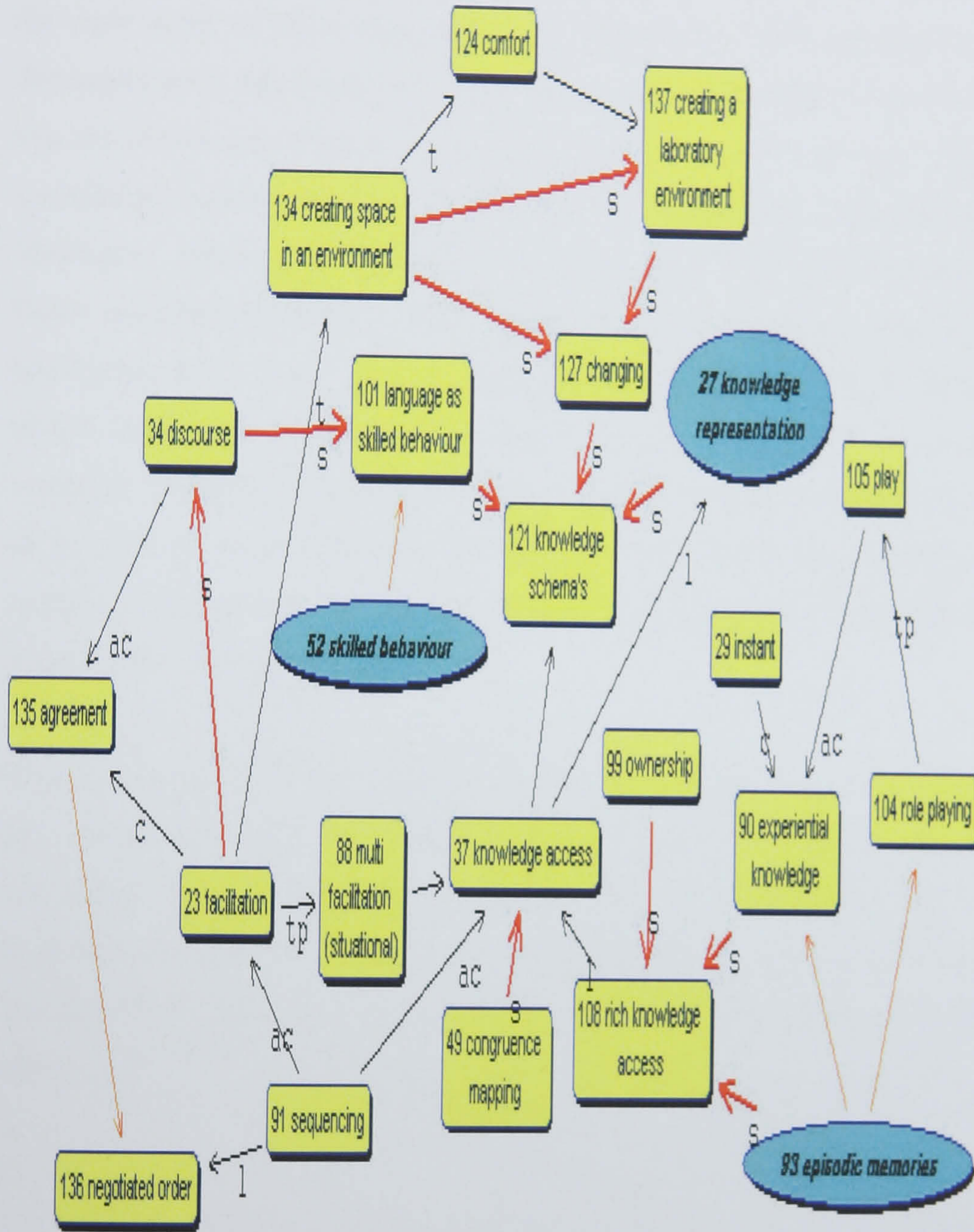


Figure 4.19 Knowledge Classification at Shell International

Figure 4.19 represents an explore map of the cluster of concepts labelled *Knowledge Classification at Shell International*, emphasising the role of the facilitator managing and accessing knowledge. This position is

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dependent upon the concept of 'multi-facilitation (situational)' where knowledge access is dependent upon 'negotiated order', 'sequencing', 'discourse' and 'agreement'. It is the facilitator who is trying to 'sequence' the right order of knowledge which is 'negotiated'. This negotiation is dependent upon agreement amongst participants. It can be seen in figure 4.19 that the knowledge schema is changing through 'skilled behaviour'. This knowledge transformation is dependent upon 'every day language' and 'discourse' rather than 'technical', 'explicit' and 'bounded discourse'. Other contributing factors include trying to get participants to own the knowledge in the map. Such a 'strategy' creates rich knowledge access, which is driven by the use of 'episodic memories' as a form of mental material. 'Episodic memories' promote personal experiences and events, along with the use of 'experiential knowledge' which uses the concepts of 'playing' with knowledge. The combination of these concepts emphasises a strong link to rich knowledge access.

Figure 4.19 also identifies a cluster of concepts which leads to 'changing' knowledge schemas. This is achieved through creating a 'comfort' zone for participants, by allowing them space to think. It is important for the facilitator to create an environment in which participants feel comfortable and allowing disclosure of knowledge resulting in knowledge schemas changing.

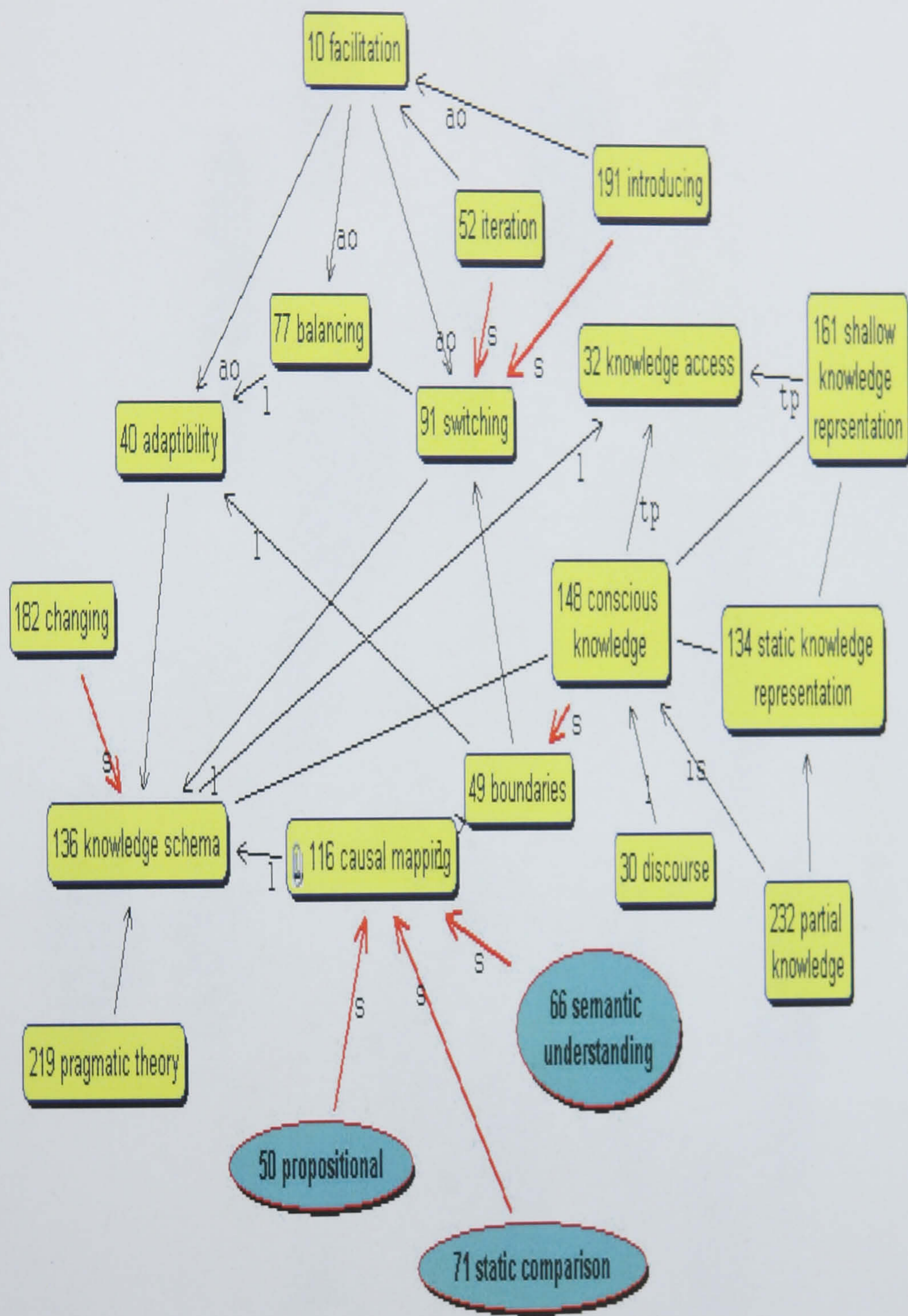


Figure 4.20 Knowledge Schema at British Airways

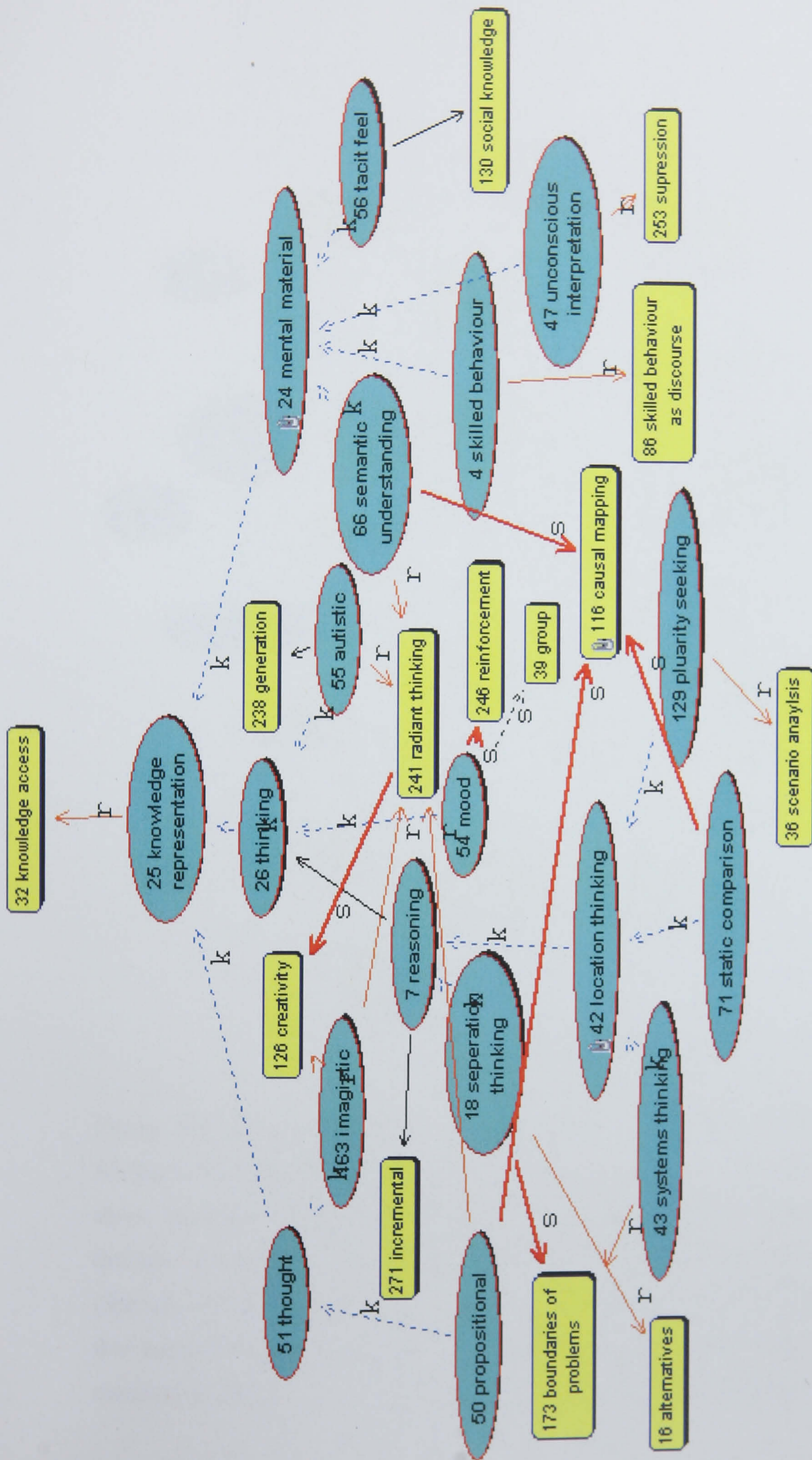


Figure 4.21 Knowledge Representation at British Airways

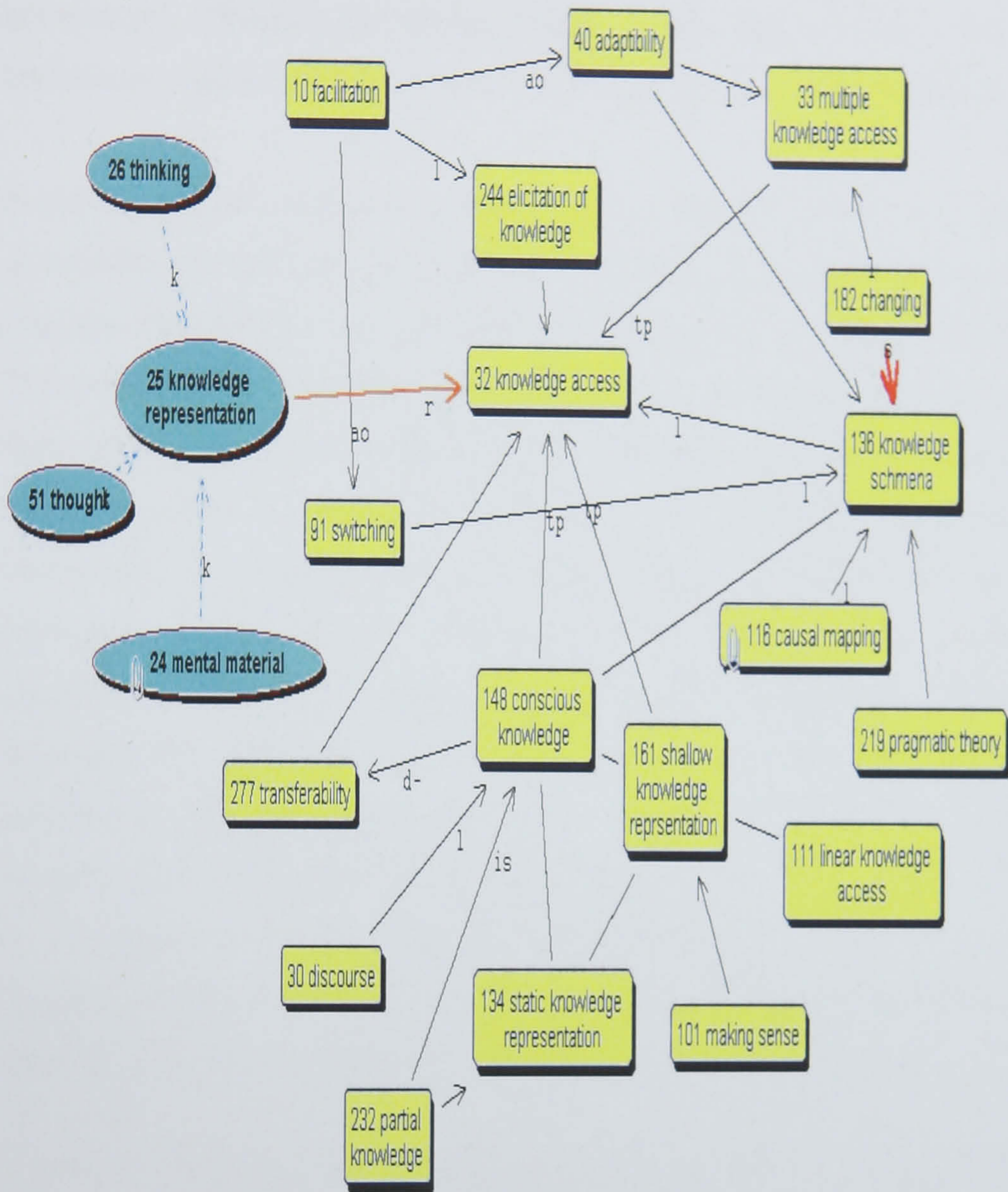


Figure 4.22 Knowledge Access at British Airways

Figure 4.20 is a representation of managing knowledge at British Airways. The figure illustrates how the facilitator makes a judgement about transforming knowledge through changing knowledge schemas through accessing further cells in Sparrow's knowledge equation (Sparrow 1998). Figure 4.21, highlights the diversity of knowledge cells that transacts during a problem intervention. What is evident from the research, is that the facilitator is accessing these cells at various points

during the intervention, through reshaping the knowledge schema. Figure 4.21 illustrates that 'knowledge access' is linked to 'elicitation of knowledge', 'multiple knowledge access', 'knowledge schema', 'shallow knowledge representation', 'conscious knowledge' and 'transferability'.

A closer examination of the situation through figure 4.22 shows a cluster of concepts around 'knowledge access', in which the facilitator is using the concepts 'adaptability' and 'switching' to change the knowledge schema. This process allows 'multiple' knowledge access' resulting in a strong link from 'changing' to 'knowledge schema'. Whereas, the cluster of concepts that surrounds 'conscious knowledge' are 'shallow knowledge representation', 'linear knowledge access', 'partial knowledge' and 'static knowledge representation'. These concepts are associated with 'bounded reasoning', which demonstrate the limitations of a conscious knowledge approach. The facilitator realises that furthering understanding of the problem is more than 'reasoning', as it depends upon the concept of 'transferability'. The link between 'transferability' and 'knowledge access' is a negative or rather 'depends on' connection. In order to achieve 'transformation' and 'change' in the knowledge schemas, the facilitator must use a process that calls upon more than conscious knowledge.

A clearer example of how facilitators use this process of knowledge transformation emerges in the Academic Consultants case. Figure 4.23 represents 'bounded reasoning' at Hull University.

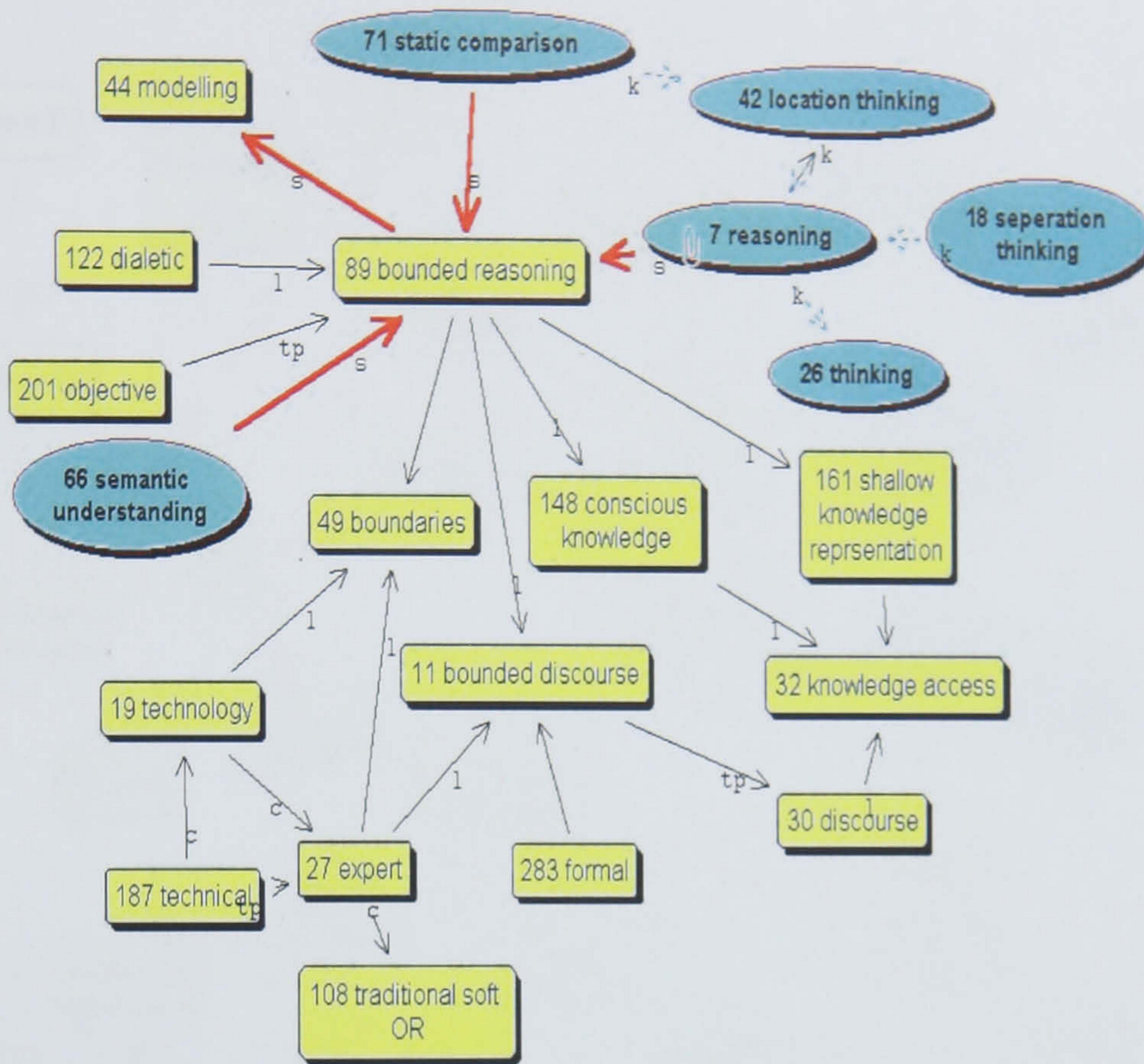


Figure 4.23 Bounded Reasoning at Hull University

Bounded reasoning draws upon ‘semantic understanding’, ‘mental material’, ‘static comparison’ as ‘location thinking’ and ‘separation thinking’. This is a classical example of a reasoned knowledge schema. This schema that produces a formal discourse which is ‘dialectic’ and ‘objective’. Knowledge is conscious and shallow, which produces a boundary to understanding, as the language is seen as ‘expert’ based, ‘technical’ and supported by technology.

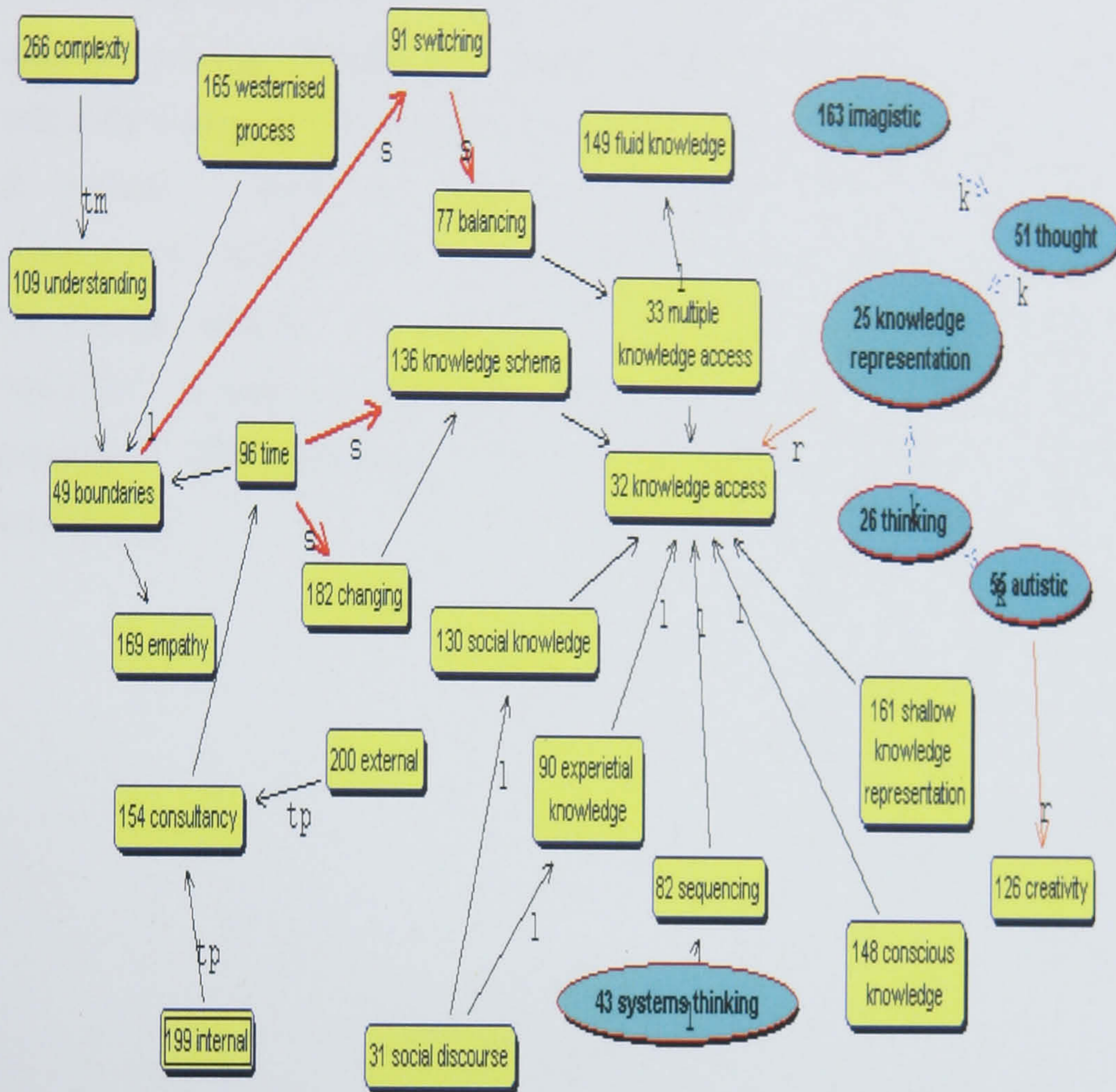


Figure 4.24 Changing Knowledge Cluster at Hull University

In figure 4.23, bounded reasoning is identified as a ‘boundary’ of discourse. In order to deal with this boundary, figure 4.24 shows how the facilitator at Hull University changes a knowledge schema. This involves ‘switching’ between methodologies and trying to balance the different types of knowledge, thus leading to ‘multiple knowledge access’. Other concepts that contribute towards changing the knowledge schema include ‘time’. The facilitator understands that attitudes change over time rather than in an instant, and therefore uses time as a means to create understanding.

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By creating a new view in DECISION EXPLORER, figure 4.25 expands upon the concept of time. The facilitator realises the knowledge schema will only change if knowledge is negotiated due to the concept of 'power & politics'. Here, the facilitator balances 'social and cognitive congruence', this is done over a time period in order to change the knowledge schema. In parallel, the facilitator is creating zones of 'comfort' in order to create an environment where change becomes possible. This environment is about socialisation and 'experiential' knowledge.

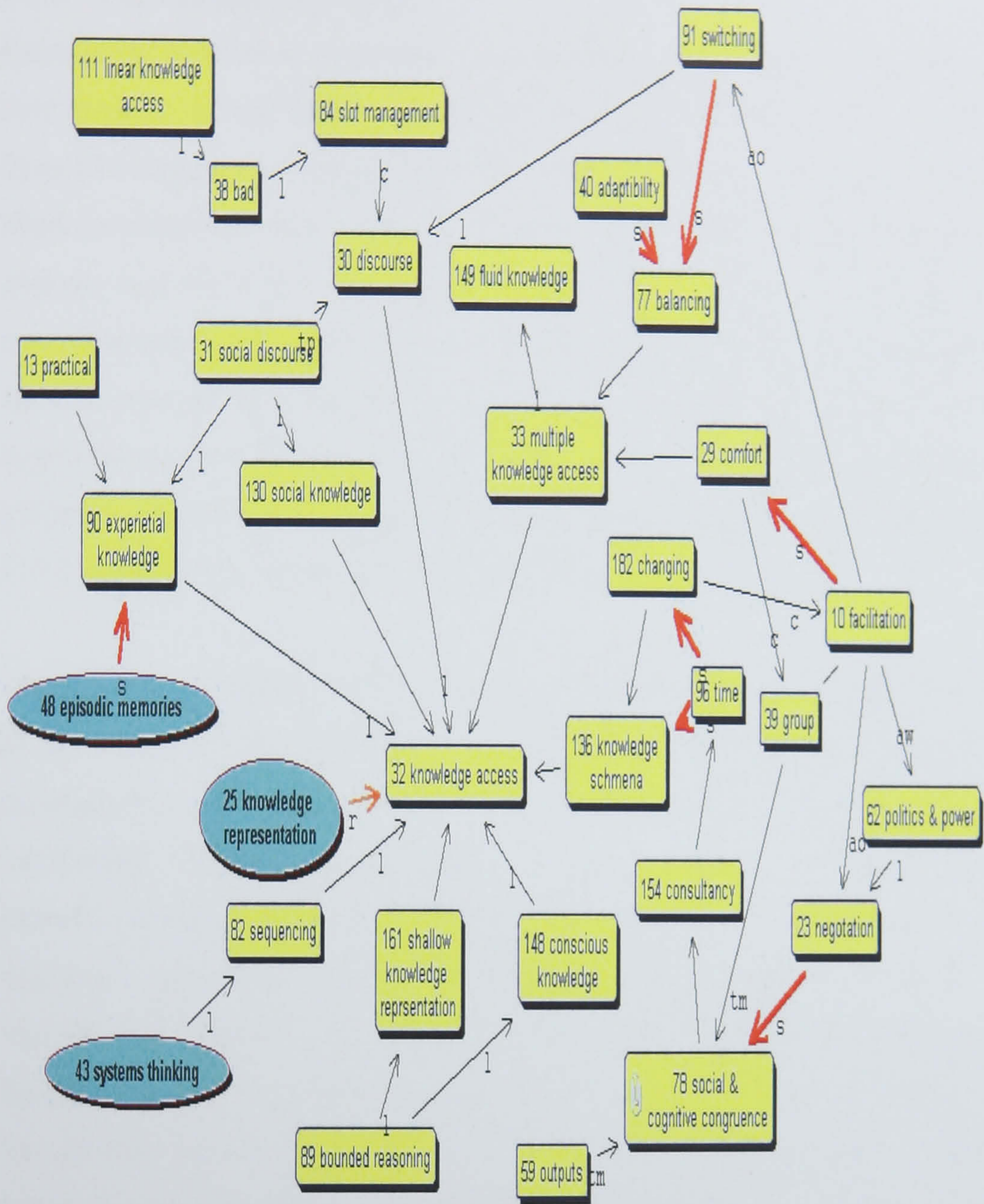


Figure 4.25 Knowledge Map at Hull University

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4.2.6 *Facilitating Knowledge*

Facilitation is the most important concept that is constructed across all the case studies. In the British Airways case, a central analysis score of 61 from 124 concepts, is supported by a domain analysis with 20 links. In the Shell International case, there are 69 loops from 113 concepts at central analysis and 34 links at domain analysis. In the Academic Consultants case, Lancaster, Sheffield Hallam, Lincoln and Strathclyde Universities rank the concept as of most importance. For example, at Strathclyde, 50 loops appear from 89 concepts at central analysis and 22 links at domain analysis. At Hull, the concept of facilitation represents 67 concepts from 117 loops at central analysis, and 24 links at domain analysis.

The concept of facilitation is best understood through interpreting the type of links between the concepts. The concept of facilitation in the Shell International case (Figure 4.26) is linked by the concepts of 'action', 'awareness', 'characteristics', 'types of' and 'leads to'. 'Action' links include 'keeping track of events', 'sequencing', 'making explicit', 'guiding', 'judgement decisions', 'balancing', 'negotiation', 'iteration', 'output' and 'tactics'. These actions are a representation of what the facilitator does in a problem intervention. They are derived from the 'awareness' links of 'time', 'power & politics' and 'groups'. The facilitator refers to these concepts before taking 'action'.

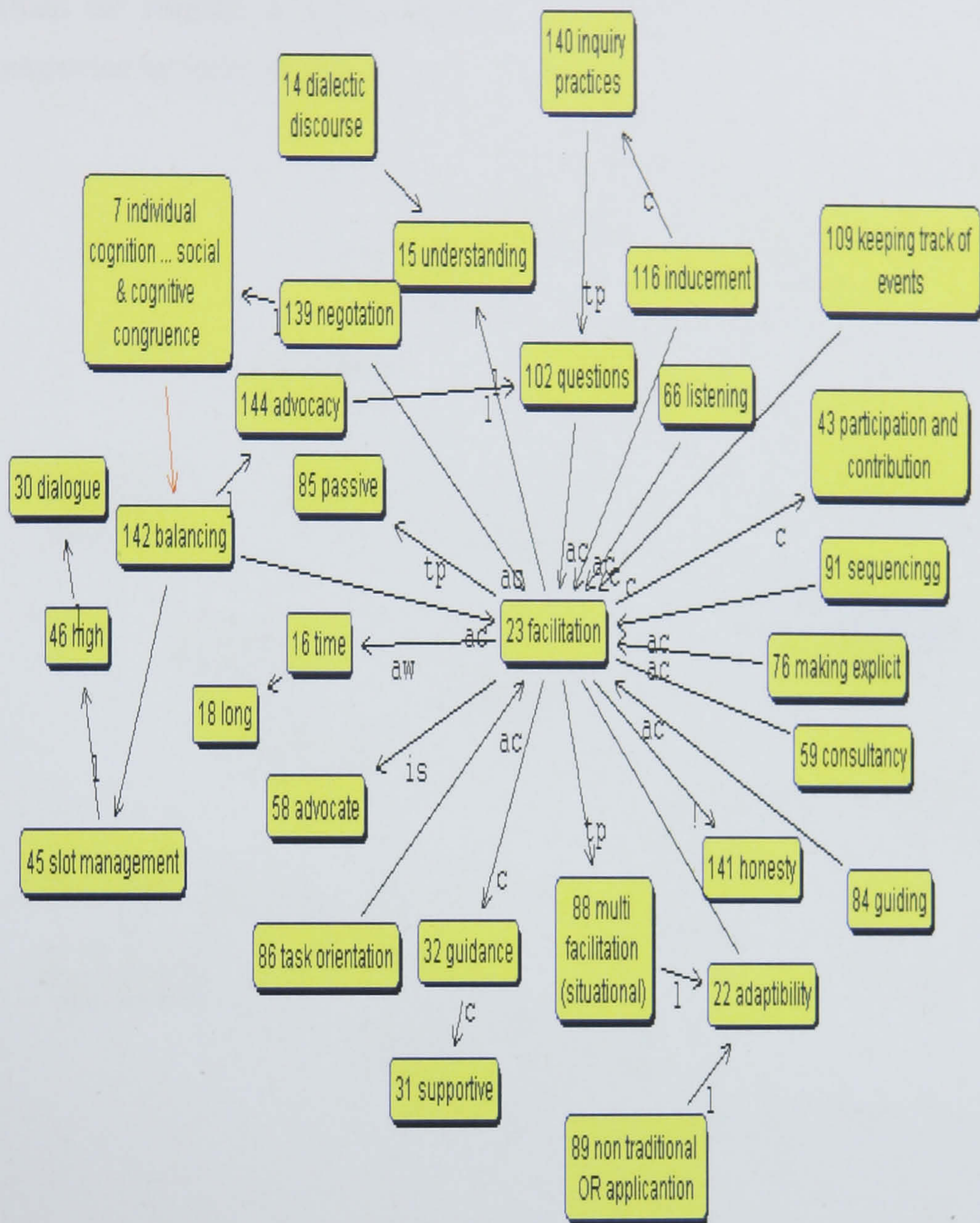


Figure 4.26 Cluster Analysis of Facilitation at Shell International

Three types of facilitation interventions are identified across the cases: ‘passive’, ‘hierarchical expert’ and ‘multi (situational)’. Staying with the Shell International case and exploring the concept of facilitation, figure 4.27 highlights a construction of the hierarchical facilitation, which explains how the facilitator works with ‘causality models’. The facilitator is ‘walking with the client’ in order to help them understand a problem, in

which the content is 'task orientated', 'structured', 'output driven' and 'supported by technology'.

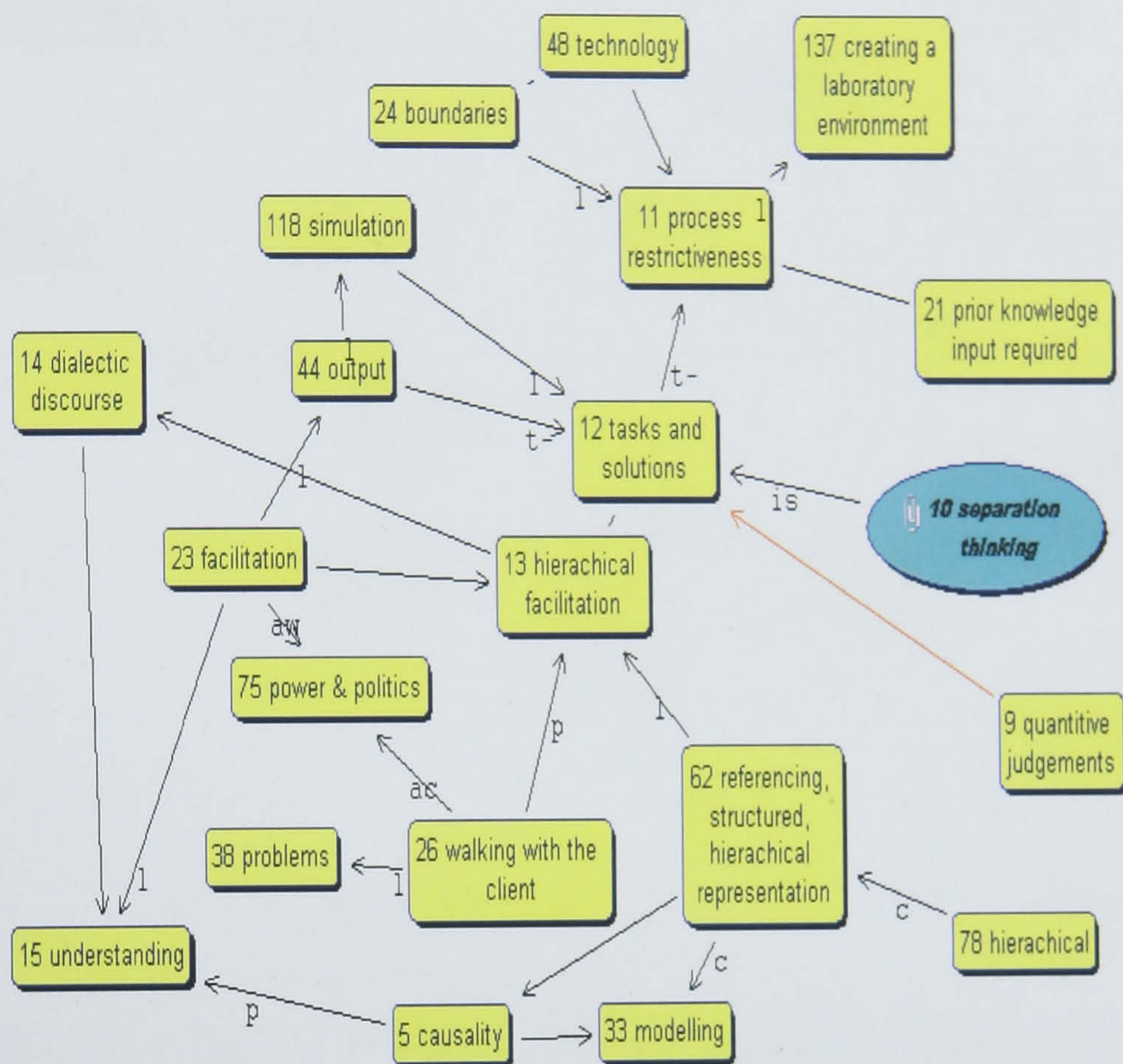


Figure 4.27 Hierarchical Facilitation at Shell International

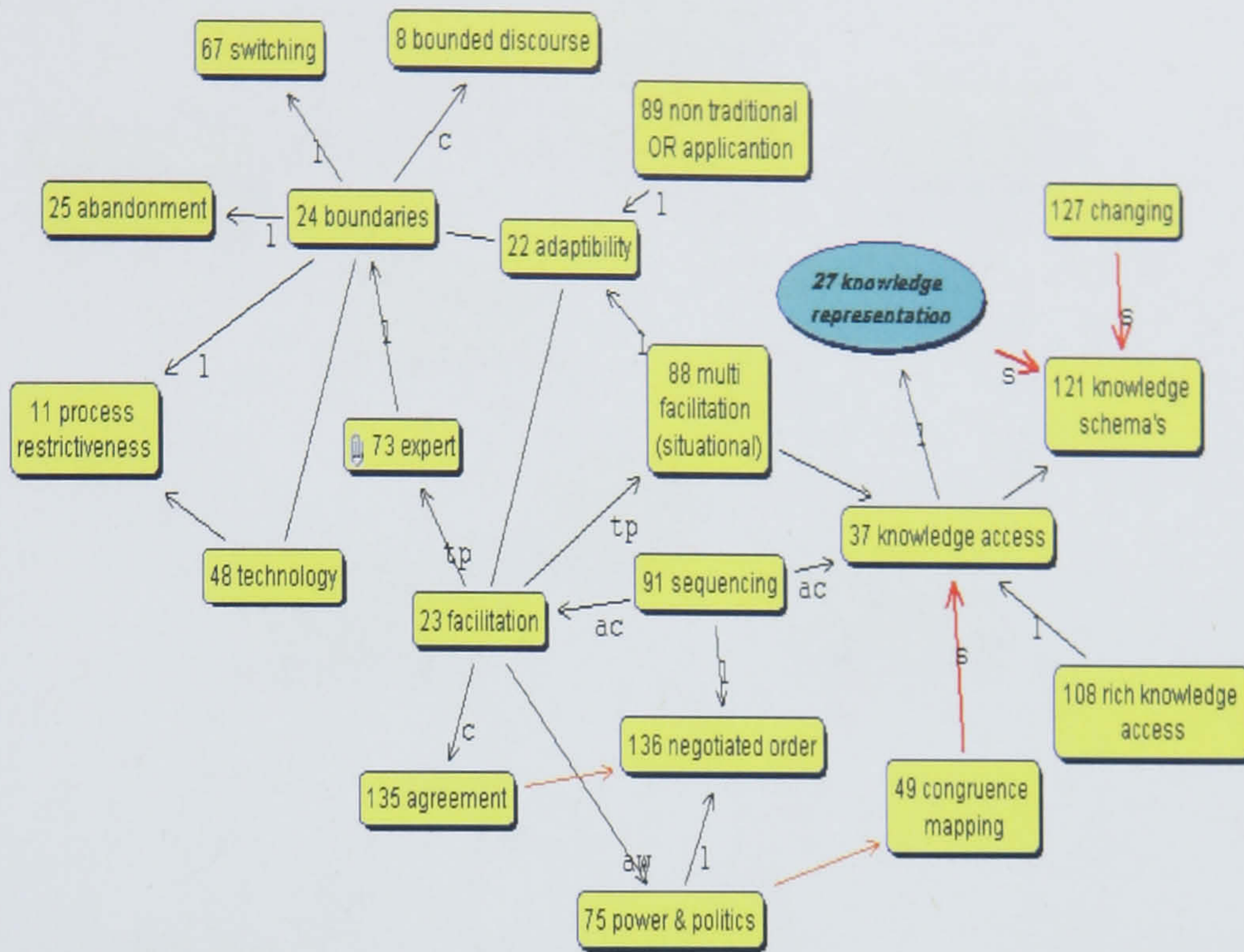


Figure 4.28 Multi (Situational) Facilitation at Shell International

Within the problem intervention, a multiple situational facilitation style is adopted where the problem situation changes or new understandings are required. Figure 4.28 highlights how at Shell International, multiple facilitation is used when techniques are used in sequence. For example, a different facilitation style is required for Fast-Break which generates ideas amongst disciplines, followed by the use of systems thinking diagrams (Senge et al 1994) to structure problems. Within the realms of systems thinking, a unique style of facilitation is required that balances advocacy with enquiry (figure 4.29). The key to the process is the use of questions to find answers to understanding. Questions such as ‘how come’ and ‘so what’ illustrates how reflective practices are used to focus and expand upon the problem.

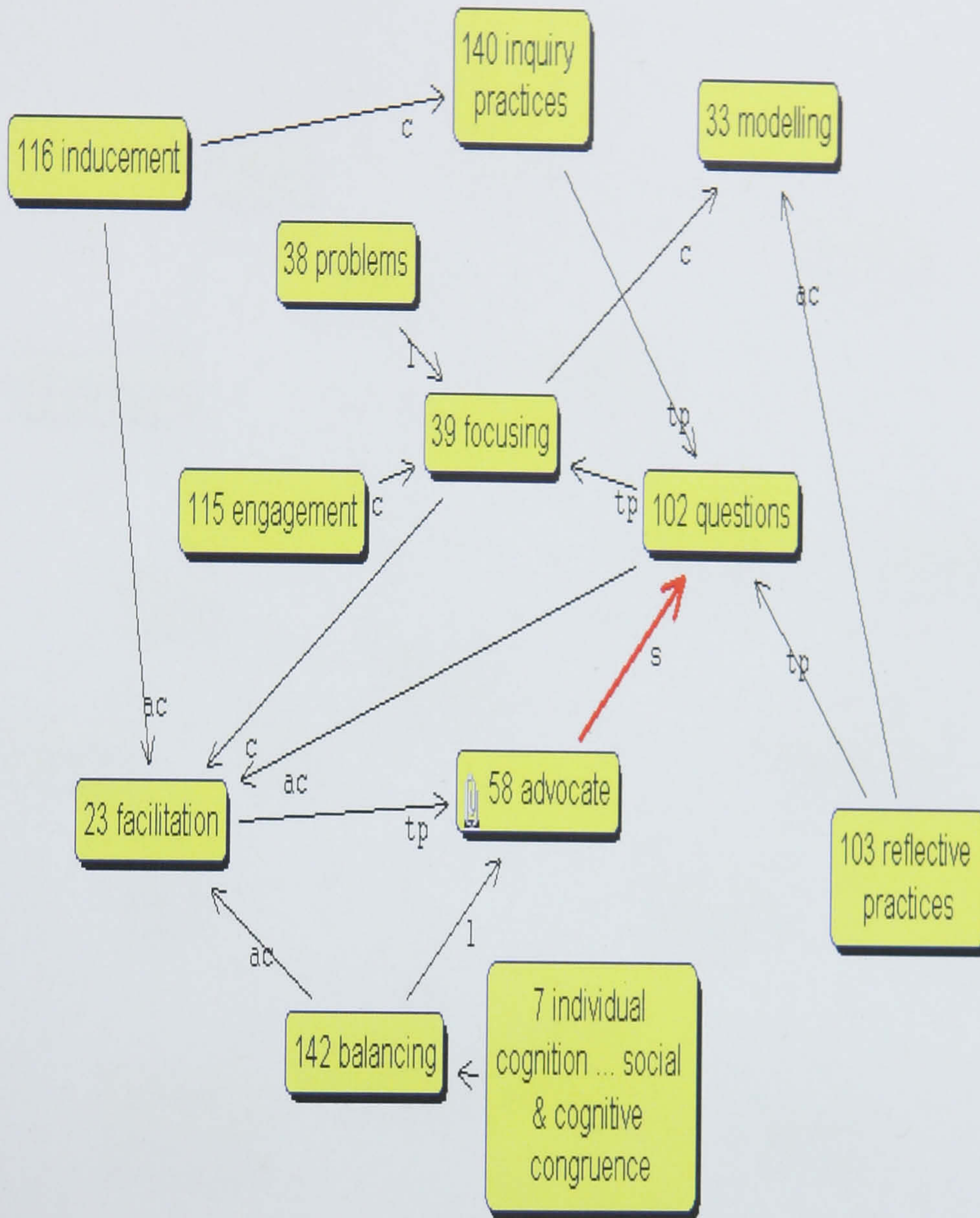


Figure 4.29 Balancing Advocacy and Enquiry at Shell International

Multiple (situational) facilitation is important when the facilitator is making judgements about knowledge access. The facilitator is wanting the participants to focus on specific knowledge cells in Sparrow's (1998) equation i.e. semantic understanding, or, expand and encompass a range of knowledge cells i.e. tacit feel, episodic memories and propositional thought. By expanding into multiple knowledge cells, different types of understandings are brought to a problem situation. The participants' cognitive schema changes.

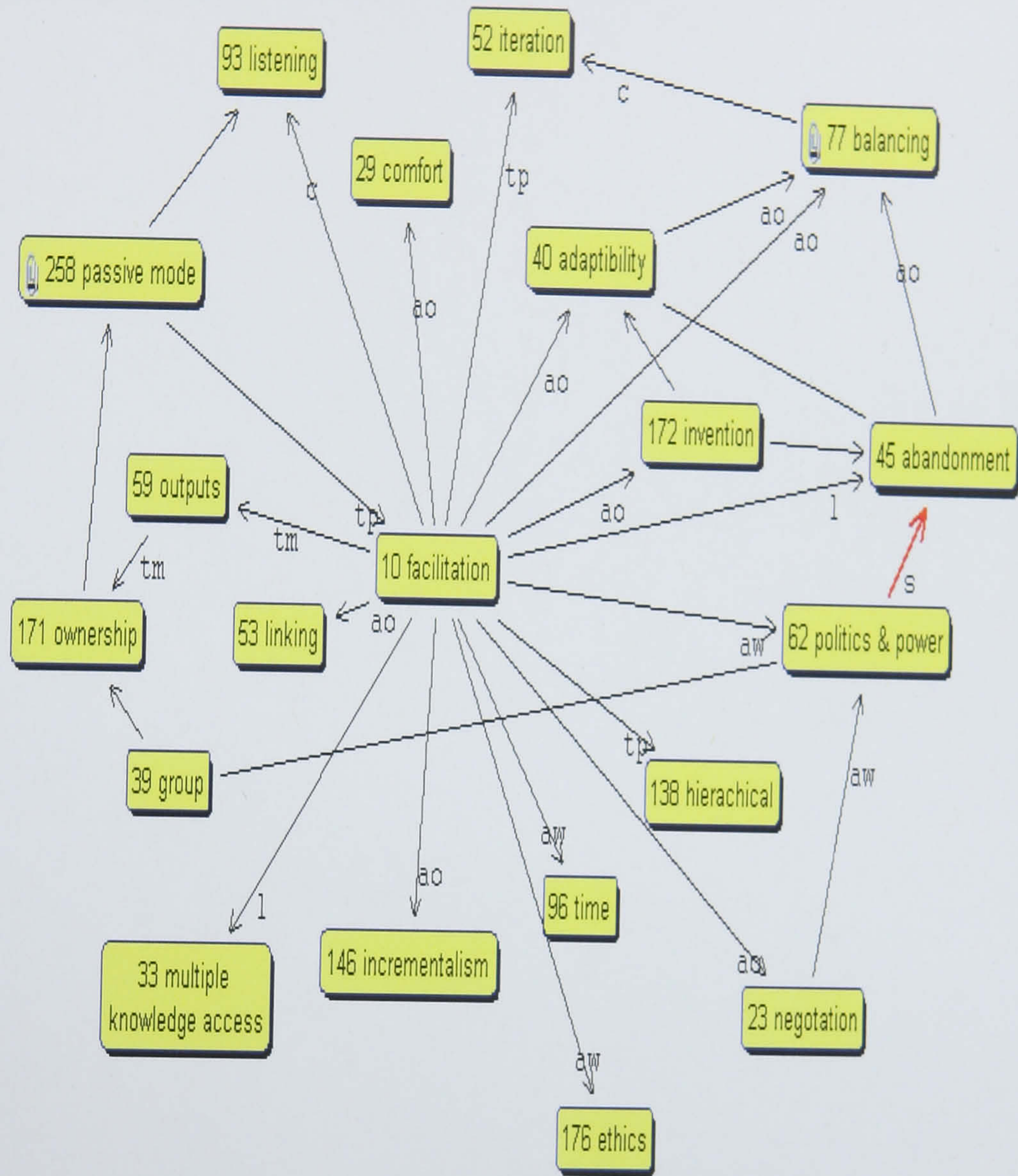


Figure 4.30 Passive Facilitation at Luton University

Figure 4.30, Passive Facilitation at Luton University is based upon allowing the group to self-facilitate. This mode of facilitation requires the facilitator to be a careful listener, observing group behaviour and allowing the group to make their own decisions. Such an intervention allows the group themselves to deal with the concept of 'power' and 'politics'. The facilitator is no longer acting as a gatekeeper or knowledge exchanger, he

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is outside the situation. Passive facilitation in this context allows the group to decide their own direction and deal with the problem in their own time resulting in greater ownership of the problem.

4.2.7 Knowledge Congruence

Modelling is the central feature in OR (Yeoman et al 2000; Checkland 1981), as OR is the process of using models to represent and solve problems. The model is the unifying principle that binds Soft OR, a core concept that scores highly in the results. Modelling in the Shell International case represents a central score of 35 from 72 concepts and 13 links at domain analysis. A similarly high score in the British Airways case, gives 59 from 118 concepts for a central score and 20 links at domain analysis. In the Academic Consultants case study, Strathclyde University notches up 32 from 68 concepts for a central score and 11 links in the domain analysis. Across all the cases, modelling is either the first or second most important concept from the cognitive mapping analysis.

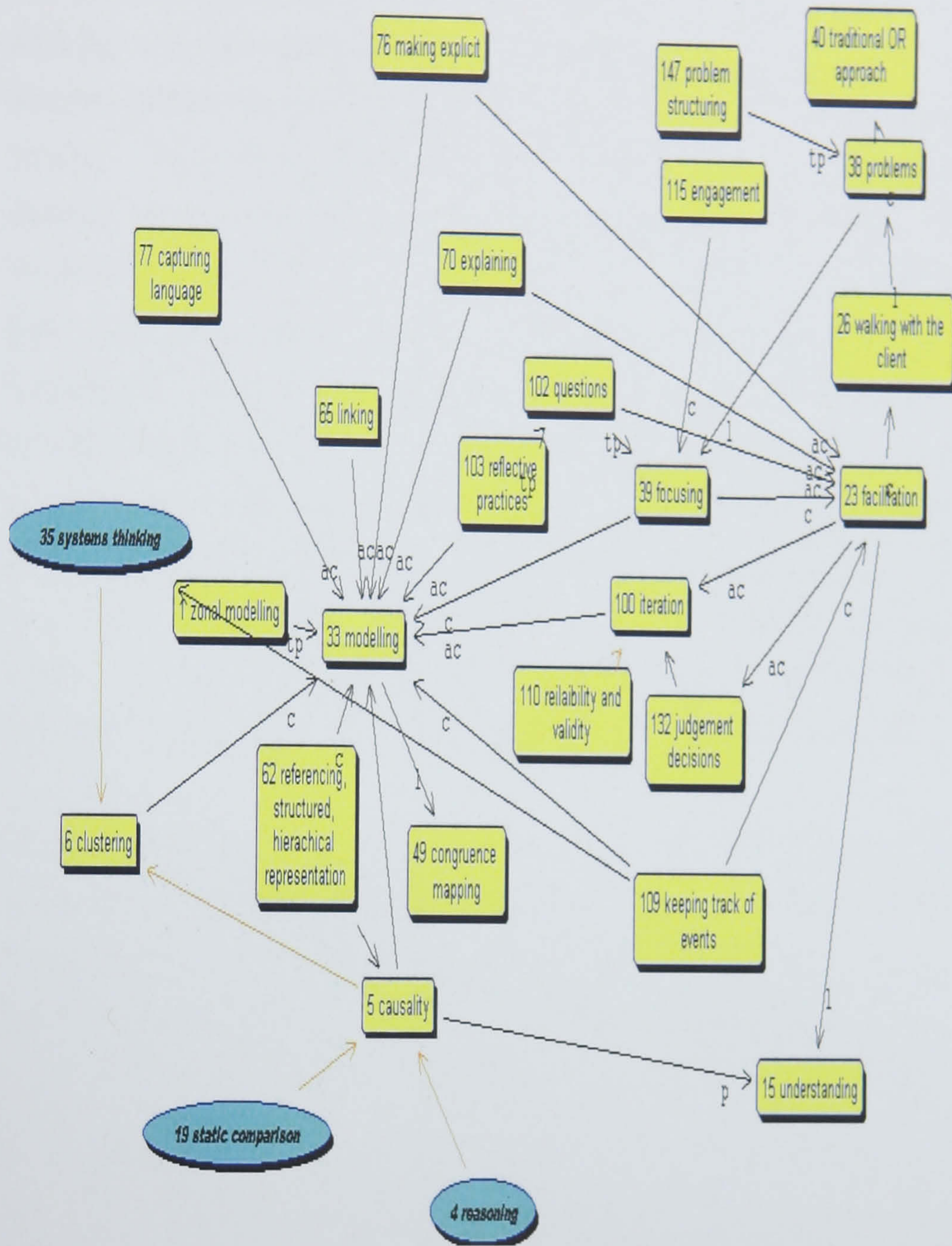


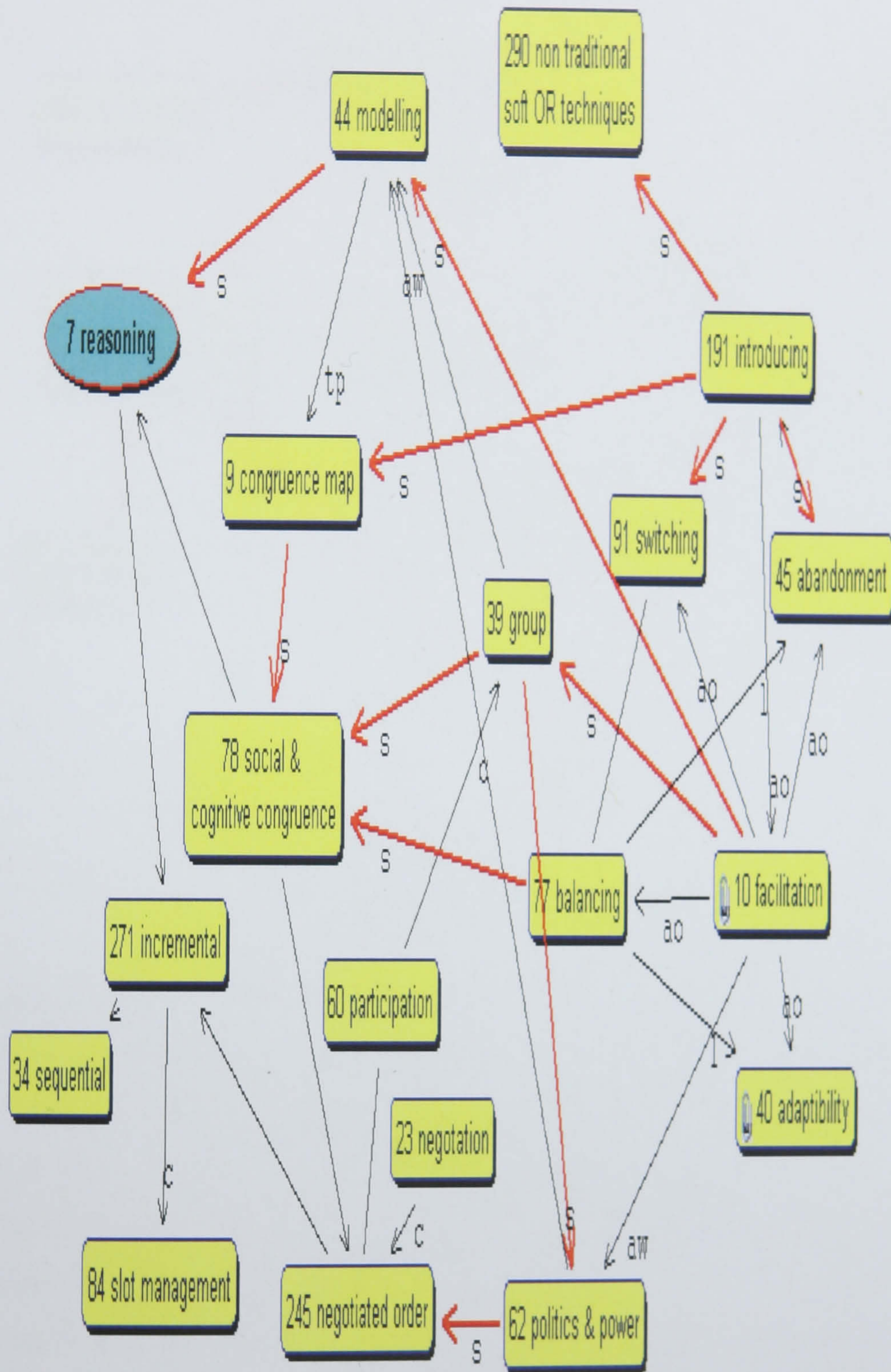
Figure 4.31 Modelling at Shell International

In figure 4.31, the majority of the concepts that surround 'modelling are 'action' links. These links are all defined as 'actions' of the facilitator, identifying a clear link between facilitation and modelling. The term 'modelling' is used rather than the model, as modelling is a facilitation activity. These actions are 'trying to capture language', 'linking', 'making

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explicit' and 'explaining'. The facilitator takes on the role of the modeller, working with the discourse that is generated from participants. The discourse that surrounds the model, goes through a process of being made 'explicit. Once the knowledge is made explicit and is represented in a physical format through the model, the facilitator is concerned with 'reliability and validity' of knowledge. The concept of 'iteration' also links facilitation and modelling. The facilitator is making a series of 'judgements' about the discourse, these judgements are represented through using questions. The style of questioning is important, as they are a 'reflection'. Reflection is a process of using reasoning to validate knowledge (Sparrow 1998; Senge et al 1994). The use of physical models as a 'focus' for discussion allows the modeller to 'capture knowledge' through explicit representation. Participants can 'keep track of events' through the model acting as a 'group memory device' (Schwartz 1994).

The model in Soft OR is a holding device for knowledge labelled 'congruence'. Congruence is a term that is more like a map than a model, as a map is a cryptic label that acts as an access for other forms of knowledge. In figures 4.32 and 4.33, the concept of 'adaptability'



Figures 4.32 Congruence Mapping Cluster at British Airways

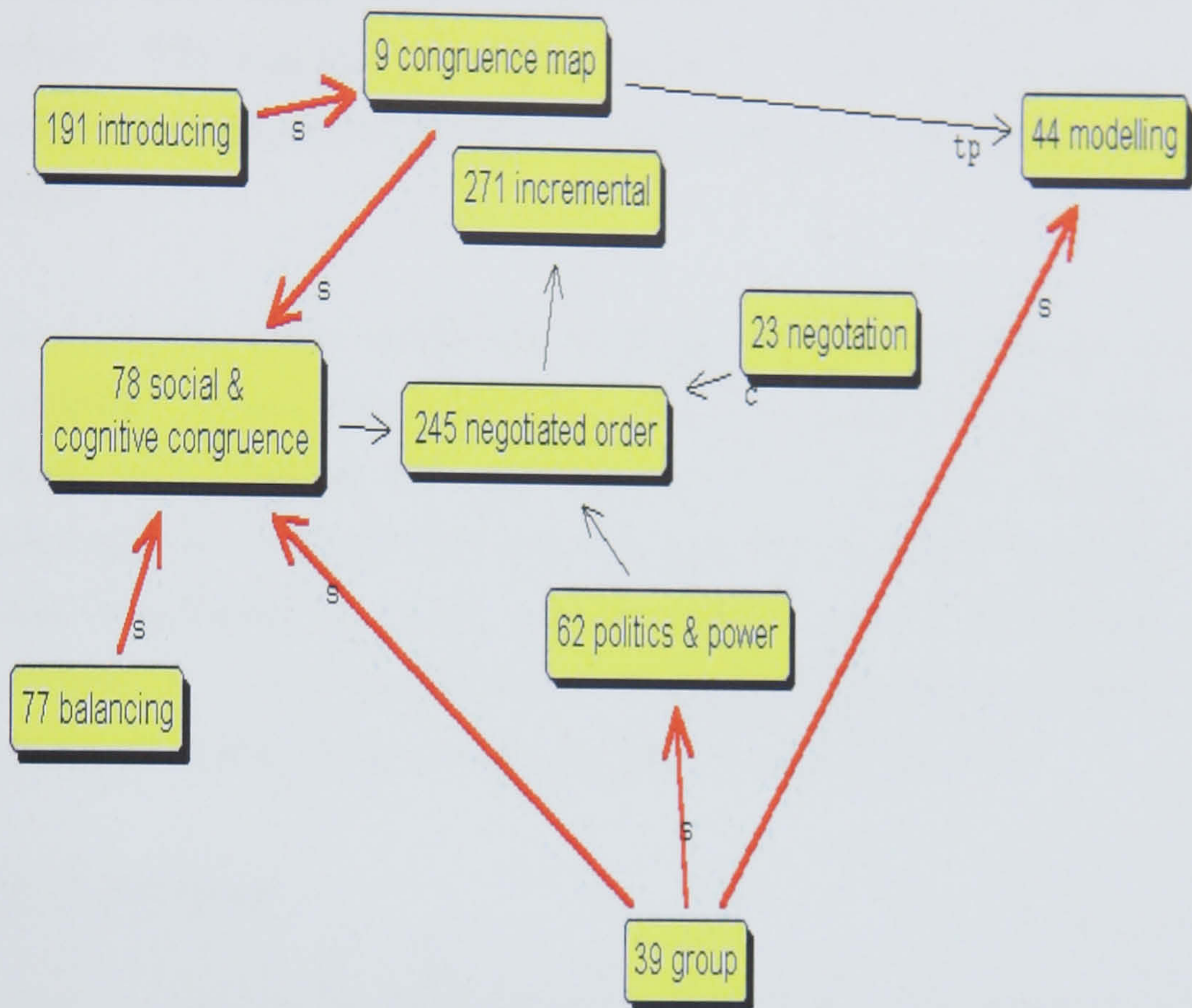


Figure 4.33 Congruence Map (Explore) at British Airways

seems to explain the development of the model. The process merges and combines with other methodologies like mind mapping, in which pragmatism drives the change. Congruence maps represent a mixture of knowledge, both explicit and implicit in nature, as certain types of knowledge cannot be held in an explicit manner (Sparrow 1998). This mixture of knowledge shows a strong link between 'social and cognitive congruence' and 'congruence map'. In figure 4.33, it is also linked to 'balancing'. This locates the facilitator in the centre of knowledge, working with both implicit and explicit knowledge in order to balance knowledge that is found in social and cognitive schemas. 'Social and cognitive congruence' links with 'negotiated order' of knowledge, in

which the importance of the right of sequencing of knowledge is identified. In figure 4.32, 'negotiated knowledge' shows a strong link to 'power & politics', thus suggesting that the process is bound up with social knowledge comprising of 'unconscious interpretation', 'tacit feeling' and 'mood'.

The facilitator in the centre of knowledge, relates to the concept of 'balancing', in which the facilitator is aware of the different types and formats of knowledge that are involved in an encounter between participants in a Soft OR intervention, hence the connection to cryptic labels of knowledge or holding devices, in which concepts are explored and discussed. These types of maps do not imply ownership or answers, rather guidance for discussion – in which knowledge is negotiated.

4.3 Conclusions

This chapter has demonstrated how a conceptual map of Soft OR was interpreted and constructed. The surprising factor across all of the case studies, is the degree of commonality between the cases of how the facilitator works with the tools and methodologies in practice. Even in the Academic Consultants case where a higher degree of semantic differential between the Soft OR methodologies and tools can be seen, the application of how they are used is common.

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This commonality goes beyond the cluster of ‘knowledge in Soft OR’ where practice is more than the proposition of reasoning and a theoretical disposition of restrictiveness. What does emerge, is a new understanding and interpretation of how the tool-user works with Soft OR; a cognitive explanation that has not so far been accounted for. Emerging from this analysis is a range of factors that makes Soft OR work in practice. Whether it is the concept of ‘metacognition’ in which the facilitator ‘adapts’ or ‘abandons’ the tools to suit the purpose or situation, or use of ‘comfort zones’ to deconstrain political situations, the findings highlight the words of Taket (2002:126) who states that the starting point in Operational Research is facilitation:

No matter what type of OR one is involved in, facilitation is a necessary part of the process

Further, this research supports Radarel’s (2003) *notion de catachresis* by focusing on the tool-user rather than the tools/techniques, a greater understanding of the practice of Soft OR can be explored. The next chapter accounts for Taket’s and Radarel’s works in order to find meanings and explanations of how facilitation works and what the tool-user thinks when using Soft OR. Figure 4.34 is the foundation of that chapter in which a series of clusters come together as a conceptual map of Soft OR practice, representing the concepts of ‘knowledge in Soft OR’, ‘metacognition’, ‘social and cognitive congruence’, ‘knowledge transformation’, ‘facilitating knowledge’ and ‘knowledge congruence’.

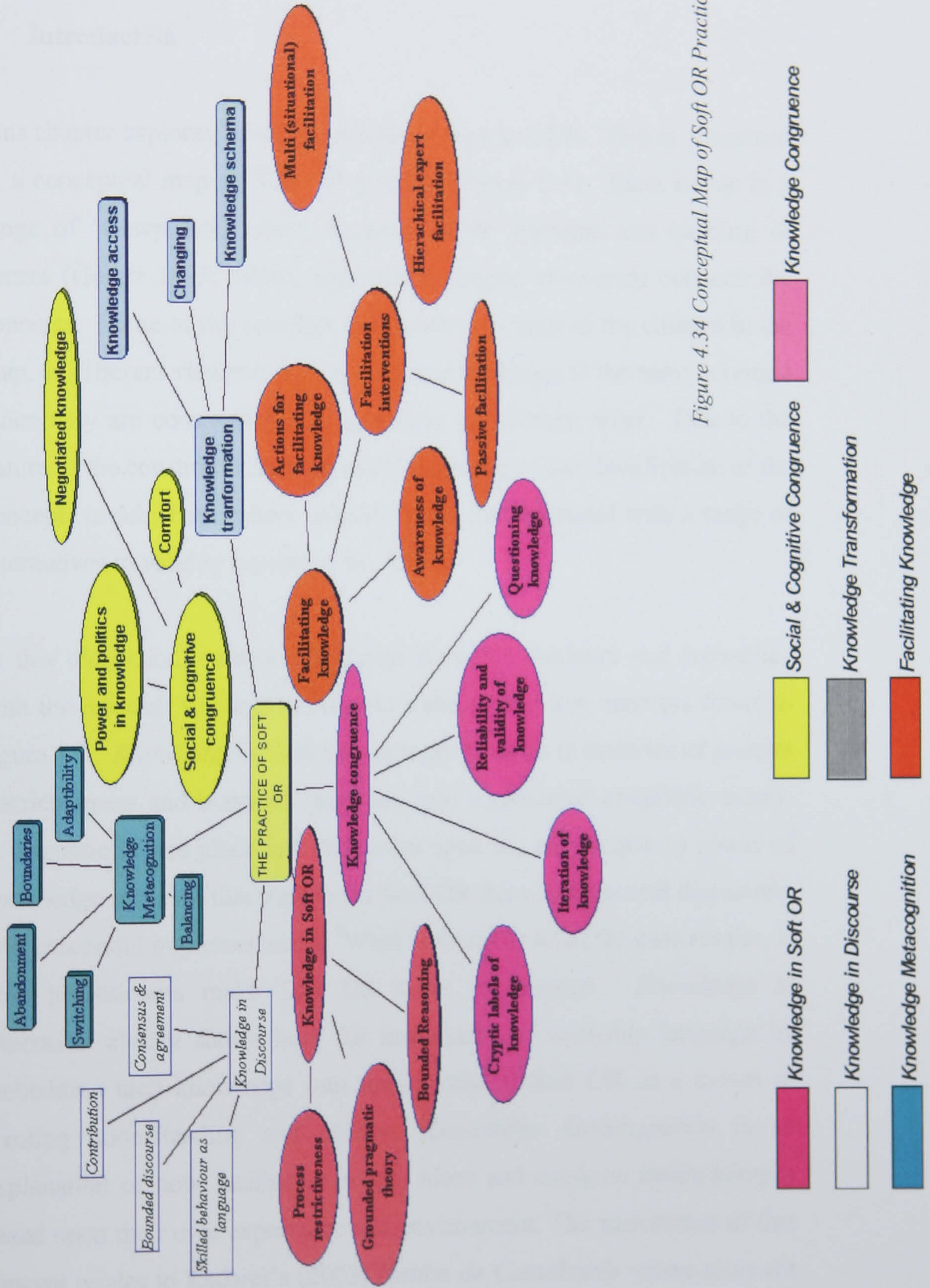


Figure 4.34 Conceptual Map of Soft OR Practice

DISCUSSION OF FINDINGS

5 Introduction

This chapter explores ‘how’ the facilitator uses Soft OR. This is presented in a conceptual map of Soft OR practice (Figure 5.1). Such a map is a range of ‘viewpoints’ which, because of the systemic and blurring of genres (Geertz 1983; 1988), embodies a degree of overlap between the concepts. Some of the concepts are common to each of the clusters in the map, as different viewpoints bring multiple meanings to the same concepts when they are constructed and connected in different ways. Due to the nature of the constructivist interpretation paradigm, the classification of the concepts is subjective where objectivity is never captured with a range of alternatives to validity becoming the focus.

In this discussion, evidence is drawn from the literature and reconciled with the research findings in order to elaborate the key concepts found in figure 5.1. *Knowledge in Soft OR* emerges from its boundaries of process restrictiveness and bounded reasoning into a grounded pragmatic theory. A discussion takes place that elaborates upon the emancipatory power of knowledge in action that transforms Soft OR from a theoretical disposition into successful implementation. What is found in all of the case studies, is how practitioners make Soft OR work in practice. *Knowledge in Discourse* clearly shows how the importance of everyday language by embedding tacit knowledge into the process of Soft OR as a means to creating understanding and change. *Knowledge Metacognition* is an explanation of how facilitators adapt, adopt and combine methodologies based upon their own experience and environment. The importance of this concept relates to Radarel’s (2003) *Notion de Catachresis* where tools are

not merely about what they are designed for, but how and the way they were used. *Social and Cognitive Congruence* can be understood by the process of how facilitators have to deal with the issues of cognition and social issues through a series of political manifestations and defensive routines which dominate in groups and organisations through relationships and disclosure. Examples are drawn from the case studies of how the facilitators deal with these situations through using comfort zones to overcome defensive routines and create consensus in order to deconstrain manifestations.

Knowledge Transformation highlights how Soft OR has an epistemology that is transactional and subjective in which the facilitator uses an adaptable framework in order to create new understandings and knowledge. *Facilitating Knowledge* identifies types of facilitation modes, actions of the facilitator and the awareness process of the facilitator, when using Soft OR tools as evidenced in the case studies. *Knowledge Congruence* is concerned with how facilitators use models as maps through cryptic labels and the use of iteration to validate knowledge. Evidence was found that facilitators in British Airways using cognitive maps, and at Shell International using Systems Thinking approaches, use maps as holding devices with low levels of semantic networks in order to negotiate and explore issues. The chapter concludes by reiterating findings through a comparative analysis with the literature review in Chapter 2 and the resultant implications and recommendations for the OR community.

5.1 A Conceptual Map of Soft OR Practice

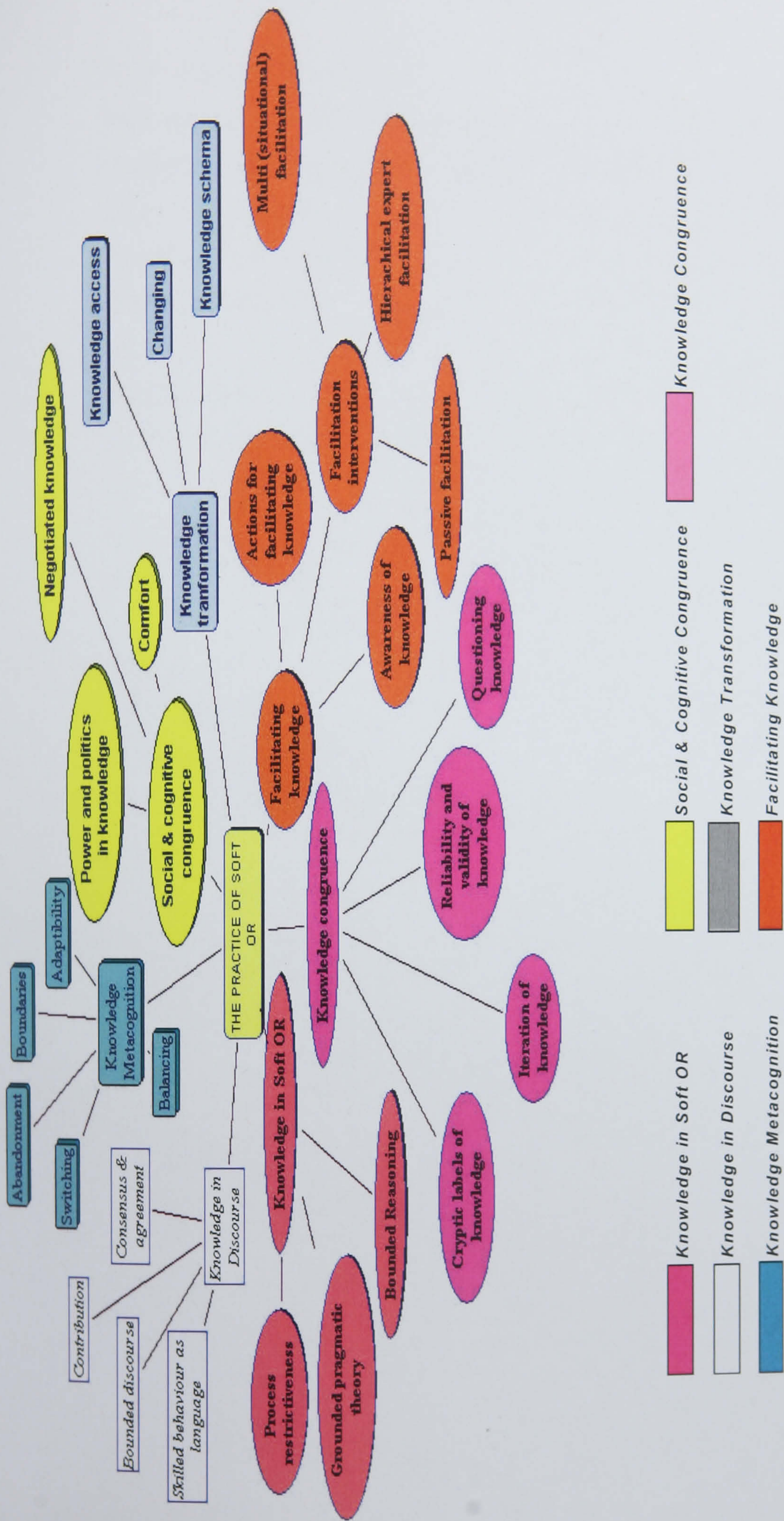


Figure 5.1 A Conceptual Map of Soft OR Practice

5.1.1 *Knowledge in Soft OR*

The practice of Soft OR emerges from its 'boundaries' of process restrictiveness and bounded reasoning into a grounded pragmatic theory. This is the emancipatory power of knowledge in action (Blosch 2001) which ensures a local relativism of success. Soft OR in practice is no longer a theoretical disposition; it is shaped by its local relativism of realism, success and action. Whether Soft OR practice is a paradigm of constructivist interpretation, it is important to understand that a transactional epistemology creates understanding through process rather than being a mechanism of the tool. Constructivist interpretation is a methodology that is hermeneutical, with importance being placed upon adaptability and interpretation, rather than prediction and control. Such adaptability and interpretation is represented, but not fully explained by Rosenhead's (1997) concept of contamination. Much of the literature focuses on a theoretical interpretation of Soft OR (Mingers 2003), or extends our understanding of the methodologies, but there is a lack of research and explanation of Soft OR practice in context. Too much emphasis is placed upon the tool rather than the tool-user (Radardel 2003).

Across all the case studies, Soft OR is grounded in pragmatism in which Soft OR is used to talk about the problem. In fact, the consultants in the Shell International case had difficulty in defining Soft OR. They saw the concepts of 'Soft OR', 'facilitation' and 'consultancy' as having the same semantic differential as one continuous concept. Soft OR in the Shell International case study, is defined as *a practice used by consultants as part of the facilitation process so that they can talk about problems through a range of tools.*

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Within the British Airways case, Soft OR is defined as *a grounded pragmatic process of knowledge construction which enables participants to understand and learn about problems, primarily through models*. This definition is very close to the Shell International case, even in the Academic's case, Soft OR is defined as *a pragmatic grounded theory, which predominantly uses models to structure and / or explain problems. The process draws upon the development of traditional OR, and carries those characteristics from a 'process restriction platform'*. *Soft OR fundamentally evolves around the concepts of 'facilitation', 'consensus', 'problems', 'modelling', 'boundaries' and 'reasoning'*.

The more robust emphasis in the Academic Consultants' case study for a 'process restriction platform', highlights how the academics anchor an interpretation of Soft OR in theoretical propositions. Whereas, the Shell International and British Airways case studies had a stronger tendency to support the arguments of Ormerod (2000) in which meta-theoretical frameworks have failed to have any relevance or uptake outside the domain of academic authors. It is as if the language of Soft OR is not accessible to frontline practitioners. This language (White & Taket 1997) belongs to the world of certain academics (Mingers 2002a, 2002b), which is trapped and cannot transcend into the world of the frontline practitioner.

5.1.1.1 Process Restrictiveness

Across all the case studies, consultants can easily identify the ‘wrong parts’, ‘barriers’ or ‘problems with’ Soft OR, as it is easier to recall failure than success. Consultants recognise the process restrictiveness parts of Soft OR. These boundaries are associated with ‘technology’, ‘expertise’, ‘conscious knowledge’, ‘artificial’, ‘laboratory’ and ‘technical’. These are the concepts that do not allow or become a barrier to the emancipatory power of Soft OR. Technology in the British Airways case, hinders the natural conversation, which participants prefer. This is supported by poor contribution, in which conversational slots are difficult to fill (Buffney 1993). The more reliant the methodology is on technology, the more participants dislike or avoid using such an approach. This is evident across all the case studies. When consultants were asked to make a judgement about Decision Conferencing (McCartt & Rohrbough 1989) and Robustness Analysis (Rosenhead 1997), these methodologies were seen as ‘unpopular’, ‘artificial’, ‘unreal’, ‘expertise’ and ‘laboratory’ based. Within the British Airways and Shell International cases, these methodologies were not used because of these negative concepts. Only within the Academic Consultants case study, in particular the London School of Economics (LSE), were these methodologies used. Decision Conferencing and Robustness Analysis were not able to transcend outside the original author’s domain due to the expert and technical nature of such methodologies.

In the British Airways and Shell International cases, technology in general was seen as a barrier to learning as an association was made between ‘technology’ and ‘expertise’. The barriers evolved around ‘expert language’ from the participants’ point of view. When consultants used technology, for

example DECISION EXPLORER, the consultant had to be 'hot' in the usage of such technology and participants in the workshop had to understand the concepts and language of DECISION EXPLORER, implying 'prior learning'. These arguments have a familiarity with Ackoff's (1970) proposition that technically-based approaches are from a world of 'logic' and 'rationality', and do not marry with the diversities of knowledge found in business and management.

5.1.1.2 Bounded Reasoning

It is this proposition of logic and rationality which is identified as 'bounded reasoning' within the case studies. Sparrow's (1998) suggestion that Soft OR is an extension of positivism and science, dressed up for a post-modernist world is, in fact, shrouded in reasoning and logic. This understanding is drawn from Soft OR as a sense-making process using a reasoned knowledge schema in which concepts are processed at a conscious level, deliberated, considered, and developed through procedurally rational approaches. Authors such as Pidd (2001), Lehaney et al (1999), Eden & Ackermann (1998), and Keys (1995), emphasise rationality and logic as the foundation of Soft OR, where formal structures are used to provide a language to talk. These physical mechanisms are termed 'procedurally rational', where the problem is talked about at an explicit and conscious level. Sparrow (1998) classifies this as 'reasoning', 'propositional thought' and 'semantic understanding'. Within the case studies, to a certain extent, 'bounded reasoning' is seen as a negative framing device (Adams & Avison 2003), which does not account for the socialisation and externalisation of knowledge.

This is evident in the British Airways case where consultants link cognitive mapping to the ‘bounded reasoning’ concept, the maps are seen as ‘hierarchical’, ‘structured’ and ‘clustered’. This representation of ‘conscious knowledge’ and ‘explicit knowledge’ which participants feel is ‘shallow’ and ‘poor’, hence, the label ‘bounded reasoning’. This is because knowledge in action (Blosch 2001) is more than at a conscious level. In fact, knowledge at a decision-making level, happens at a subconscious level (Grinyer 2000; Sparrow 1998), based upon ‘intuition’, ‘skills’, and ‘mood’. These concepts are not deliberated but are automatic and instant. A bounded reasoning framework becomes its own scaffolding (Vygotsky 1962) in which participants cannot escape, reinforcing the point that ‘bounded reasoning’ becomes a barrier to practice in which the emancipatory power of Soft OR is trying to break free from suppression.

5.1.1.3 Grounded Pragmatic Theory

The success of Soft OR is grounded in Eden & Ackermann’s (2002) two-hundred case studies of JOURNEY making. Checkland’s (Checkland & Stowell 2002) Soft Systems Methodology (SSM) must be acknowledged as one of the most well respected and written about approaches within the Soft OR literature. SSM has been around for over thirty-years and has clearly transcended out with the systems and OR community into mainstream business practice (Ledington & Donaldson 1992; Munro & Mingers 2002). An account of this transformation is unexplained. Soft OR literature has failed to provide a full and rich account of pragmatism, even to the extent that Mingers (2000) puts forward the argument that pragmatism is a ‘theory without knowing’. Pragmatism does not explain to the reader how a particular theory or model works, what it does, or how it exists. Jackson (1991) goes on to state that researchers must not follow the road of pragmatism as a conscious

link cannot be maintained. But, if pragmatism is the explanation for the success of Checkland's and Eden's work, pragmatism cannot be dismissed, it must be observed. Where pragmatism can be observed, an explanation can be derived that equates to this success. Observations are made across all the cases, which verify Rosenhead's (1997) contamination theory and explain the realism of Eden & Ackermann's (2002) case studies and Checkland's (Checkland & Stowell 2002) history of practice. It is the ability of the facilitator to go beyond 'bounded reasoning' in which knowledge is transcended through 'adaptability' that allows pragmatism to manipulate knowledge in the real world (Nietzsche 1969).

This manipulation through adaptability goes beyond a knowledge schema of 'reasoned thinking', 'propositional thought' and 'semantic understanding' (Yeoman et al 2000) that explains how the facilitators in Soft OR go beyond knowledge that lies outside immediate consciousness. Pragmatism is about learning by doing, where methods and techniques are tested and adapted, in order to embody explicit knowledge into the facilitator's own tacit knowledge. Soft OR as a grounded pragmatic theory, embodies the realism of practice where reality shapes the methodology. As an evolution occurs, the facilitator ensures that Soft OR works in practice. It is the ability of the Soft OR tool to be adapted beyond the original author, that ensures that it works in action. Across all of the case studies, methodologies and techniques that are successful, are emancipatory tools, as facilitators see, read and use tools in different ways (Radardel 2003; Bourgon 1992)

5.1.2 Knowledge in Discourse

In the Soft OR literature, there is a lack of understanding on how facilitators and practitioners manage discourse in conversation. In particular, there is no

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understanding of how participants listen for information and how facilitators control the flow of information. The whole purpose of discourse in Soft OR is to create a debate about the problem. Visual models and discourse communicate a sense of place – a sense of here in relation to there (Lehaney et al 1990; Robinson 2001). The Soft OR model, supposedly, brings ‘structure’, ‘logic’, and ‘language’ to making sense of the phenomena that surrounds a problem. Concepts, which Chafe (1995) calls ‘thematic’, ‘rhetorical’, ‘referential’ and ‘focus’ as a means to connect the visual model with discourse.

In the Strathclyde and British Airways cases, cognitive maps used in a causality format show clear characteristics of semantic understanding, evidenced as participants having a clear understanding of the goals and intentions of the Soft OR process. A language evolves that is ‘logical’ and ‘formal’. Such a strategy is purposeful when a reasoned output is required. Participants consider such an exercise as useful, where the facilitator uses a ‘considered response’ strategy, although the process has a down side in that it is seen as hierarchical and expert-based. Across all the case studies, Soft OR models and maps are viewed as very good at semantic networks, as participants can keep track of the central elements in the discourse through referencing against the Soft OR model. The vast majority of these semantic networks are used in congruence, where the semantic network is low, and concepts are cryptic labels of knowledge. By using models in this way, semantic dissonance is avoided (Lincoln 1985). The models in Soft OR also provide ‘good focus’ due to their visual impact throughout problem interventions.

5.1.2.1 Bounded Discourse

Pidd (1998) argues that the formal structures of softer methods provide a language to talk, by trying to take the heat out of conflict-ridden situations through forcing the debate to operate at a different level of abstraction. The formal structure of discourse in Soft OR draws upon the history of OR (Ormerod 2002a; Jackson 1992) where the past shapes the present and future, bound up in science, in which observations are made in a real world and then discussed as accurately as possible in order to formulate solutions. Sparrow (1998) propositions that Soft OR is governed by rules and regulations that surface through discourse of rationality and logic. This can be seen as a poor framework for knowledge elicitation and explanation by drawing upon Tversky and Kahneman's work (1973;1974) where rationality recycles assumptions rather than tackling underlying occurrences. Negative frameworks are described by Adams and Avison (2003) as 'inflexible', 'expert-based' and 'narrow in scope', which are usually based upon formal and logical methodologies. Knowledge that is highly structured based upon logic and driven by expert-based language, has little opportunity for open dialogue and deeper explanation (Antaki 1994). Billig (1987) suggests that reasoned discourse focuses on the thinkable rather than the unthinkable. Taket and White (1993) imply that the language of Soft OR is 'technical', 'expert-based' and 'full of logic' which, in turn, becomes a barrier for learning. Sparrow (1998) believes that the language of Soft OR is cognitively blinkered by rules of structure and process logic, which produces a bounded cognitive schema. If this is followed to its natural conclusion, Soft OR becomes a negative framing device which is bounded by its own scaffolding (Vygotsky 1962) in which participants cannot escape.

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Across all the case studies, evidence suggests that bounded discourse links to a reasoned knowledge schema. Here, the discourse and thinking emerge as a continuous cycle of conscious knowledge which misses out knowledge that is deeper and subconscious. Participants become caught in cycles of reasoning, where mental models do not move, rather they are reinforced. In the Lancaster University case, concepts such as 'technology', 'clinical language' and 'expertise', contribute towards a formal discourse in which the natural flow of conversation is impinged. Bounded discourse is associated with 'laboratory' or an artificial discourse that is a representation of conscious and explicit knowledge, which is far away from the real problem. In the British Airways case, technology contributes towards bounded discourse through Soft OR methodologies that are seen as 'structured', 'hierarchical' and 'reasoned'. The discourse has characteristics of being 'forced' or 'dialectic'. In this scenario, the conversation becomes 'rhetorical', 'defensive', and 'deliberated', which cannot access social and tacit knowledge. Technology impinges upon the natural discourse of conversation, as when used in a formal and structured manner, an expert-based language is generated which excludes every day discourse. In this scenario, prior learning is required in order to access such language.

Such an interpretation would support Sparrow's (1998) belief, that the language of Soft OR is cognitively blinkered by rules, structure and process logic. Sparrow's statement draws upon much of the work of Billig (1987), Antaki (1994) and Grice (1975; 1989), based upon research that can be described as 'class room observations', 'laboratory experiments' and 'discourse in isolation'. Such research that are a discourse analysis methodology, cannot capture the holistic properties of 'environmental attributes' (Gubrium & Holstein 2000), 'disclosure' (Argyris 1969),

‘relationship building’ (Vickers 1988), and ‘intuition’ (Argo 1989). Even Taket and White’s (1993) interpretation of the language of Soft OR is unproven.

From this research, it was found that bounded discourse could be interpreted as one of the process restrictions of Soft OR. To overcome this restriction, the facilitator moves ‘reasoning’ beyond knowledge that is conscious, to incorporate ‘skilled behaviour’ as language, in order to make the process work, as knowledge in action.

5.1.2.2 Skilled Behaviour as Discourse

There is a lack of amplification in the Soft OR literature about how conversation is used. It is conversation that is naturalistic that creates the externalisation and socialisation of knowledge in order to access knowledge cells beyond reasoning (Sparrow 1998). When models are used in congruence to create a transformation that is beyond reasoning and conscious knowledge, it is ‘skilled behaviour’ as language that emerges (Berry & Broadbent 1984; Reber 1967). What can be seen across all the cases, is the facilitator using the concepts of naturalistic ‘language’, ‘conversation’ and ‘dialogue’ as a means to compound tacit knowledge (Berry & Broadbent 1984; Polanyi 1958) into the conversation. This is recognised across the cases as the concepts of social knowledge and social discourse. The facilitator is ‘abandoning’ or ‘adapting’ the use of Soft OR tools and techniques in order to use them as a background framing device (Vygotsky 1962; Adams & Avison 2003). Skilled behaviour emphasises the natural flow of conversation in which the structure and formality of conversation is removed. Even in the London School of Economics’ case study where techniques such as Decision Conferencing (McCartt & Rohrbough 1989)

and Robustness Analysis (Rosenhead 1997) were used, which are extreme examples of structured conversation, skilled behaviour as language surfaces through the concepts of 'interactive' and 'participation'. In the Shell International case, skilled behaviour as language is also supported by episodic memories (Tulving 1983), where participants tell stories to recall an incident or make a point about a situation. Episodic memories bring a personal dimension to the problem situation, making it real, in which a good flow of conversation is recorded and conversational slots are easily filled.

5.1.2.3 Consensus, Agreement and Contribution

Judgements can be made about how participants contribute to the discourse in conversations. Buffney (1993) uses the term 'conversational slots'. These slots are closed or small where the conversation is described as 'formal', 'considered', 'logical' and 'structured', whereas slots are large and easily filled if the discourse has the characteristics of 'natural', 'free flowing', and 'social'. Antaki (1994) proposes that closed or small slots in discourse are attributed to a reasoned paradigm. This is the language of science drawing upon Sparrow's (1998) reasoned knowledge schema of 'semantic understanding', 'propositional thought' and 'reasoned thinking'.

The results in the case studies connect a reasoned knowledge schema with closed or small conversational slots. Bounded discourse which is 'forced' or 'dialectic' was found to produce poor conversational slots. This type of conversation is linked to technology and formality, where the technology becomes a hindrance to contribution. In all the cases, natural discourse produces good conversational slots. This is linked to the use of congruence mapping, the use of stories through episodic memories and skilled behaviour.

Pidd (1998) and Lehaney et al (1999) state that softer approaches are a means by which people can debate perceptions of their world in order to reach accommodation and consensus. Consensus and agreement is used as a means to move discourse forward in order to capture, explore and debate multiple viewpoints. This is important in order to deal with the concept of power and politics in-group behaviour. Accommodation and consensus are at the heart of Soft OR, as a way of taking the heat out of conflict. They are a means to overcome defensive routines (Argyris 1990) that are found in the 'power & politics' cluster. This interpretation of accommodation and consensus, allows discourse to move on, a view that may be considered an 'agreement to act' (Lehaney et al 1999). It is a desire to 'achieve and deliver' that makes pragmatism work (Blosch 2001). Agreement to act, does not imply cultural change but a desire for direction and movement in the discourse.

5.1.3 Knowledge Metacognition

Rosenhead (1997) coins the term 'contamination', where practitioners adapt, adopt and combine methodologies and techniques based upon their own experience, environment and problem intervention. Such a proposition, is supported by Mingers & Taylor's (1992), Munro & Mingers' (2002), and Ledington & Donaldson's (1997) surveys of Soft OR practice. They draw conclusions that Soft OR methodologies are disseminated and adapted as practitioners become creative in their usage and change the ingredients. This explanation of creativity and change is evident in this research. Across all the case studies, consultants 'adapt', 'balance', 'switch', 'identify boundaries' and 'abandon' Soft OR methodologies, tools and techniques.

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The collective term for these concepts is metacognition. Metacognition is defined as the

Scientific study of an individual's cognition about his or her own cognition.

As such, metacognition is more of a subset of cognition, put differently, metacognition is a kind of cognition.

Nelson (1999: 625)

Metacognition is a higher order range of judgements associated with 'feeling of knowing' (Hart 1965), borne out of unseen or automatic practises of facilitation. These are grounded in pragmatism, in which knowledge is located in action. These metacognitive concepts of Soft OR are related to knowledge as a living experience in which metacognition is a manipulation of the real world. The Soft OR facilitator, when faced with complexity and pluralism of knowledge, have to be adaptive, opportunistic and sensitive to social and political knowledge (Carter 1997). Metacognition is an observation of 'how' the facilitator uses Soft OR, a higher order schematic representation of the tool user's mind that embodies Radardel's *notion de catachresis* where tools are not merely about what they were designed for, but how and the way they were used.

Across all the case studies, a number of 'boundaries' of Soft OR are identified that include 'lack of adoption', 'technology' and 'bounded reasoning'. The facilitator makes a decision on whether the tool or the methodology can help him. They may abandon the Soft OR tool altogether or temporarily. Boundaries automatically identify what the Soft OR tool can do or cannot do. Many of these decisions are based upon the intuition of the facilitator. Where boundaries are identified, the facilitator adapts the tool to suit the

circumstances or the experience. For example, in the British Airways case, cognitive maps move from causality and reasoned thinking models to congruence mapping. Through the process of adaptability and combination, the concept of 'switching' emerges. In the Shell International case study, different Soft OR methodologies and tools are 'combined' and 'switched' by the facilitator, depending upon the type of thinking that was required. For example, Senge's Systems Thinking Archetype diagrams (Senge et al 1994), were used by facilitators who wanted to create linkages and understanding of the systemic properties of the problems with participants. Whereas, FastBreak (Kreutzer 1995) was used as an idea generation tool, where the issues of the problem had to be generated quickly. In the Academic Consultants' case, the facilitator has to balance process and task, this means dealing with issues of power and politics in-group situations. The facilitator balances social and cognitive issues in the group in order to achieve some sort of negotiated ending, output, or agreement.

Metacognition supports the proposition put forward by Munro & Mingers (1992) and other surveys of Soft OR practice that methodologies and techniques are 'disseminated', 'adapted', and 'made more creative' but the concept of metacognition explains 'how' such methodologies and techniques are adopted. This helps to overcome much of the weaknesses found in survey-based approaches, when trying to examine the mind of the Soft OR practitioner. Metacognition is the 'feeling of knowing' (Nelson 1999) which becomes the control device of the facilitator's own cognition. An inference based upon intuition and confidence judgements that predict behaviour and decision making. Metacognition is a higher order of activity that focuses on the tool user and how they use the tool, which is a plausible explanation of Rosenhead's (1997) 'contamination' theory.

5.1.4 Knowledge Congruence

When defining OR (White 2002), it is the model that is common to both hard and soft approaches (Hicks 1991), but it is the format and structure that is different between Soft OR approaches. Whether it is Checkland's (1981) Rich Pictures, Eden and Ackermann's (1998) Cognitive Maps or Senge's (1994) Systems Thinking archetypes, these models bring some sort of formal, logical or systems analysis to the process (Mingers 2003). These enable the presentation of a problem in a holistic fashion, that has visual impact and can be used as an interactive device in which participants debate and learn about the problem (Bright & Johnson 1991; Belton & Elder 1994). The literature (Friend 2002; Forrester 1961; Hodgson 1981; Ulrich 1981) suggests that models in Soft OR are about improving organisational action. This gives elucidation to the proposition that models have an emancipatory power. Here, the content in the model represents more than symbols (Cossette & Audet 1992). The literature, however, does not explain the concept of emancipatory power and how it happens although it is known that change in the use of Soft OR techniques occurs.

Works by Eden & Ackermann (1998) and Pidd (1997) suggest that the language of logic and formality focus on knowledge that is conscious rather than immediate language outside conscious, like intuition and skilled behaviour. Cognitive schemas (Axelrod 1997; Weick 1997; Grice 1989) based upon reasoning, are recognised as cognitively limited, leading to a simplification of reality. These formal structural models miss out the discursive elements of representation. Reasoned models with high levels of clustering, lots of semantic networks and hierarchy leads to semantic dissonance (Lincoln 1985). What is missing is how facilitators go beyond using causality and systems thinking models, that is more than conscious knowledge. These results account for this, as the facilitator uses knowledge in congruence.

5.1.4.1 Cryptic Labels of Knowledge

The cases suggest that there is separation between theory, literature and practice. In reality, reasoned models are used in congruence to represent knowledge outside immediate consciousness. Bourgon (1992) observes that participants in group decision making use models in six different ways. As such, models are in fact maps of problems in which people see and read models in different ways. Each map has enough discrepancy or freedom, which enables participants to share their own cognitive schema with the Soft OR model.

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Across all the cases, models in Soft OR are used as cryptic labels of knowledge, in which comparisons can be made to Bourgon's classification. The results of this research do not identify different types of congruence modelling, but it was found that congruence modelling happens. Facilitators use models as cryptic labels in which to negotiate territory. This allows participants to probe and explore concepts in which they can 'hook and anchor' discourse as a means of negotiating territory. By using the concept of cryptic labelling (Bartunek 1984; Silverman 1970) the models become holding devices or a frame of reference in which participants interact to resolve and discuss problems. Within the case studies, the importance of cryptic labels cannot be under-estimated, as these allow the facilitator a degree of discrepancy and adaptability, which is important in a grounded pragmatic theory.

For example, in the British Airways case, cognitive maps (Eden & Ackermann 1998) are used in a very simplistic form so that facilitators can explore and negotiate issues. Simplicity relates to low levels of semantic networks. The cognitive map becomes the holding device in which to explore the problem, this allows focus and referential management (Billig 1987). Participants can see the main arguments and issues of the problem without getting lost in too much detail. They can keep track and understand the whole problem whilst still focussing on one particular element. Congruence modelling allows participants to contribute in a fluid mode without having to stop to deliberate about the problem in a reasoned approach. An exchange of discourses takes place at a social level and in a naturalistic manner, thus, enabling participants to internalise explicit knowledge as tacit knowledge (Sparrow 1998).

The use of congruence modelling allows access beyond knowledge that is conscious, drawing upon 'skilled behaviour', 'episodic memories', 'mood' and 'intuition'. The contributing concepts in congruence modelling are 'adaptability', 'discrepancy' and 'negotiation'. Such concepts allow a normalised environment in which social discourse can take place. Cryptic labels of knowledge bring a meaning that is 'fuzzy', 'not final' and 'can be shared'. It is able to deal with dynamic knowledge (Kintsch 1974) that is visual, non-verbal or linguistic. Here, this knowledge is fragmented, vague, open-ended and sketchy, leading to an interpretation of application that confirms Soft OR as pluralistic rather than prescriptive concept. Therefore, facilitators go beyond 'bounded reasoning'. This observation, is an observation of the tool user and how they use the tool, which reinforces Radardel's (2003) proposition and brings substance to the Soft OR model as an emancipatory device.

5.1.4.2 Iteration, Reliability, Questioning and Validity of Knowledge

White (2002) emphasises that Soft OR models are used to capture, analyse and feedback to participants the substance of the issues that are under discussion. Scriven (1996) identifies a range of terms that are associated with the facilitator reiterating the content of discourse. These concepts are 'resolve puzzlement', 'elucidate', 'paraphrase', 'makes clear', 'fill in detail', 'reclassify' and 'reinterpret'.

Across all the cases, the facilitator is iterating with participants and checking the reliability and validity of content, which supports Scriven's (1996) series of phrases. The 'actions of modelling' include 'probing', 'exploration', 'making explicit', 'asking questions' and 'reinforcement'. For example, when the facilitator in the Shell International case uses the concepts of

Systems Thinking (Senge 1994), the facilitator is constantly challenging participants about the content of the model through asking them to reflect on what has been said and what has been modelled. The facilitator is using reflection techniques in order to try and surface assumptions. This is called 'balancing advocacy with enquiry' where a range of questions like 'so what' and 'how come' are used to probe and explore the content in models. This reliance on iteration and reflection draws upon Weick's (1990) statement of 'how do I know what I think until I see how I act', in particular, asking participants to challenge and change assumptions rather than reinforce assumptions (Simonds 1957). Conclusions from the results, suggest that the changing of assumptions through iteration revolves around congruence mapping in which a language of natural discourse and skilled behaviour is evident.

5.1.5 Knowledge Transformation

Pidd (2001) and Ormerod (2002a) reiterate Soft OR as a framework to discuss problems in a reasoned manner. This is knowledge of deliberation and reflection using a reasoned knowledge schema (Sparrow 1998). However, Sparrow's propositions that knowledge is more than reasoning and deliberation, as much cognition takes place outside immediate consciousness. Sparrow's proposition criticises Soft OR as not being able to access knowledge that is not of a reasoned schema. This is based upon the argument that Soft OR cannot socialise and externalise knowledge (Nonaka & Takeuchi 1995), by embedding tacit knowledge through Soft OR processes. Sparrow (1998) sees no account in the literature of 'skills', 'intuition' and 'mood' that are necessary in a knowledge transformation process. However, if Soft OR has been successful, and if methodological

choice is based upon some sort of intuition (Munro & Mingers 2002), the influence of pragmatism and adaptability must have some sort of bearing. As pragmatism (Blosch 2001) is about learning by doing, in which one 'tests', 'modifies' and 'embodies explicit knowledge' as one's own account, a gap appears that does not account for or provide a rich description of how Soft OR embeds tacit knowledge through externalisation and socialisation (Nonaka and Takeuchi 1995).

If Soft OR has an epistemology that is transactional and subjective, it needs an adaptable framework in order to create new knowledge. What is observed across all the case studies, is the facilitator through a process of induction is trying to create knowledge through accessing and changing knowledge schemas. As already discussed through the concept of bounded reasoning in which knowledge is classified as reasoned thinking, propositional thought and semantic understanding (Sparrow 1998), the facilitator is trying to move this knowledge schema beyond consciousness. In the Shell International case, the facilitator uses naturalistic conversation through 'skilled behaviour'. The use of skilled behaviour as discourse allows conversational slots to be easily filled (Buffney 1993) supported by the use of stories, which draws upon episodic memories. Participants through a combination of these knowledge cells, start to embed their tacit knowledge in the conversation. Further evidence in the British Airways case, shows how facilitators use the concepts of 'play' and 'experimentalisation' to create a rich knowledge schema that embraces most of the cells in Sparrow's (1998) knowledge equation. Examples of 'play' include the use of alternative stories and the use of De Bono's (1989) Six Thinking Hats.

In the Shell International case, it is the facilitator as the tool user who is responsible for changing knowledge schemas. This position is dependent upon the concept of 'multiple facilitation (situational)' where the knowledge schema changes through a combination of concepts. For example, the use of everyday language rather than technical and expert-based language. The use of comfort zones for participants allows them space to think. The facilitator tries to create an environment where conversational slots are easily filled which enables a changed and rich knowledge schema to go beyond reasoned and conscious knowledge. The facilitator uses the structures of Soft OR to go beyond reasoning that creates a transformation of knowledge. The use of such structures is dependent upon the use of models in congruence, in which discrepancy and negotiation allows participants to transform their knowledge schema. The role of the facilitator, is one of knowledge creating strategies that allows access, change and transformation of participants' knowledge schema.

5.1.6 Facilitating Knowledge

According to Taket (2002), facilitation is the most important concept in Soft OR as facilitation occurs in all Soft OR activity and is often unnoticed and not often written about in the OR literature. Much of the facilitation literature in OR concentrates on the 'do's' and 'don't's' in workshops (Phillips & Phillips 1993) or facilitation is viewed as a neutral concept. Bentley (1994) considers the actions of facilitation around a number of concepts of 'listening', 'questioning', communicating', 'acting', 'reviewing' and 'adapting'. Heron (1997) considers a number of facilitation styles from cathartic to structured interventions. As Taket (2002) observes, facilitation occurs in all OR activities. Across all the cases, facilitation is about 'actions', 'awareness' and 'types of'. The actions of the facilitator include 'keeping track of events',

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‘sequencing’, ‘making explicit’, ‘guiding’, ‘balancing’, ‘negotiation’ and ‘iteration’. These actions put facilitation at the core of soft OR activity. Before taking actions, the facilitator is the observer of events and behaviour. The facilitator ‘has to be aware of’, ‘situations’, ‘be a careful listener’, particularly with ‘groups’ and the concept of ‘power and politics’.

In all the case studies, a number of types of facilitation are observed, ‘multiple facilitation (situational)’, ‘hierarchical expert facilitation’ and ‘passive facilitation’. Multiple facilitation (situational) is the most common type of facilitation, as this allows adaptability and is associated with congruence modelling. Such a combination of concepts leads to a rich and changing knowledge schema, which is important for a grounded pragmatic theory. Multiple facilitation (situational) links to metacognition, which incorporates the concept of ‘adaptability’. Metacognition seems to be ‘how’ multiple facilitation works.

Hierarchical facilitation is associated with ‘structured maps’, ‘outputs and results’, ‘task orientation’ and ‘technology’. In the Shell International case, hierarchical facilitation is also associated with ‘causality models’ and ‘walking with the client’. Hierarchical facilitation is purposeful where the group needs direction, results are needed or the group requires a lot of support. In the Academic case study, hierarchical facilitation is seen as the same as expert facilitation. Experts are seen as ‘technical’, ‘unpopular’ and ‘backroom’, producing a knowledge schema that is ‘static’, ‘linear’ and ‘shallow’. In the Luton University case, ‘passive facilitation’ emerges, allowing groups to self-facilitate themselves, making their own decisions about direction and content. Here, the facilitator becomes the observer. Passive facilitation is important in allowing the group to take control of the process, in particular, passive

facilitation is good at dealing with the concept of power and politics. The group regulates themselves, enacting ownership of the problem. It is the concept of facilitation, that makes Soft OR work, contributing to an understanding of how the tool user uses the tool (Radardel 2003). The tool user is the facilitator, the tool is just an extension of the facilitator or 'the conductor's baton' (Radardel 2003).

5.1.7 Social and Cognitive Congruence

Yeoman & Sparrow (1997) and Eden & Ackermann (1998) comprehend that models in Soft OR are a means to hold and capture knowledge, and provide a visual interaction device in which negotiation happens. The model is a representation of territory on paper that somehow represents peoples' partial perception of a problem. The model becomes a holding device in which knowledge and territory are negotiated. It is a means of changing knowledge schemas and mental models (Fletcher & Huff 1990). According to Weick (1990), models represent a socially constructed world of territory in which issues are debated. This is evident in Eden & Ackermann's (1998) terminology 'social and cognitive congruence' where participants balance cognitive understanding with social dimensions. Further, such an interpretation is supported by the work by Lehaney et al (1999) in their examination of a National Health Service Outpatients Department, where SSM is used as a means to debate and discuss problems, representing a process of balancing cognition with social issues.

The issue of balance is critical in social and cognitive congruence. Observations across the case studies draw upon a series of manifestations and defensive routines (Argyris 1990) which dominate the negotiated order

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of relationships and disclosure. A role emerges, where the facilitator is negotiating both social and psychological dimensions, trying to balance the demands for maintenance of existing order, but at the same time, trying to create incremental new order.

Balancing of social and cognitive congruence comes about due to the presence of the concept of 'power and politics'. Power according to Eden & Ackermann (1998) deals with how participants' aspirations are disputed, how conflict is managed and how participants compete with each other. Political feasibility is about determining the extent of change and the likelihood of change when dealing with the situation of political judgements. Schumann (1999) identifies political judgements as the most important concept in facilitation. Across all the case studies, 'an awareness of' the manifestations of power and politics is an important concept for the facilitator. Argyris (1969; 1990) coins the term 'defensive routines' drawn from a number of concepts that are labelled 'not contributing', 'resisting ideas' and 'finding excuses'. Sparrow (1998) links these concepts to the work of Stokes (1994) in which group participants are wary of disclosure and contribution, that rely on 'relationships', 'friendships', 'loyalties' and 'dependencies' in the political arena.

Across all the case studies, the manifestations of power and politics include 'conflict', 'withdrawal', 'manipulation', 'consensus', 'disclosure' and 'cohesion'. This A series of concepts are linked to unconscious interpretations (Stokes 1994; Sparrow 1998). In many of these situations the facilitator does not challenge these manifestations but allows the group to 'trundle along'. What the facilitator does, for example in the British Airways case, is to move the conversation into a 'comfort zone'. In a comfort zone,

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manifestations are defused and defensive routines are overcome. Agreement and consensus is used to deconstrain these manifestations through managing viewpoints and gaining coalition support.

In order to balance social and cognitive congruence, knowledge must be negotiated. The model in Soft OR has a level of discrepancy in which a rich conversation can deal with politicking, manipulation and territorial disputes. The model is in fact a map, which is not an accurate representation but an abstraction of the problem.

Throughout all the case studies, facilitators use congruence mapping as a means to deal with power and politics. The map is used in a simple form in order to deal with high levels of discrepancy through which participants negotiate territory and bring their own knowledge schemas. By using the Soft OR model in this way, participants 'seek and see' (Bourgon 1992) rather than rejecting such a process. In the British Airways case, facilitators shy away from large amounts of clustering and detailed maps. Cognitive maps (Eden & Ackermann 1998) are used in congruence rather than highly structured causality maps. Simple models with a low level of semantic networks (Lincoln 1985) tend to access deep forms of knowledge found outside reasoning i.e. 'intuition', 'mood' and 'skilled behaviour'. The facilitator is actually very clever in 'balancing' structure with contribution. The facilitator through creating comfort zones, uses the congruence model to give participants 'space' to think about the problem. This 'space' is created through the cryptic labels in the model and the discourse that surrounds the model. The facilitator carefully balances rationality with pragmatism. In the Shell International case, an observation is made about negotiated order of knowledge. Facilitators realise that creating understanding and 'output' are

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related. There seems to be a procedural order in which knowledge is created and used. FastBreak (Kreutzer 1995) is used in idea generation, and Systems Thinking (Senge 1994) is used to structure problems. In British Airways, Six Thinking Hats (DeBono 1989) is used to create alternative and immediate understandings, cognitive mapping is used to structure and explore issues and Weltanschauung's (Checkland 1981) are used to explore rational alternative viewpoints. By using methodologies in a mixed mode, facilitators are able to create consensus and agreement inadvertently, through a mixture of 'creating space' and 'comfort zones' that lead to the right order of knowledge creation that achieves an 'output' of agreement.

5.2 Conclusions : Findings and Implications

5.2.1 Findings

At the end of Chapter 2, a number of disparities or limitations were identified in the literature namely:

- The vast majority of the Soft OR literature is identified with key expert authors who are accomplished academic researchers. What is lacking is research into how non-researchers or practitioners use Soft OR methodologies and techniques. Where such research has been undertaken, it is often fundamentally flawed, using a research design of quantitative survey methods, that have tried to recall and capture practitioners use of Soft OR methods, often a long time after the event and out of context. Such recall and capture is frequently blurred and partial.
- Many Soft OR authors have constructed meta-theoretical frameworks in order to help users apply different methodologies and techniques within

the same problem intervention, though many of these frameworks are based upon conscious choice and premeditation. Such meta-theoretical frameworks concentrate on the methodology and tool rather than studying the tool-user or facilitator.

- Much of the literature in Soft OR focuses on methodologies and techniques, emphasising design and creation rather than facilitation and the tool-user. Such an emphasis does not reconcile with Rosenhead's (1997) contamination theory where methodologies and techniques are adapted and utilised.
- Soft OR is associated with logic and deliberation, which is classified as 'reasoned thinking', 'propositional thought' and 'semantic understanding'. This reconciliation of knowledge does not equate with pragmatism, realism and knowledge in action. The success stories of Eden & Ackermann's (2002) two-hundred case studies, and Checkland's (Checkland & Stowell 2002) thirty-years of successful practice, may be presumed to be found outside reasoning and rationality that is not accounted for in the Soft OR literature. What is missing is an account of the knowledge creation process (Nonaka & Tomaya 2003). If knowledge creation is linked to pragmatism, such observations and theories are often dismissed by Soft OR authors as 'theory without knowing'. Pragmatism is not observed as it cannot be validated, so academic researchers tend to dismiss it. By observing the practice of Soft OR, an explanation may be found through modelling and discourse, that explains how the Soft OR practitioner reconciles knowledge in action. There is no such explanation in the Soft OR literature that demonstrates how models and discourse work together as knowledge creation and transaction processes.

This thesis addresses these disparities and limitations and recognises a number of emerging constructions and interpretations:

- The research design faults that are found in quantitative survey methods (Munro & Mingers 2002; Ledington & Donaldson 1997; Mingers & Taylor 1992) are overcome through providing a qualitative approach that gives a rich, narrative description of how Soft OR is practised using a triangulation of research tools that capture the variety and argumentation of knowledge in Soft OR practice. Although this thesis agrees with the findings of those surveys that Soft OR in action is used in a creative and adaptive way, verifying Rosenhead's (1997) contamination theory, it provides a stronger, grounded argument based upon a qualitative research methodology that is more appropriate for recalling Soft OR practitioners' use of methodologies and techniques.
- Such a verification goes beyond adaptation and utilisation by observing the concept of metacognition, in the way facilitators recognise the boundaries of Soft OR tools, adapt and change tools depending upon the circumstances and environment, switch in between tools and methodologies, abandon the process and balancing process with content. Metacognition is an explanation for why meta-theoretical frameworks are not used beyond the few academic authors who invented them. Meta-theoretical frameworks are based upon premeditation and conscious choice rather than automatic decisions and subconscious choice. Additionally, metacognition is a reconciliation of reality in which reasoning, bounded discourse and process restrictiveness are overcome.

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- The way in which the facilitator goes beyond knowledge that is conscious and reasoned, is found through congruence modelling and skilled behaviour as language. Here, Soft OR models are used as a visual interaction of where negotiation happens. The model is in fact a map, which represents more than its symbols, as they are cryptic labels of knowledge in which an emancipation occurs. It is when the model is used with low-levels of semantic structure that an emancipatory power emerges. Participants can then negotiate through the visual representation. A naturalistic discourse occurs through 'skilled behaviour as language', that allows access to further cells in Sparrow's equation. It is the rejection of a highly structured and semantic model that allows participants enough discrepancy to negotiate theirs and others knowledge that goes beyond consciousness and reasoning. This explanation accounts for how facilitators embed tacit knowledge through a socialisation and naturalistic process.
- Pragmatism is dismissed by Mingers (2000) as a 'theory without knowing'. In fact, by observing what the facilitator does, this thesis provides an explanation of pragmatism as a 'theory of knowing'. This knowing is based upon the combined concepts of metacognition, modelling and discourse, that represent a conceptual map of how the facilitator practises Soft OR (figure 5.1). The map overcomes the 'without knowing' of Mingers' work, in which the emancipatory power of practice has broken free from the boundaries of Soft OR in order to reconcile with the reality of practice. Further, a theory of knowing overcomes the suppositions of writers who dismiss pragmatism without observing and searching for an explanation.

- By concentrating on the tool-user rather than the tool (Rardarel 2003), an explanation of how the facilitator draws upon the Latin of facilitation *facilis*, meaning ‘to make easy’ can be found. Such a translation is founded upon how the tool-user is more powerful and knowledgeable than the methodology or tool. The tool-user is, in fact, able to reconcile knowledge in action and all of the concepts of complexity that have been found in this doctoral study. Take away the facilitator or the tool-user and you understand only the static and sterile aspects of Soft OR.

5.2.2 Implications

The two main practical implications of these findings for the OR community include:

- The research findings highlight a movement from techniques to tool-user. Such an implication will have an impact upon how to teach Soft OR in Universities. Figure 5.1 moves our understanding of Soft OR from a technology-based approach (Keys 1995) to a cognitive facilitated understanding. This is based upon the premise that whatever techniques of Soft OR facilitators use, they are going to be adapted in the context of use. The drivers behind this change relate to the concepts of discourse, facilitation and modelling, found in Figure 5.1. Course designers need to accommodate these concepts as they represent the reality of practice. This map represents the cognitive processes that are required in order to perform the tasks and functions of Soft OR.
- One of the problems of working with the tools and techniques of Soft OR, is the issue of dealing with the ambiguity of process. Soft OR is more than the tools and techniques of cognitive mapping (Eden & Ackermann 1998),

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Systems Thinking (Senge 1992) and Strategic Choice (Friend 1989), as Soft OR is to a certain extent a methodology. As methodologies are an ambiguous process, there is no right or wrong way to use tools and techniques. As these findings highlight, it is the tool-user who determines how it happens. This determination is based upon the concepts that are found in the conceptual map of Soft OR practice. This map represents the facilitation process that is specific to Soft OR, therefore, Soft OR practitioners have an explicit guide that untangles ambiguity and allows foresight of what happens in the Soft OR consultancy or group process.

CONCLUSIONS

6 Introduction

The aim of this thesis was to develop a conceptual map of Soft OR practice. In order to achieve that aim, five objectives were set. The first objective set out to explore the world of Soft OR practitioner from a cognitive perspective. This cognitive perspective explains ‘how’ practitioners make Soft OR work in context. This thesis explores Soft OR users through a range of case studies, namely British Airways, Shell International and Academic Consultants. These collective minds represent the best brains that were accessible both in the terms of expertise and co-operation. A qualitative research methodology approach was followed that allowed the researcher to gather a deep, meaningful and rich text of understanding of how the practitioner used Soft OR in context.

The second objective was to identify a gap in the Soft OR literature based upon the disparities and weaknesses in previous works. The literature was used to identify a range of concepts in order to build a conceptual map of Soft OR practice. At the end of Chapter 2, a number of disparities and limitations were identified in the literature. These are weaknesses in research methodologies in previous studies, a lack of research into non-researchers’ use of Soft OR and the lack of uptake of meta-theoretical frameworks. Frameworks used were limited as they were based upon conscious choice and premeditation, whereas the choice of methodologies and techniques in Soft OR practice is based upon subconscious and automatic choice. In addition, much of the literature reviewed focuses on methodologies and techniques

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rather than facilitation and the tool-user. No explanation in the literature correlates the success of Eden and Ackermann's (2002) and Checkland's (Checkland & Stowell 2002) successful practice with Rosenhead's (1997) contamination theory. Such a correlation must go beyond Sparrow's (1998) proposition of logic and deliberation, as this does not equate with pragmatism, realism and knowledge in action. What is missing in the literature is an account of a knowledge creation process that links pragmatism to success. There is a lack of understanding of how practitioners assemble a cognitive understanding of situations and how they make decisions on how to proceed. Much of the literature about Soft OR has a tendency to concentrate on the tool rather than the tool-user; hence, a lack of understanding of how Soft OR works in practice can be found.

The third objective was to construct a conceptual map of Soft OR practice using a constructivist interpretation paradigm. In this paradigm, the researcher acted as a Bricoleur in which a set of cognitive patterns could be put together that represent a conceptual map of Soft OR practice. The Bricoleur deployed a triangular approach of research methodologies and tools in order to capture the variety of knowledge of Soft OR practice and the deployment of a range of tools, such as DECISION EXPLORER, which was able to show an argumentation of knowledge through tracing the different concepts and bringing these together in such a fashion that it made sense.

The fourth objective was to construct an interpretation of emerging Soft OR practice that was derived from questioning and reflecting upon findings from a series of case studies using Sparrow's knowledge management equation as a framework to explore, explain and build accounts of Soft OR practice. The use of Sparrow's framework was, in the first instance, mechanical, as it was used as a guide to view the concepts of Soft OR practice. By deploying such a

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strategy, a hierarchical tree node system was built up using Nvivo. This framework further allowed the researcher to develop, construct and interpret other concepts, known as free nodes, which provided a much richer text in the case studies. This deployment along with other tools of triangulation was both useful and purposeful for exploring the cognitive issues that surrounded the practice of Soft OR.

The final objective sets out to make recommendations to the OR community, based upon the implications of the research. From a teaching and learning viewpoint, the conceptual map adds value in the teaching of Soft OR and the design of courses. Lecturers now know how the tools and techniques work in practice. From a facilitation viewpoint, the conceptual map deals with some of the ambiguity and uncertainty of the decision process rather than emphasising on what each tool is. Here, the conceptual map becomes the process of facilitation of Soft OR, explaining to users what the tool-user or facilitator does with Soft OR tools and techniques, hence, bringing explanation to the methodology of Soft OR.

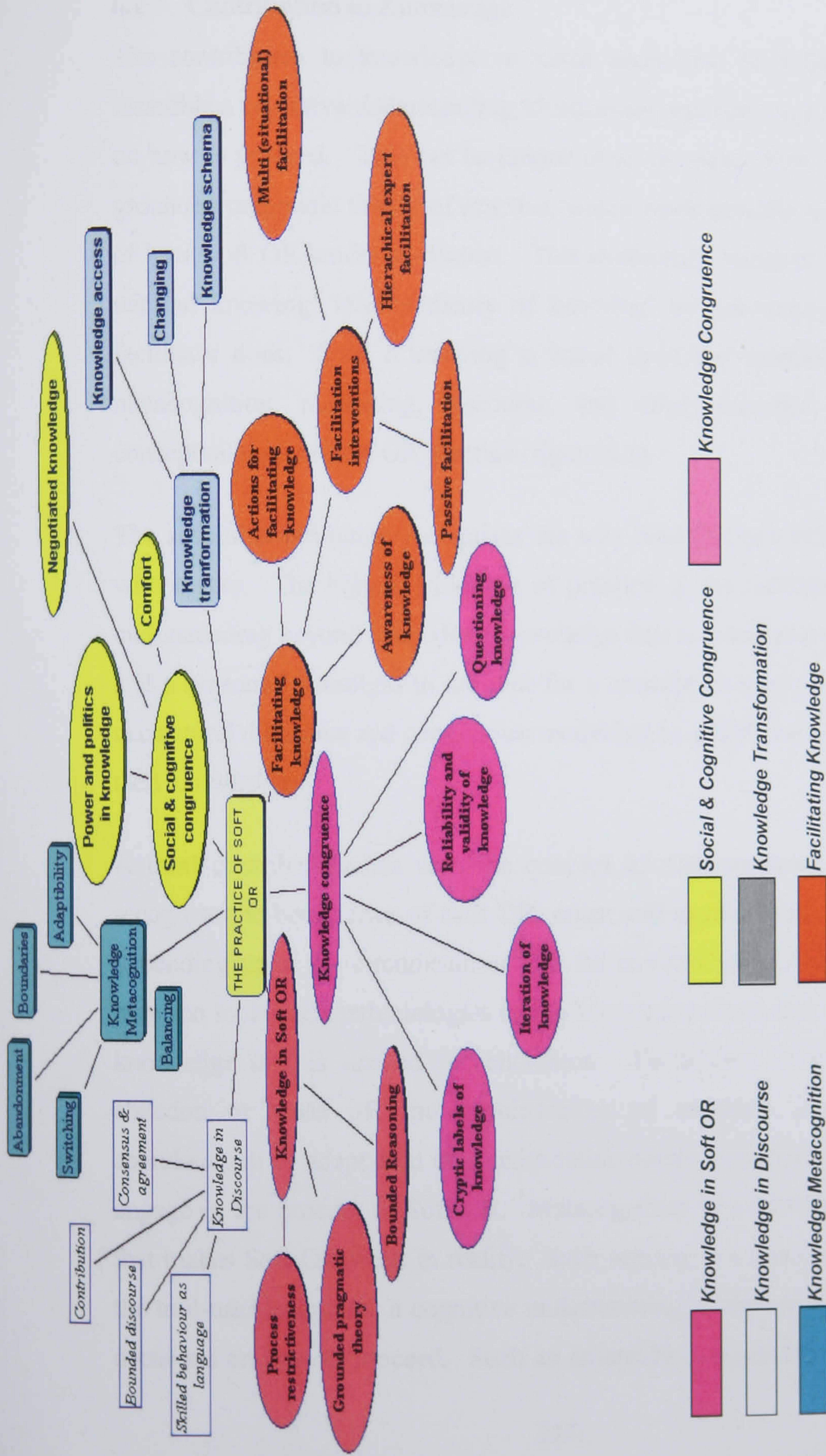


Figure 6.1 A Conceptual Map of Soft OR Practice

6.1 Contribution to Knowledge

The contribution to knowledge is based upon how Soft OR practitioners assemble a cognitive understanding of situations and how they make decisions on how to proceed. This can be judged in seven ways. Firstly, Soft OR is a grounded pragmatic theory of practice, which represents the truth, and reality of how Soft OR works in context. This overcomes Mingers' (2000) 'theory without knowing' into 'a theory of knowing' by accounting for what the facilitator does. Such a knowing is based upon the combined concepts of metacognition, modelling, discourse, and other concepts found in the conceptual map of Soft OR practice (figure 6.1).

The second contribution recognises the way Soft OR practitioners reconcile with reality. The biggest influence of practice, is the facilitator who moves understanding beyond immediate knowledge that is found at a conscious level and a reasoned paradigm to account for a conceptual map where facilitators use natural discourse and congruence modelling to embed social knowledge as tacit knowledge.

A third contribution lies with the concept of metacognition, as facilitators recognise the boundaries of Soft OR, adapt and change tools and techniques depending upon the circumstances and the environment. Facilitators switch between tools and methodologies depending on circumstances and the kind of knowledge that is needed for elicitation. Facilitators, without hesitation, abandon or trade off the sophistication of technical expertise. This abandonment or adaptation of sophistication allows participants to retain and engage in the process of Soft OR. Metacognition is a critical success factor that makes Soft OR work in reality. Such success is a concentration on how the tool-user assembles a cognitive understanding of the situation and makes decisions on how to proceed. Such an assembly is dependent upon the tool-

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user rather than concentrating on the design of the tool. Here, a significant emphasis moves away from methodology to how the Soft OR practitioner utilises these methodologies.

A fourth contribution lies in the importance of the Soft OR model as a cryptic label of knowledge in which there is a territory for negotiation. This relationship highlights how the facilitator uses the model in the negotiation of knowledge. The model is in fact a map with a loose semantic structure and a strong visual presence. The symbols in the map are cryptic labels in which an emancipatory power emerges. This allows participants enough discrepancy to negotiate theirs and others knowledge beyond consciousness and reasoning.

A fifth contribution builds upon this, where the use of everyday discourses allows a balance between usable structures of Soft OR models around which social discourses can be built. Soft OR techniques, which are not usable and present boundaries to naturalistic discourse, are abandoned or not used outside original authors. The importance of skilled behaviour such as language and congruence modelling allows a knowledge transaction in which social knowledge is imbedded as one's own tacit knowledge. It is the facilitator who can embrace usable structures in such a manner that makes Soft OR work in action.

A sixth contribution is found in how the conceptual map of Soft OR practice could be used in the OR community. Educators now have a single guide to facilitation that is appropriate for courses in Soft OR, acting as a benchmark for syllabus content and course design. Practitioners have a channel to process facilitation that is appropriate across all the tools and techniques of Soft OR.

The contribution to knowledge of this thesis clearly lies in how the facilitator assembles a cognitive understanding of situations and makes decisions on how to proceed. Such an understanding moves Soft OR from the tool to the tool-user that reconciles with the Latin of facilitation *facilis*, meaning 'to make easy'. It provides an understanding of how the facilitator makes the process effective that reconciles with reality.

6.2 Reflection on Methodology

Easterby-Smith and colleagues (Easterby-Smith et al 1991) draw conclusions that there will always be difficulty with qualitative research, in deciding how and when to impose an interpretative framework. This is the continuous question faced by all qualitative researchers, and this research is no different. Upon reflection, a number of points can be considered.

Participants in the British Airways and Shell International case studies saw Soft OR as one continuum rather than distinguishing methodologies and techniques. Hence, this thesis is unable to differentiate or make a contribution towards the debate about the distinction between Soft OR methodologies, techniques and tools.

The Bricoleur did not validate or verify the interpretation that was concluded with those researched. Therefore, the research findings are limited to the expertise and bias of the Bricoleur. Although subjectivity is acceptable within a constructivist interpretatist paradigm, others may take a more objectivist stance as the Bricoleur has not created a dialectical debate with the participants in the case studies. Participants have had no opportunity to constructively criticise and debate such interpretations. The results are, in fact, only verified by the Bricoleur to the point of theoretical saturation and sensitivity.

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the process of capturing the variety of knowledge and the interpretation of documentation through a Computer Assisted Qualitative Data Analysis software (CAQDAS) may be seen by some as an over-use of technology. Such a weakness may lead to a reductionist rather than an induction interpretation. This over-use of technology can become evident especially when using RepGrid II when interpreting repertory grid interviews. Marsden (1997) points out, that the researcher sometimes gets lost in numbers and starts to be over-reliant on a quantitative interpretation rather than using a qualitative judgement as a means of interpretation. However, due to the breadth of data gathered in this research and the importance of the researcher to be able to show a 'tracing' in order to construct a conceptual map of Soft OR practice, it is deemed purposeful to use a CAQDAS approach as outlined in this thesis.

The majority of the fieldwork was undertaken in 1998. Since then, new methodologies and techniques have emerged and others have disappeared. Within the Soft OR literature, many papers have emerged in the last two or three years which have brought new ideas and interpretations of Soft OR. An imbalance is identified from when the fieldwork was completed until this thesis was submitted. Such an imbalance between fieldwork, recent publications and thesis submission may have some bearing upon the validity of the results; in particular, the mind of the Bricoleur has changed over a number of years as new knowledge emerges. Further, the Bricoleur may have difficulty of putting into context some of the research that happened in 1998 against an interpretation in 2003.

Initially, this thesis has constructed a cognitive understanding of Soft OR, but such an interpretation should be closely linked to social psychology. There is a difference between recalling participants' understanding of the situation after

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event (cognition) as against observing the event as it happens (social psychology). Or as Eden and Ackermann (1998: 37) state:

We should be aware of the difference between 'theories in use' (how people think and act) and espoused theories (how people account for how they think and act). Clearly official (espoused) statements are an important system of symbols that are used to justify action, and develop stories, which influence the culture of the organisation. However, there is no substitute for capturing 'theories in use' employed by managers as they deal with strategic issues. Embed conscious assumptions and 'world-taken-for-granted' assumptions into bureaucratic procedures, or follow rituals dealing with routine developments that can profoundly affect the strategic future of the organisation.

Further Studies

This thesis has advanced understanding of Soft OR in practice; however, consideration needs to be made to further studies. This thesis was unable to distinguish between Bourgon's (1992) types of congruence modelling. As congruence modelling and natural discourse have been identified as important concepts in Soft OR practice, it is relevant that further research should focus on types of congruence modelling with discourse in order to discover further understandings. Such research could focus on how facilitators and participants integrate knowledge, listen and converse. This could draw upon earlier work by Chafe (1994) where rhetorical, referential, and focus management may help the OR community understand how participants scaffold a process of communication with discourse style and congruence model type.

There is further opportunity to understand the importance of scheduling the use of Soft OR techniques to create a richer understanding of the problem. For example, what is the relevance of using rich pictures before or after a structured hierarchical map? Does the scheduling of techniques and hence the scheduling of different types of knowledge or cognitive schemas, have any relevance on the process of learning and understanding about problems? This

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cept of negotiated order of knowledge has particular relevance in naging political feasibility in overcoming defensive routines and disclosure. here is value in the scheduling of knowledge, in which Soft OR techniques ome the tool of such scheduling, a useful insight in the knowledge nsformation process can be gained, that will be of benefit to the OR and ler business community.

ilitation as ‘feeling as knowing’ and a metacognitive concept are worthy of nore micro study in order to investigate the concepts and relationships of aptability’, ‘balancing’, ‘switching’, ‘abandonment’ and ‘boundaries’. is study could bring further verification to the concepts found in tacognition and could make a contribution to understanding of knowledge citation, access and transformation. It could be hypothesised that the greater utilisation of these concepts in metacognition, a richer knowledge schema onstructed.

study that measures the impact of different cells and combination of cells m Sparrow’s knowledge equation could bring insight into how Soft OR is ed. For example, the use of stories to access episodic memories as against mal maps to access semantic understanding and reasoning. A study is evant to find out what cells or combinations have greater impact in problem ventions.

nally, recognition is given to the fact that further studies should be found to ply this map in education and learning to measure its effectiveness. A mpetence based learning model could be adopted that marries the concepts the conceptual map against the skills and learning that are required, using e map in practice, which will lead to further iterations and refinements not and in this thesis.

6.4 Conclusions: The Significance and Importance of this Study for Operational Research

The importance of this thesis provides the most comprehensive understanding to date of how facilitators assemble a cognitive understanding of situations and how they make decisions on how to proceed. It provides an account that verifies and answers Taket's (2002: 126) statement:

Firstly, no matter what type of OR one is involved in, facilitation is a necessary part of the process. Secondly, this is often unnoticed, or assumed to be true only for some types of OR.

The significance of this research is that the OR community now has a conceptual map which can act as a list of critical success factors that could be used as benchmarks in the design of and explanation of processes in Soft OR. This conceptual map of Soft OR practice now moves the debate from the tool to the tool-user, highlighting a research agenda for the OR community.

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Soft OR Methodologies Reviewed

These soft OR approaches have been highlighted in the Operations Research literature by Lehaney et al (1997), Hicks (1991), Yeoman et al (2000) and Rosenhead (1989a).

The following being the best known;

- Cognitive Mapping (Eden 1989, Eden & Ackermann 1998)
- Critical Systems Heuristics (Flood & Jackson 1991c)
- Decision Conferencing (McCartt and Rohrbough 1989a)
- Hypergames (Howard 1989)
- Hexagons (Hodgson 1992)
- Metagames (Bennet et. al 1989)
- Robustness Analysis (Rosenhead 1989)
- Soft Systems Methodology (Checkland 1981)
- Strategic Assumption Surfacing and Testing (Mason & Mitroff 1981)
- Strategic Choice (Friend 1989)
- Systems Dynamics (Forrester 1994)
- Systems Thinking (Senge et al 1994)

The purpose of this doctorate is not to review soft OR methodologies, but to understand the practices of soft OR. For a further discussion of soft OR methodologies, readers are referred to *Lehaney, B. Martin, B. & Clarke, S. (1997) A Review of Problem Structuring Methodologies, Systemist. Vol 19, No 1, pp11-28*. Each soft OR methodology is only mentioned in order to frame the readers mind of what soft methodologies are and *what contribution they make to soft OR practice*¹.

¹ An example of the contribution that individual soft OR techniques, tools and methodologies makes, is highlighted in *italics*.

Cognitive Mapping

Cognitive Mapping enables a modeller to represent participants' individual thoughts on a problem situation. The map itself shows a series of linked ideas, with arrows indicating how one idea might lead to another, i.e. it is a sign directed map expressing chains of cause and effect among the issues comprising and relating to the problem area. The theory of cognitive mapping draws upon Kelly's (1955) Personal Construct Theory, as a process of constructing and eliciting a person's understanding of a problem.

Cognitive mapping is the tool used in Eden & Ackermann's (1998) JOURNEY of Strategic Management, which was developed at Strathclyde University as a means to cope with the qualitative aspects of complex messy problems (Eden 1985; Ackermann 1992). The approach emphasises equally the importance of discussion content and discussion process, through the use of cognitive maps, which may be developed using the computer package 'Decision Explorer'. The contribution of cognitive mapping to soft OR, is through a *simple process of engaging participants' thoughts through causal style diagrams*.

Critical Systems Heuristics

Critical Systems Heuristics (CSH) (Ulrich, 1983, 1987) studies existing or planned systems, from a point of view of discovering whose interests and viewpoints the system serves. (Lehaney et al 1997) It examines closely the assumptions and values associated with the system (or proposed system), involving the use of 'boundary questions', such as "What is the actual purpose of the systems design?". The power of the questions to reveal the normative content of the systems design is best seen if they are put in 'is' mode and 'ought' mode. Thus, the questions, "Who is the actual client of the systems design?" and "Who ought to be the client of the systems design?" would be asked. These boundary

questions are designed to highlight sources of control, expertise, legitimating and motivation. (Jackson, 1992: 191). CSH is considered to be 'emanicipatory', because of the emphasis throughout on discovering whose interests the system serves. The methodology has a relative weakness in not supporting the actions necessary to implement the identified needs for 'empowerment' (Lehaney et al 1997). *It is the use of questions to enable participants to think about problems, which makes a contribution to soft OR.*

Decision Conferencing

The methodology brings together decision analysis group processes and information technology in an intensive session, usually lasting two or three days, attended by all those involved in the problem or decision area. The ideal is to include all participants. The session typically has the small group involved seated around the perimeter of a round table talking through problems with the facilitator. It is the facilitator who guides group interaction and knowledge sharing. In the background another decision analyst uses interactive decision aiding technology to model individual and group views on issues such as multi-attribute option evaluation and resource allocation. (Lehaney et al 1997). *The contribution of Decision Conferencing lies in the synthesis of decision analysis techniques, such as eliciting subjective probabilities and utilities, and the positive characteristics and dynamics of small group decision making. Participants gain a sense of common purpose and commitment to action.* The conferencing of decisions to a consensus gives participants a greater sense of 'ownership' of the problem and a greater likelihood of implementation. Criticism of the generation of 'group think' in the process has been forwarded, although a skilled facilitator, aware of the potential problem, can avoid this (McCart and Rohrbough, 1989; Lehaney et al 1997).

Hexagons

Hexagons or their commercial name of IDONS, is authored by Hodgson (1992). According to Dodds & Hocking (1994) they assist in the process of introducing and structuring ideas. Hodgson (1992: 227) states that:

“Concept mapping with IDONS is the process of rendering tacit models sharable by use of representation mapping. This mapping is done by means of a variety of techniques which are like moving diagrams”. The fundamentals of the process involve, in a group session, individuals noting down ideas on magnetic, coloured hexagons, which are placed on white-board. These hexagons are then clustered to show related concepts and connections to ideas. The flexibility of the method means that it can be used in various contexts and provides a means to stimulate creative thinking (Dodds & Hocking 1994) and eliciting a collective view of ideas. *The contribution of hexagons to the soft OR debate lies in its ability to cluster and connect problem component parts through the use of coloured hexagons for quick identification.*

Hypergame Analysis

Hypergame Analysis may be used in situations where several parties have influence over the problem situation and have an interest in the outcome. It is distinguished from other game-based approaches in that there is emphasis on the fact that actors have differing interpretations of reality. There is generally an element of conflict between the participants, although of course there may be also points of agreement (Lehaney et al 1997). *The contribution of hypergame analysis lies in the process of helping participants understand the consequences of how decisions effect others.* In recognising that the individual perception of a situation is unique, it accepts the individual is part of a system. Thus, when deciding on a course of action, the first problem is a decision about

who is being helped by the analysis. The process involves discussing a range of strategies, preferences, options and outcomes.

Quantitative values are assigned to a player's preferences and these determine the values assigned to outcomes. It is assumed that each player knows all the strategies available, but not what others will choose to do. This may be considered a little presumptuous, but consideration of the successful spheres of application, particularly in military arenas, indicates that there are often obvious limitations on the available strategies (Bennett et al 1989; Lehaney et al 1997; Lehaney 1999). A central feature of the process is the iterative modelling process, as a process of feedback, reliability and validity. The methodology is particularly strong in identifying the power structures and supporting challenges for participants. A methodology grounded in Stokes (1994) work on groups and teams, through unconscious interpretations of knowledge (Stokes 1994).

Metagame Analysis

Metagame Analysis highlights the results of co-operation, or conflict, between actors in the problem situation, dealing with Stokes work on unconscious interpretations (Stokes 1994). The process begins by deriving a list of actors and possible options. The options listed do not exclude each other, i.e. an actor may take all, some or none of the options listed attributed to them. Practitioners see this first stage as vital in raising participants' awareness to aspects of power and control. As a particular theoretical course of action is tested, a figure 1 is written next to those options that would be taken and the figure zero against any options that are declined. This listing of one's and zeros is denoted as a 'scenario', (Lehaney et al 1997; Lehaney et al 1999), each scenario represents a combination of actor's plans and provides one possible line into a future state. Again, this consideration, in the preparation of

differing scenarios helps the participants reflect on a wide variety of possibilities.

In preparing scenarios some will be just plainly infeasible, either logically or physically. Once a set of feasible scenarios is available they are classified into one of four groups, *Status Quo*, *Present Scenario*, *Positions or Compromises*, by an analysis of threats and promises, i.e. a consideration of what pressures actors can exert on each other. Howard (1989) gives a full explanation of these categories. Once this process is complete, a strategic map showing a summation of this is produced to enable discussion of results. Lehaney (Lehaney et al 1997) considers the contribution of metagame analysis as *enabling managers to recognise the importance of a consideration of human relations in their work, an integral part of a soft methodology*.

Robustness Analysis

Robustness Analysis provides a framework for considering problem situations where there is a high degree of uncertainty and decisions are capable of being made sequentially. It seeks to identify those decisions made early in the sequence that retain the widest range of options for later. Thus, in considering a decision, it is recognised that the available choices lead to differing futures (Lehaney et al 1997). The analysis is thus concerned with keeping flexibility for those future choices. This of course differs from the methods of traditional operational research, where a single optimal future would be sought. The 'robustness' of any decision is quantified as the number of acceptable options at the planning horizon, with which it is compatible, divided by the total number of acceptable options at the planning horizon. This yields a figure between 0 and 1, with values closer to zero indicating the initial decision is less influential in affecting the ability to re-configure the system at a later date. A robustness index is a measure for comparison of options in a situation

whose parameters are defined by the participants. It is recognised by practitioners that the quantitative measures obtained are not prescriptive. Rather, they focus attention on developing perceptions about the problem situation and likely outcomes of decisions. "The robustness score is an indicator of flexibility, but its calculation does not absolve one from the need to investigate its quality and significance" (Rosenhead 1989b: 217).

The flexibility of the methodology in retaining several 'futures' for analysis is a major strength. Lehaney (Lehaney et al 1997) recognises the *contribution of Robustness Analysis as providing a framework for considering problem situations where there is a high degree of uncertainty and decisions are capable of being made sequentially.*

Soft Systems Methodology

Soft Systems Methodology (SSM) is an approach to modelling developed by Checkland (1981). SSM enables the people involved in running a system (Actors), those responsible for controlling it (Owners), and those who receive its benefits (Customers), to participate in the process of developing a system model, which is likely to encourage acceptability of the model. *The contribution SSM makes is the process of engaging participants through simple systems diagrams and structure in order that participants become involved in an action research approach to problem solving and construction.* SSM may be used to aid the identification of system boundaries and system activities, particularly in complex systems, by means of a seven-stage process (Checkland 1981; Lehaney et al 1997). SSM is a process, not methodology around seven stages. The process elicits a real world picture of the problem situation through a 'rich picture'. To discuss alternative notions of this picture, conceptual models are built up from root definitions and discussion of system boundaries. The process then concludes with an agreed action plan for implementation of the issues raised and political aspects, rather than the

systems dimension that is the focus of attention (Churchman, 1979; Mason and Mitroff, 1981).

Strategic Choice

Strategic Choice was developed during the 1960s and 1970s as part of the action-research which was being undertaken jointly by the OR Society and social scientists from the Tavistock Institute of Human Relations. (Friend and Hickling 1987; Lehaney 1999) The approach is both interactive and incremental, and it is used to help facilitate group communication about complex situations.

Strategic Choice makes a notable contribution to soft OR through an incremental approach in taking decisions, by focusing on alternative methods of managing this uncertainty. The process of strategic choice has four modes, 'shaping' (forming an agreed view of a problem structure), 'designing' (identifying courses of action), 'comparing' (evaluating actions against criteria) and 'choosing' (agreeing on an incremental process for decision making). This can be contrasted with the majority of management science techniques that primarily only address the 'designing' and 'comparing' modes. Within these four modes there is a wide variety of techniques used to consider the problem area, with the emphasis upon the outcomes of possible decisions (Lehaney et al 1997). Friend (1989) gives a full consideration of these. When used as an aid to participate in decision making, a set of operational guidelines transcending the four basic modes is used. These are listed, in the major text on the subject, as technology, organisation, process and products (Friend and Hickling, 1987). *The strategic choice approach can best be summarised in that attempts to make explicit how best to manage uncertainty in a decision making arena* (Lehaney et al 1997).

Systems Dynamics

System dynamics (Forrester 1961) is a methodology for studying and managing complex feedback systems, such as one finds in business and other social systems. In fact it has been used to address practically every sort of feedback system. While the word system has been applied to all sorts of situations, feedback is the differentiating descriptor here. Feedback refers to the situation of X affecting Y and Y in turn affecting X perhaps through a chain of causes and effects. One cannot study the link between X and Y and, independently, the link between Y and X and predict how the system will behave. Only the study of the whole system as a feedback system will lead to correct results. The field was developed initially from the work of Jay W. Forrester. His seminal book *Industrial Dynamics* (Forrester 1961) is still a significant statement of philosophy and methodology in the field. According to Lehaney (Lehaney et al 1997) the contribution that System Dynamics makes, *is that by modelling dynamic feedback experiences, the behaviour of complete systems can be understood.*

Systems Thinking

Systems thinking is a way of thinking about, and a language for describing and understanding the forces and interrelationships that shape behaviour of systems. It is concerned with how to change systems more effectively, and to act more in tune with large processes in the natural and economic world. *The contribution that systems thinking makes lies in the tools of causal loop diagrams, archetypes and computer models. This allows groups to talk about interrelationships more easily, because they are based on the theoretical concept of feedback processes.* This approach to problem solving is associated with the work of Senge (1992).

Sparrow's Knowledge Equation

The study of knowledge in the context of cognition and management is noted by Walsh (1995) in the early classic works of March & Simon (1958) and Cyert & March (1963). More explicit treatment of cognitive processes in management and organisational studies began in the early 1980s (Huff & Huff 2000; Huff 1990). For example, *The Thinking Organisation* by Henry Sims (1986), provided a particularly influential collection of theoretical and empirical papers that highlighted the usefulness of knowledge and thinking for the understanding of many organisational processes.

Soft OR has witnessed a movement from a belief in the need to work with logical or optimum solutions towards a use of processes that can structure or amplify the thinking of human participants. Techniques have been developed that can create 'private' and 'shared' arenas where 'views' can be crystallised and interrelated (Yeoman et al 2000).

There has, however, been an increasing awareness that supporting participants in the course of their problem solving may entail more than considering knowledge in a 'deliberative' or a reasoned way (Thomas 1986). Much of the cognition of human beings takes place in ways that lie outside immediate consciousness. The influence of 'skills', 'intuition', 'mood' etc, has been acknowledged by Soft OR consultants (Eden & Spender 1998), but not significantly addressed or understood in the terms of knowledge taxonomy. It is Sparrow's equation of knowledge cognition, which is accepted as appropriate for addressing those issues. It provides a means to explore and guide the Bricoluer through an interpretation and construction of Soft OR practice.

Appendix B: Sparrows Knowledge Equation

Sparrow's (1998) equation proposes that knowledge has three dimensions: kinds of mental material, forms of thought and types of thinking, therefore Sparrow represents knowledge as an equation;

$$\textit{Knowledge} = \textit{mental material} + \textit{thought} + \textit{thinking}$$

Kinds of Mental Material

The literature suggests there are five types of mental material. These are semantic (Tulving, 1983), episodic (Tulving, 1983), skilled (Anderson, 1982), tacit (Polyani, 1958) and unconscious (Freud, 1915; Jung, 1961) material. A taxonomy of literature on mental material is represented in Table 3.1.

Table B.1 Kinds of Mental Material

Five Kinds of Mental Material					
	Episodic memories	Semantic understanding	Skills	Tacit feel	Unconscious interpretations
Consciousness / awareness (1)	Conscious		Subconscious		
Unconscious (2)					Unconscious
Knowledge type (3)	Declarative		Non-declarative		
Expertise type (4)	Adaptive		Routine		
Memory type (5)	Episodic	Semantic			
Articulate / inarticulate (6)	Articulate			Inarticulate	
Skilled and tacit (7)			Skilled	Tacit	
Conscious / implicit learning (8)	Initially consciously acquired knowledge			Initially implicitly acquired knowledge	

Appendix B: Sparrows Knowledge Equation

- (1) James (1890)
- (2) Freud (1915)
- (3) Stokes (1994)
- (4) Hatano & Inagaki (1986)
- (5) Tulving (1972)
- (6) Polanyi (1958)
- (7) Berry & Broadbent (1984)
- (8) Reber (1994, 1967)

Source: Knowledge in Organisations (Sage 1998)

Semantic mental material is the knowledge that is about ideas/objects/events and how they operate. It is the 'understanding' that an individual has of an issue. It is the categorisations and models that they have of their sphere. This information is stored in a structured way and can be considered consciously. An alternative way in which people store their experience is in terms of particular episodes. Decisions and actions can sometimes be the product of 're-runs' of particular sequences of events that have been stored intact. The deeper significance or broader implications implicit within a particular 'chain of action' are not part of the thinking process in utilising episodic mental material. In addition to the conscious mental material that is processed in the course of decision making, skilled and tacit mental material can be processed by the brain. Indeed, it is important to recognise that 'parallel' forms of processing are taking place (Reber and Squire, 1994). The 'result' of such processing may not be a 'single' position upon a problem. Skilled and tacit subconscious mental material and processes are 'automatic' routines that a person has developed. In the case of skills, these are practices that once needed to be consciously controlled but have, as a result of repetition, become an automatic sequence (Holyoak and Spellman, 1993).

Appendix B: Sparrows Knowledge Equation

Tacit mental material and processing is the subconscious reading of situations that operate with in the light of accumulated experience. It is a reading that has not been consciously considered but which, nevertheless, colours our perception of events and our subsequent actions. It is the reading of situations that tells us that something does not 'look right' (Berry and Broadbent, 1984).

Finally, reference is made to unconscious mental material and processing. These are the basic mechanisms that are used to deal with some of the over complexities that people face. In a sense, it is our preferred way of simplifying (Freud, 1915; Jung, 1961). The role that unconscious processes can play in individual and group decisions and actions at work have been recognised by Stokes (1994).

Forms of Thought

In examining thought, Sparrow (1998) draws attention to two different fundamental forms of thought: propositional and imagistic.

Table B.2 Forms of Thought

Forms of Thought	
Propositional (1)	Imagistic (2)

(1) Anderson (1990).

(2) Wheatley, Maddox and Anthony (1989).

Propositional forms of thought may be used when thinking occurs through language. People seek to establish the linkages that a person holds about a particular idea (Anderson 1990). In the terms of personal construct

Appendix B: Sparrows Knowledge Equation

psychology, (Fransella & Bannister 1977) it is the way a person has construed an idea/object/event. Imagistic forms of thought are used in the consideration of mental images (Wheatley, Maddox and Anthony, 1989).

Kinds of Thinking

The final element of the knowledge equation is the type of thinking that is occurring.

Table B.3 Types of Thinking

Three Types of Thinking			
Reasoning (1)			
Separation	Location		
	Static comparison	Systems thinking	Plurality seeking
Mood (2)			
Pervasive effect	Mood congruence effect	Mood-state dependence	
Autistic (3)			

(1) Sparrow (1998)

(2) Matlin (1994) / Kuiken (1991).

(3) Buzan (1993) / Fournier & Guiry (1993)

Reasoning as a type of thinking, is where people think in 'lines' and their thoughts are linked in some rational manner. This is the type of thinking people use to 'figure out' a situation. It is the application of logic to interpret concepts. Reasoned thinking has been classified into a secondary level of separation and location thinking. Separation thinking is about 'pushing' the boundaries of our understanding, by identifying new, deeper or broader

Appendix B: Sparrows Knowledge Equation

considerations. This is the process of finding differences between things. Separation thinking seeks to define things. It is an approach to thinking where the logical separation of things is the quest. One is seeking to discriminate or differentiate between items.

Location thinking has three different aspects. All of them concern how the 'bits' fit together. Firstly, static comparison is about how one categorises things. It is a thinking mode about the relative size of shapes. A good example of this is causal thinking. Causality attempts to locate elements in a particular way. It seeks to explain how the location of an element effects other elements.

Secondly, systems thinking is about boundaries. It is about defining sets of elements that, at some level, operate in an interacting way (Sparrow 1998). Systems thinking is about identifying meaningful systems and constituencies of elements that can be construed to be combined to some end. When engaged in systems thinking, one is not merely examining how one element affects another, but explores the dynamics of an interrelationship where the very nature of an element changes as it interacts with other elements.

Thirdly, plurality seeking is about recognising wider cultural and historical contexts of interpretations. Events can be located in a larger number of histories. Plurality thinking has an emphasis on multiplicity rather than singularity of meaning.

It is recognised that people engage in less directive thinking on occasions. A second type of thinking is 'autistic' thinking. This is where thinking 'sparks off' from one idea to another. It is neither rigorous nor directional. This less

Appendix B: Sparrows Knowledge Equation

rigorous, non-tested sort of information processing is what is involved in day dreaming (Fournier & Guiry 1993). It is used as part of creativity (Buzan, 1993).

A third type of thinking that people engage in is mood thinking (Kuiken, 1991). Here, people are, in a sense, thinking in circles. The things that sadden them loop their thinking round to further things that sadden them. Thinking is 'locked into' a prevailing mindset. To depict a world where the 'chain' of thinking is singular is to deny a great deal of human decisions and actions. There are three relationships to consider how mood mental material is processed. The first relationship is concerned with pervasive effect. People process pleasant items more efficiently and accurately than less pleasant items (Matlin 1994). The second relationship is the mood congruence effect. This describes the findings that memory is better when the material to be learned is congruent with a person's current mood. Thus, a person in a negative mood may reflect on negative words and events more than positive items. The third relationship is called mood-state dependence. People recall events and items where the mood they were in is the same as the mood they are in now.

This combination of mental material, thought and thinking represent the diversity of cognitive knowledge that Sparrow (1998) rings to understanding of knowledge classification. This allows a facilitator to understand the cognitive schema of knowledge presented in a soft OR situation.

Appendix B: Sparrows Knowledge Equation

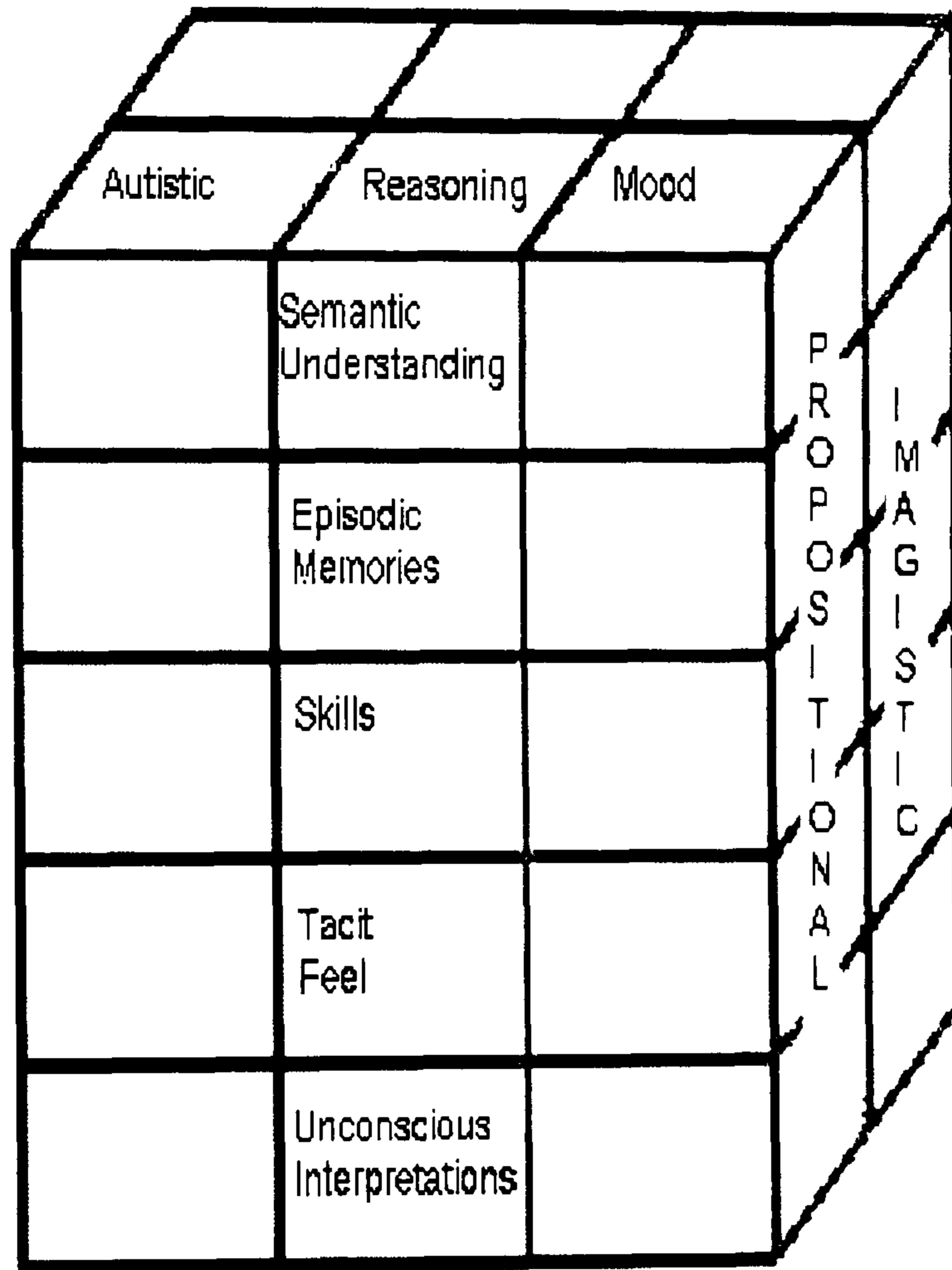


Fig B.1 Knowledge = Mental Material + Thought + Thinking

Appendix C: Decision Explorer Links



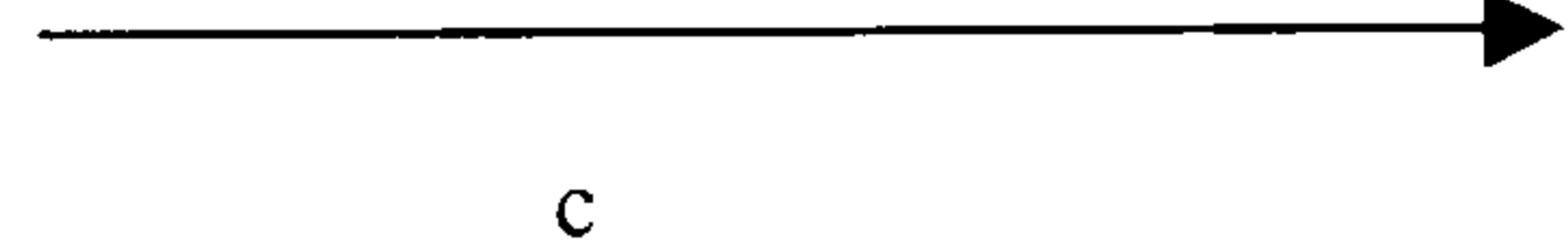
A **strong link** representing a proven, clear and causal link between concepts



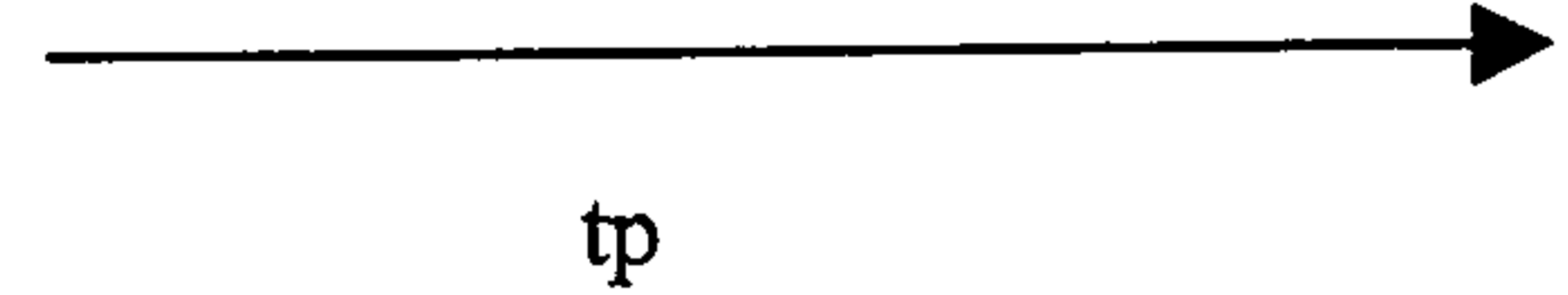
A **causal link** implies that one concept leads to another. A positive link is a plain arrow, whereas a negative link has the presence of a '-'



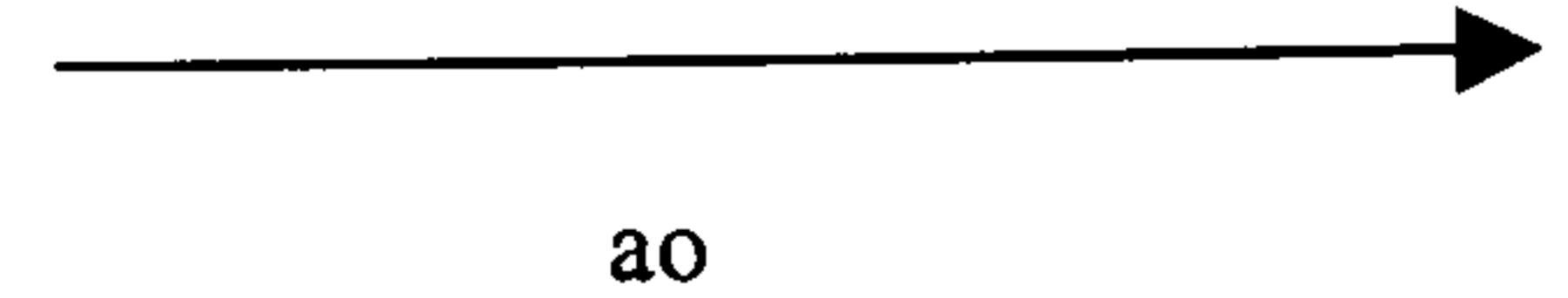
A **connotative link** between two concepts just associates them in some way. These links are bi-directional.



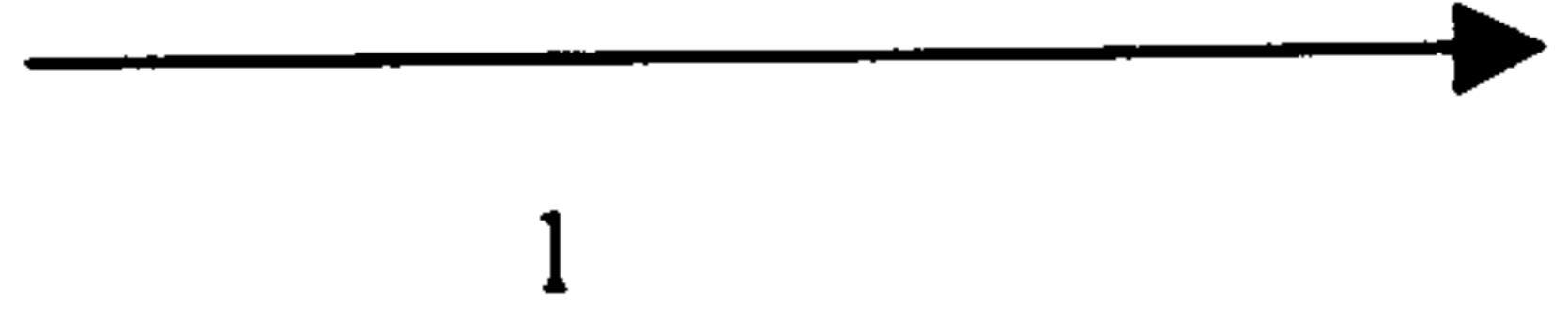
The concept is a **characteristic of** another concept i.e. 'listening' is a characteristic of 'facilitation'



The concept is a **type of linkage**. The concepts are similar and have commonality with a set or group of concepts i.e. a 'congruence map' is a type of 'model'

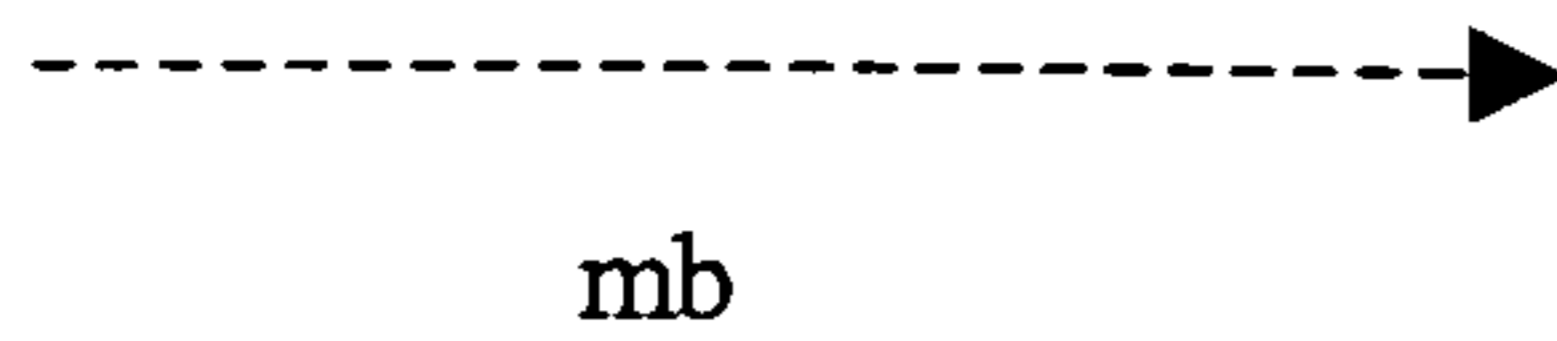


The linkage relates to **action of** between the concepts i.e. 'abandonment' is an action of the 'facilitator'

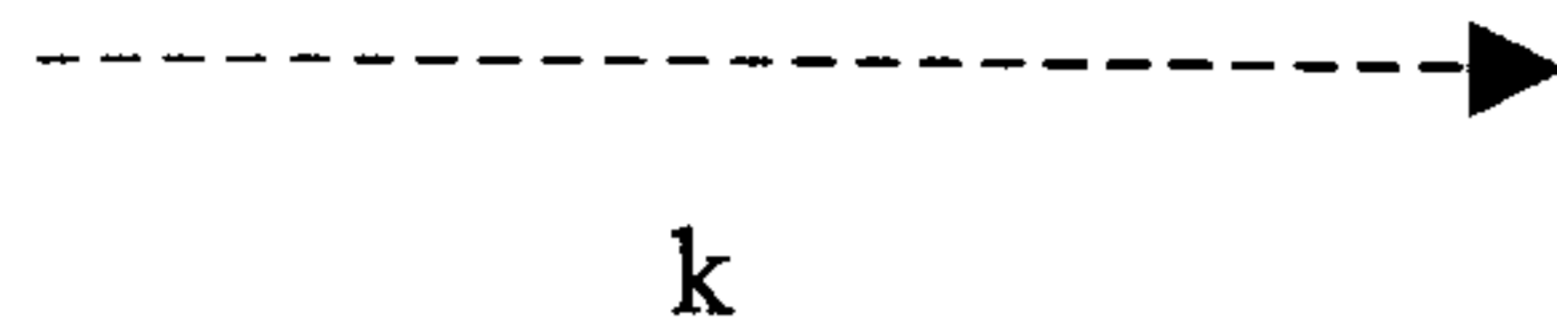


The linkage relates to **leads to** i.e. 'balancing' leads to 'abandonment'

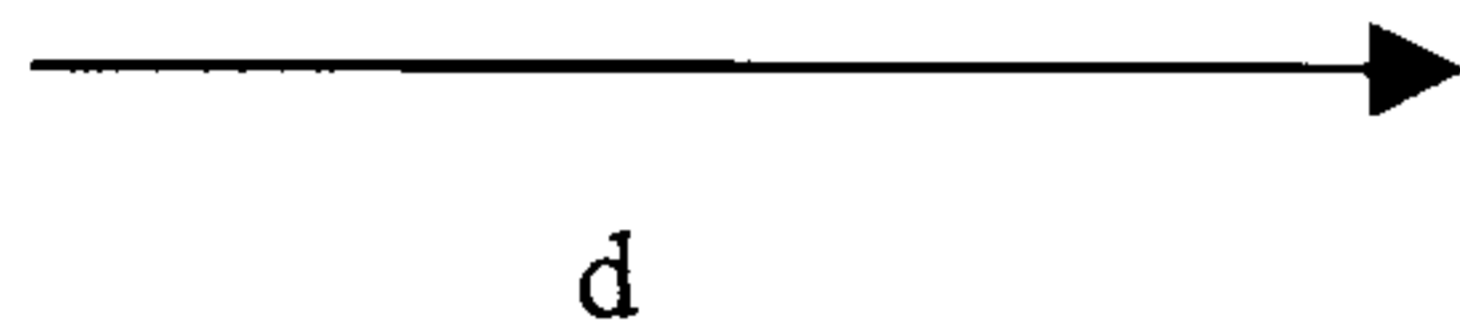
Appendix C: Decision Explorer Links



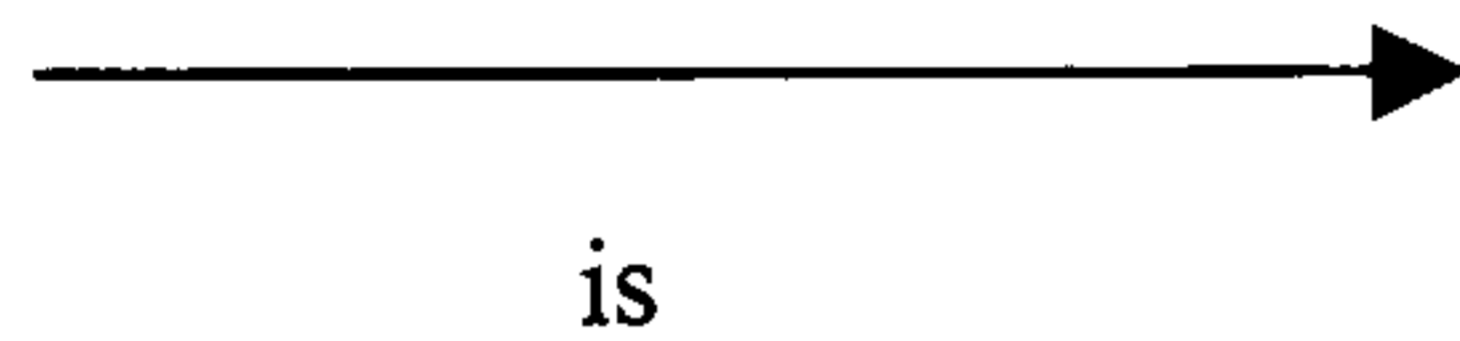
The linkage between the concept **maybe** shows some connection i.e. it is not proven.



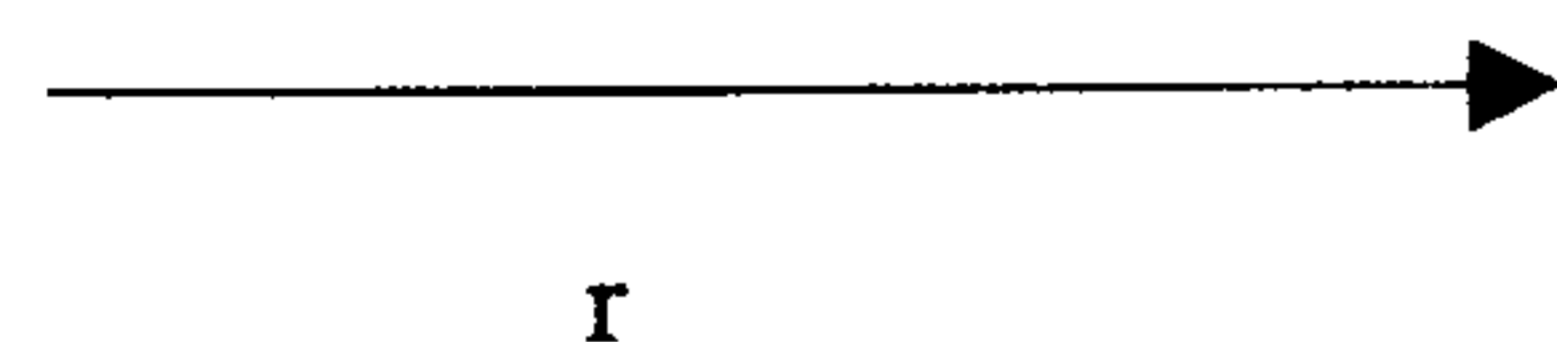
The linkage represents **knowledge access**. This linkage pertains to the concepts of knowledge classified by Sparrow's equation (1998)



A linkage that is about **depends on** i.e. 'transferability' depends on 'conscious knowledge'. A negative relationship is shown with '-' sign.



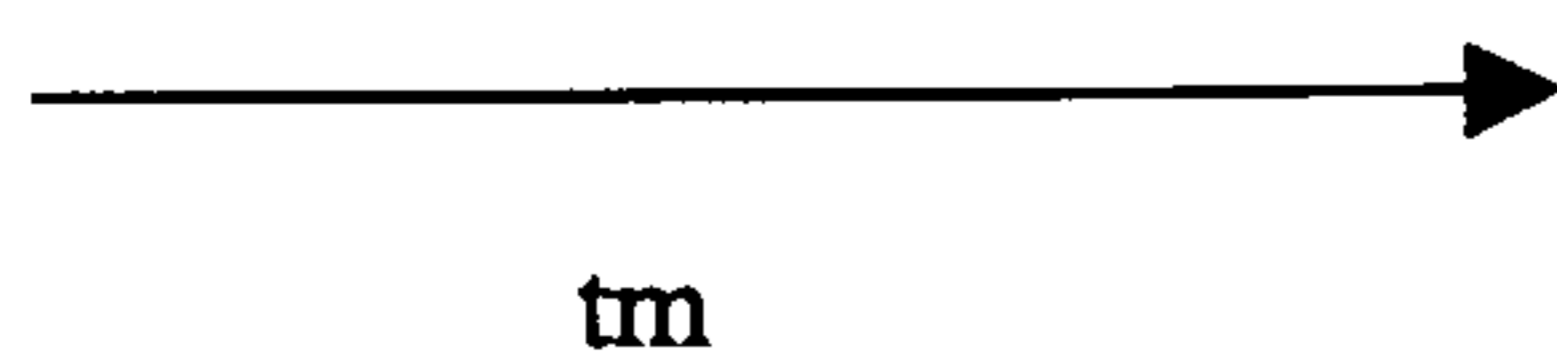
A linkage that is a i.e. 'partial knowledge' is 'conscious knowledge'.



A linkage that is **represented by** i.e. 'semantic understanding' is represented 'radiant thinking'.

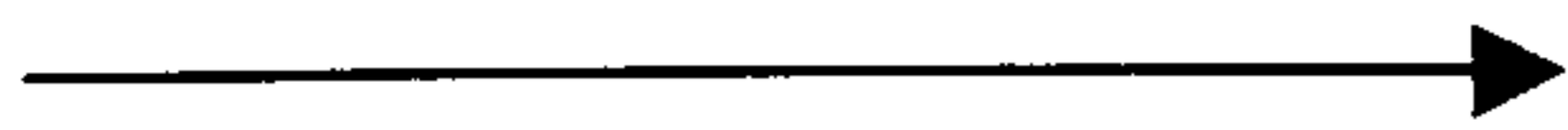


The linkage is **sometimes** i.e. 'Mood' sometimes happens in 'groups'



The linkage relates to **trying to manage** i.e. 'group' trying to manage 'comfort'

Appendix C: Decision Explorer Links



aw

The linkage relates to **degree of** i.e. degree of 'facilitation'



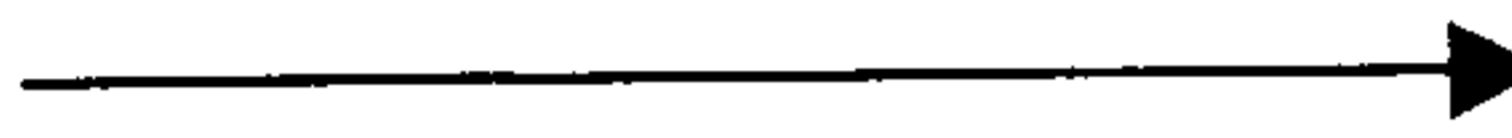
dg

The linkage relates to **aware of** i.e. 'politics' is aware of 'relationships'



i

The linkage relates to **in a** i.e. 'politics and power' in a 'group'



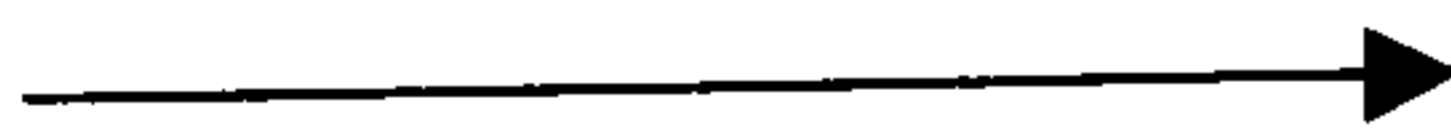
p

The linkage relates to **partial** i.e. 'conscious knowledge' is a partial 'representation of knowledge'



T

The linkage relates to **temporal** i.e. 'knowledge representation' is temporal in 'groups'



mn

The linkage relate to a **manifest** i.e. 'disclosure' manifests itself through 'disclosure'