Dissertations   Student Research

6-1-1987

From manpower to mindfulness: the high tech culture of emergence and its implications for education

Gordon F. Dveirin

Follow this and additional works at: http://digscholarship.unco.edu/dissertations

Recommended Citation

UNIVERSITY OF NORTHERN COLORADO

Greeley, Colorado

The Graduate School

FROM MANPOWER TO MINDFULNESS: THE HIGH
TECH CULTURE OF EMERGENCE
AND ITS IMPLICATIONS
FOR EDUCATION

A Dissertation Submitted in Partial Fulfillment
of the Requirements for the Degree of
Doctor of Education

Gordon F. Dveirin

School of Educational Change and Development

June, 1987

THIS DISSERTATION WAS SPONSORED

BY

Robert F. Ross, Ph.D.
Research Advisor

Gordon F. Dveirin

DISSERTATION COMMITTEE

    Advisory Professor _____
                         I. David Welch, Ed.D.

    Advisory Professor _____
                         Richard R. Bond, Ph.D.

    Faculty Representative _____
                         Robert Reinert, Ed.D.

DEAN OF THE GRADUATE SCHOOL
_____

Examination Date of Dissertation   _May 6, 1987_

ABSTRACT

Dveirin, Gordon F. From Manpower to Mindfulness: The
   High Tech Culture of Emergence and Its Implications
   for Education. Published Doctor of Education
   dissertation, University of Northern Colorado, 1987.

Contemporary educational systems, still burdened by
the mechanistic paradigm of the industrial age which they
continue to express, are contrasted with post- industrial
work settings which embody a new paradigm of creative
emergence. The practical shift described is from an
atomistic, homeostatic mode of learning to a
collaborative and heuristic mode that results in a new
kind of culture.

ACKNOWLEDGMENTS

Telling the story of how one has discovered and
progressed along the path of his or her calling requires
a selection from a greater multitude of influences than
one can easily name or acknowledge. The phrase, "All my
relations," by which the Native Americans traditionally
honored their connectedness and indebtedness to the
totality of life in all of its manifestations is perhaps
still the most economical way of thanking the many,
ultimately mysterious forces that guide one's particular
destiny. Yet, respecting the work at hand, the product
that follows, there are certain individuals who have made
an exceptional difference with their generosity and their
wisdom. To them I would like to specifically express my
sincere appreciation.

Dr. Bob Ross, my research advisor was there to greet
me at the door. From the day I first sought entrance to
the School of Educational Change and Development, the
outstanding program that drew me to UNC, and through the
challenges since that day, Bob has been an inspiring
mentor and a staunch friend. Dr. David Welch and Dr.
Richard Bond have served as members of my resource board
with patient and considered guidance and consistent

support, while permitting me the latitude I needed to pursue my own vision.

Many of the concerns reflected in the following paper grew from my collaboration with Dr. Tom Boldrey, a good friend and colleague who, since completing his doctorate at UNC, has been a compassionate and innovative force in the arena of education for employment.

Those who sponsored and participated in the Storage Tek-State Education Project as fellow learners in the risky business of action research deserve my deep thanks and admiration. Mr. Jim Tuttle and Mr. Lloyd Casey were the spearheads on the Storage Tek side; and Mr. Jim Moore, as director of the Governor's Job Training Office, went to great lengths to win the needed state support. Two other members of that project's advisory committee, Mr. Warren Ziegler and Mr. John Brennan, adult educators of considerable distinction, remain in my life as rich sources of inspiration and as my close colleagues for the work ahead.

I would be remiss if I did not also acknowledge, while introducing a paper on human emergence, those facilitators of my inner work who have brought me closer to understanding the real self, the source of creativity, that resides at the core of fully human experience. I include here the directors of the La Jolla Program of the Center for Studies of the Person, Dr. Bill Coulson,

TABLE OF CONTENTS

LIST OF FIGURES

PREFACE

Even though it no longer fits the world we live in,
who, today, believes that our system of compulsory mass
education <u>can</u> be changed? More importantly still, who
<u>owns</u> the <u>charter</u>, the <u>competence</u>, and the <u>commitment</u> for
changing it? If, with the future of our society at
stake, no ready answer leaps out at us regardless of
where we look ought we not to be growing concerned?

That our present system of schooling, to which we
still willingly consign our children, has grown obsolete
and dysfunctional is an assertion unlikely to provoke a
quarrel from those who are informed. Indeed, such a vast
reservoir of research can now be summoned to support the
need for major educational change that one can only
marvel at the strength of the <u>dam</u> which keeps this
accumulating weight of knowledge from flowing into
action. Is it likely that even <u>more</u> research will cause
the dam to burst; or do we need to look more directly
into the sources of our appalling inaction, the seeming
paralysis that has deprived us of visionary leadership at
virtually every level of educational governance? The
problem is not that we don't know what to do. The
problem is that we don't <u>do</u> it. Why not?

The answer to this last question given by the following dissertation is that the new learning arrangements urgently needed by our society, although integral to the process of innovation upon which we now depend, are still counter-cultural. We who are hopeful enough to act must therefore learn to intervene at a much deeper level than we have yet been prepared for; we must learn how to bring about cultural change.

From a strategic standpoint, we can easily see that the socio-technical foundations of our continuing prosperity are shifting dramatically. New competencies are now required if we are to maintain our position on the high value-added side of worldwide production.

The routine, segmented tasks which were appropriate to the high-volume, standardized mass production of our industrial past are today performed much more efficiently by low-cost labor outside our own borders. Meanwhile, the "covert curriculum" of the nineteenth century school, consisting, as Alvin Toffler (1981) has noted, of three courses--"one in punctuality, one in obedience, and one in rote repetitive work" (p. 29)--remains in place today, even though its originally intended outcome, a pliable regimented workforce of the kind needed for assembly-line mass production, can no longer serve our economic interests. In fact, the persistence of a structurally obsolete workforce is fast becoming a national liability, symptomatic of our decline.

To maintain our competitive advantage in the changed world market, we need new outcomes from education. This strategic consideration once raised, however, immediately encounters, head-on, the resistant fact that "culture constrains strategy," meaning that identification with what worked successfully and repeatedly in the past prevents us from doing something different in the present even though new conditions require fresh responses.

Schein (1985) defined culture as an unconscious pattern of "deeply held, long-standing assumptions, that are "taken for granted because they . . . led to prior successes" (p. 32). The more superficial elements of group or organizational experience, attitude, perception, and structure, may seem easier targets of change; but, as Schein notes in the passage just cited, those elements are:

> in a sense, artifacts of the culture: and if one thinks of changing the artifacts without confronting the underlying assumptions, one will not obtain successful change. The organization will simply revert to its prior way of operating. If a group has had enough of a history to develop a culture, that culture will pervade everything. (p. 33)

Diagnosing and intervening in a given culture, in order to restore to those who are bound by it the possibility of their making new strategic choices, is increasingly recognized as the primary task of leadership (cf., Peters and Waterman, 1982). Schools, plagued by poor performance and yet insulated against the pressures

of competition, are critically in need of such leadership.

The following dissertation does not advance a theory of cultural change. It is not a practical, hands-on model for accomplishing what, in terms of method, still remains more of an art than a science. Nor does the dissertation draw any conclusions about where the new, transformative leadership will come from, although the strongest impetus for a new direction is presently coming from the leading edge of the private employment sector where a new, highly adaptive culture is taking root.

This newer culture, which I characterize in what follows as a "culture of emergence," furnishes by vivid contrast an external or foreign viewpoint from which to fundamentally challenge the older cultural assumptions still embedded in our schools. In setting these two cultures side by side before the reader of the following disssertation, my aim has been to expose and highlight the differences between their respective paradigms so that, on the basis of the understood distinctions, more conscious choices of strategy might be made with respect to changing education. Any action plans inspired by this writing should be developed by those who will own them and carry them out. My own task has been to render the unconscious conscious as a prelude to choice and action.

There are four chapters to what follows. Chapter One explores the cultural pathology associated with the

mechanistic paradigm of the industrial age and relates
that pathology to the malaise in our present system of
education. Chapter Two, a brief history of recent
Western thought, shows how the intellectual foundations
of the mechanistic worldview have been powerfully
undermined in this century by growing acceptance of a new
paradigm of creative emergence. Chapter Three contrasts
the mechanistic culture still embedded in our schools
with the "culture of emergence" exemplified by the high
tech workforce on the basis of their nearly opposite
approaches to learning. Finally, Chapter Four discusses
the phenomenological methodology needed for observing and
understanding culture, explores the structural
differences between a mechanistic culture and a culture
of emergence, and analyzes the socio-psychological forces
that inhibit the process of creative emergence from
gaining widespread acceptance despite our growing need
for innovative competence.

Additionally, I have included as appendices two
previously written papers which supplied much of the
theoretical and empirical framework for the dissertation
and to which it makes numerous references. The first of
these papers, Appendix I, is my final report on the
Storage Tek-State Education Project, an action research
investigation into high tech competencies. The purpose of
this project was to describe the competencies that enable

high tech workers to not only stay abreast of, but to actually guide, the process of technological change.

The collaborative learning environment in which these heuristic, research and development skills (which I describe in the report) are broadly fostered was phenomenologically examined as a source of corrective alternatives to traditional education. The objective of the funding agencies was to discover more effective ways to keep the skills of the workforce current with the rapidly accelerating pace of technological change. Key decision makers from the relevant state agencies were involved (as members of the project advisory committee) so that their assumptions about education and economic development as they relate to employment could be reevaluated in terms of a direct experience of dynamic high technology in action.

My goal, as project director and principal investigator was to shift the <u>attention</u> of these influential decision makers from a narrow concern with the ephemeral kind of data supplied by routine task analysis to the wider cultural characteristics of the new mode of production, so that longer term and more comprehensive strategies and policies might emerge respecting education for employment. The workers and managers who participated in the study were responsible for a world-class breakthrough in thin film technology and thus qualified as exemplars of the innovative

capability which must now become the new backbone of our workforce.

The last paper included in what follows, Appendix II, is entitled, "The Politics of Quality: Restoring the Within of Work." I include it here becuase it captures the vision that guided subsequent stages of my work, and because it renders those subsequent stages more intelligible to the present reader. What I initially recognized in the small group structure known as the Quality Circle, which had only recently become inter-nationally important, was a social innovation that held major implications for the humanization of both work and learning (which are increasingly becoming synonymous). Some of those implications are elaborated in that paper, including the shift in the role of the worker from job performer to job designer.

What the main body of the following text, the dis-sertation, and its two appendices have most directly in common is a concern for those conditions which either empower or disempower learners. Between these two extremes, there is no neutral ground. Simply put, these are the two alternatives that we as a society must now choose between.

The future of work and learning, which is the critical concern in what follows, lies not in the domain of knowledge but rather in the domains of choice and action which we exercise in the present and guide by our

intentions. I do not believe that such choice and action should be attempted without, first, a very wide as well as deep consideration of the relevant issues.

CHAPTER I

BEYOND THE REDUCTIONISTIC FALLACY: THE TRANSFORMATION OF INDUSTRIAL-AGE THINKING AND ITS APPLICATION TO EDUCATIONAL SYSTEMS

There is a joke about a Chinese puzzle: when you put in the last piece--it blows up. Western industrial culture has been, until very recently, just such a puzzle, sustained in its mechanistic intricacy, cohesion and power only by the singular omission of its last, most complex piece--our own essential human selves.

How, particularly in the domains of work and education where conflicting human and the mechanical principles intersect, we managed this considerable feat of <u>collective self-dissociation</u> is a question to which we did only partial justice in this paper. Rather, the main focus was on the conditions now contributing toward, but by no means insuring, <u>a historical reversal of this situation.</u> Suffice it here to note that, in the detached technocratic posture we have assumed toward <u>our-selves</u> throughout the industrial era, we have substituted for an adequate awareness and appreciation of our own <u>being</u> such callous self-objectifications as "man-power," "human resources," and "human capital,"

hard-sounding terms which mask a soft, inexact kind of thinking.

These astonishingly reductive concepts are the surrogates that we have used for ourselves in order to frame with maximum leverage the basic institutions of our now-declining industrial order. That they are still a part of established contemporary usage, defining the bureaucratic stance toward work and education, and that they awaken so little objection or evident repugnance from us, is a measure of how far we have yet to traverse as a society toward conscious self-recognition. Something very close to home, in other words, has been left out of our social architecture; namely, its conscious inhabitant. This is what has given our society the semblance of a Chinese puzzle.

Were we now to insert the last piece--and the thesis in this paper is that we now must, for purely practical reasons--the result would not be merely additive: it would be transformative, like fire added to dynamite, exploding a false, closed order in favor of one much more open and spacious that might actually begin to accommodate the richness of the fully human.

The indicator of this new state of affairs would be a shift in the major focus of our collective concern from things to persons, and a consequent redirection of our energies from manpower development or human resource development to human development.

The difference between these alternative approaches to socialization resides in the respective points of view from which persons are thereby regarded. "Manpower" and "human resources" denote things or exchange values not centered in themselves but malleable and subservient to those who use them. As conceptual instruments of technical reasoning they are the products of viewing persons from a purely external standpoint, from outside the human condition. The powerful leverage acquired from this alien stance toward ourselves is won at great expense; for it enables us to exploit ourselves as though we were indeed things, moving parts of our own machinery or, at best, its software.

This parallels the alien posture we have assumed in modern times toward nature, which we have intellectually reduced from a whole and living balance to an aggregation of natural resources passively awaiting our exploittation. By thus abstracting ourselves from the biosphere upon which our own lives depend, we have habitually acted with both great manipulative strength and suicidal insensitivity toward our environment. The wanton destruction of the Amazon now in progress, with its global implications, is only the most blatant contemporary example of this blindness. Treating ourselves as human resources, standing equally passive and ready to be commanded, has required only a further extension of this same attitude.

A concern for human development, in contrast, stems from an ecological rather than exploitative perspective toward ourselves--one that traces the consequences of our activities back to us and takes careful account of their effects upon us. As viewers, we here stand fully within the circle of our own activities, recognizing that whatever we do as human participants also does something to us, not simply after, but even while, we are doing it. Lifting weights modifies our muscles. Reading books modifies our experience. Solving problems stimulates our creativity. Dull routine deadens our spirits.

This kind of human cost accounting, or human resource ecology, about which more will be offered here presently, enables us to distinguish between activities which enrich us and those which diminish or deplete us. Without such discernment, which is simultaneously sensitive to both the subjective and objective poles of our encounter with the material world, we cannot humanize our institutions of work and education so that they become the means of our growth and renewal rather than instruments of sacrifice sustained by extrinsic sanctions and rewards.

That they have often been the latter, reducing us to the status of "means in the service of means" throughout our recent history has been easily understood by those for whom detached, technical reason has not constituted a self-sealing worldview. Pius XI, for example, protested

that " . . . from the factory dead matter goes out improved whereas men there are corrupted and degraded" (Schumacher, 1975, p. 37). Marx (1906), who diagnosed the collective illness of his day as the alienation of labor, asserted that:

> Modern industry, indeed, compels society, on the penalty of death, to replace the detail worker of today, crippled by lifelong repetition of one and the same trivial operation, and thus reduced to the mere fragment of a man, by the fully developed individual . . . to whom the different social functions he performs are but so many modes of giving free scope to his own natural and acquired powers. (p. 534)

Paul Tillich (1952), documenting the Existentialist revolt in which he counted Marx a participant, noted that:

> It was the threat of an infinite loss, namely the loss of their individual persons, which drove the revolutionary Existentialists of the 19th century to their attack. They realized that a process was going on in which people were transformed into things, into pieces of reality which pure science can calculate and technical science can control. (p. 137)

That we have to a great extent capitulated to this kind of control, either unconsciously or with a measure of "quiet desperation," indicates the neurotic degree to which we have valued safety--even the paradoxically self-obliterating safety--of a predictable mechanistic order over the exercise of individual freedom with all the anxiety-provoking, undefined space the latter entails as

its condition. It is, as Tillich (1952) notes, ". . . a symptom of the neurotic character to resist nonbeing by reducing being" (p. 141).

Erich Fromm (1969) has similarly observed in our culture a tendency to "escape from freedom" through the twin avenues of <u>obedience</u> and <u>control</u>, which stand in marked contrast (as shown in Figure 1) to creative <u>participation</u> in the direct encounter with the unknown. In the movement toward its apex, Figure 1 (my own adaptation of Fromm, 1969) graphically represents the major theme of this paper, the direction of fully human emergence. Here we are trying not to explain, but to describe, a situation that has until quite recently permitted us to tip the balance between the subjective and objective poles of our nature almost exclusively to the side of the latter. The consequence, as Tillich (1952) has noted, is that:

> Twentieth-century man has lost a meaningful world and a self which lives in meanings out of a spiritual center. The man-created world of objects has drawn into itself him who created it and who now loses his subjectivity in it. He has sacrificed himself to his own productions. (p. 139)

Carl Jung (1968) traced this condition back to the Christian roots of the Western psyche and to the belief that everything good is outside of us: "With us, man is incommensurably small and the grace of God is everything; but in the East man is God and he redeems himself" (p. xxxiv). The fundamental difference between East and

participation
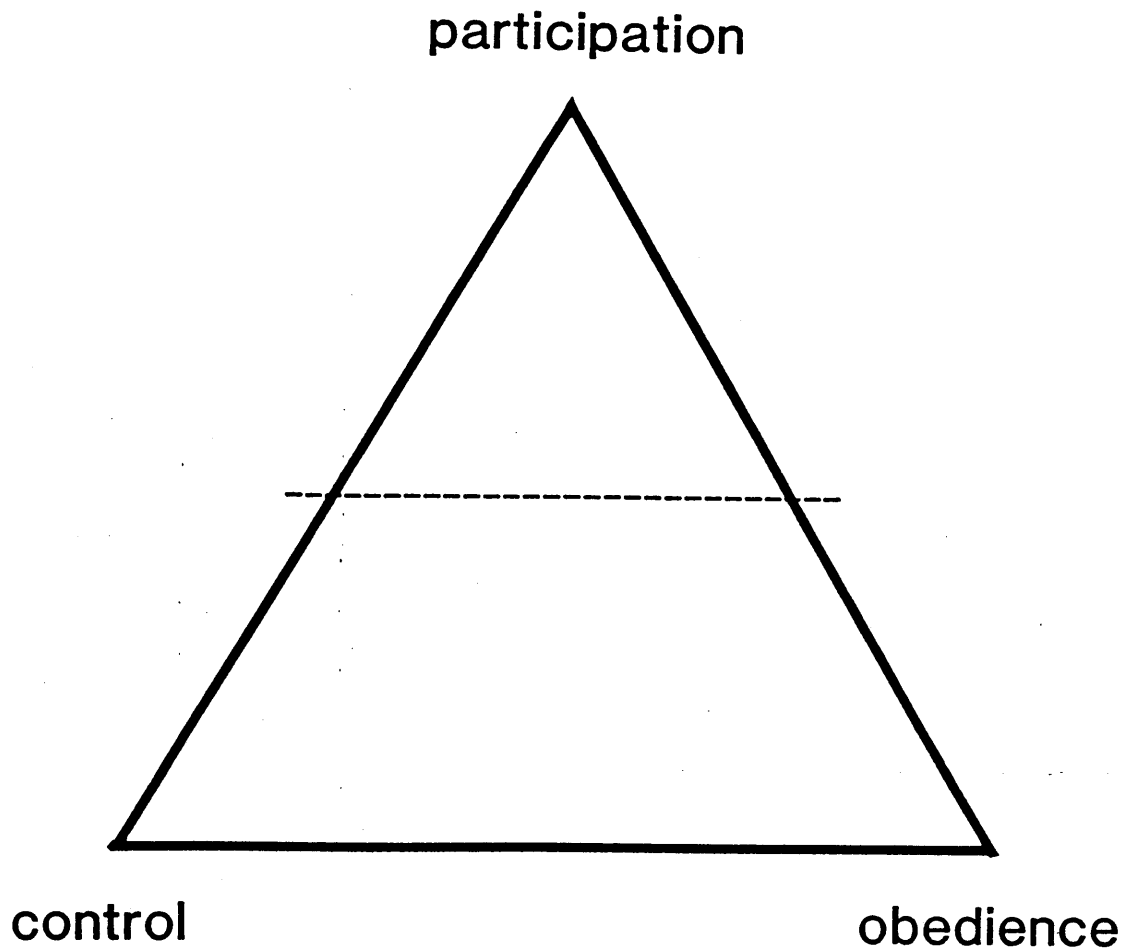
control   obedience

Figure 1.   The escapes from freedom (obedience and
             control) and their transcendence (partici-
             pation).

West, in Jung's view, is the difference between intro-
version and extraversion, respectively. The extraversion
of the West, Jung maintains, " . . . goes hand in hand
with mistrust of the inner man, if indeed there is any
consciousness of him at all" (p. xvii).

If this last inward piece of our occidental puzzle
or, to change the metaphor, the key to our wholeness, is
still missing it is because we are like Nasrudin in the
Sufi story: Nasrudin lost his key inside his house; but
he looks for it outside--"because there is more light
there" (Shah, 1972, pp. 26-27). The effects of this kind
of inappropriate overvaluation of the external world and
the dissociated intellect upon the Westerner, including
the post-Christian Westerner, are characterized by Jung
as follows:

> By fear, repentance, promises, submission, self-
> abasement, good deeds, and praise he propitiates the
> great power, which is not himself but totaliter
> aliter, the Wholly Other, altogether perfect and
> "outside," the only reality. If you shift the
> formula a bit and substitute for God some other
> power, for instance the world of money, you get a
> complete picture of Western man--assiduous, fearful,
> devout, self-abasing, enterprising, greedy, and
> violent in his pursuit of the goods of this world:
> possessions, health, knowledge, technical mastery,
> public welfare, political power, conquest, and so
> on. (Jung, 1968-2, p. xxxvii)

The East, in contrast, less afraid of the inner void it
knows we cannot fill from outside ourselves, looks within
for the sole cause of what Jung deems our higher de-
velopment and self liberation.

The condition that we have been describing thus far, the withholding of the last piece from the construct that is our perceived world, is not simply a cultural blind spot. From a psychological standpoint, it can also be considered pathological. Alexander Lowen (1983), who has professionally treated this kind of imbalance in his patients, noting its marked increase over his forty years of practice as a psychotherapist, has attributed it to our cultural narcissism: "on the cultural level, narcissism can be seen in a loss of human values--in a lack of concern for the environment, for the quality of life for one's fellow human beings" (p. ix). The Cartesian cogito or ego, cut off from its contact with the body and from the feelings which reside in the body, becomes identified almost exclusively with its outward image--especially with the appearance of power and control that the detached intellect can project as it successfully manipulates the objective world. Instead of mediating between external events and internal reality, the ego, together with its associated apparatus, loses its permeability to self and world.

> By dissociating the ego from the body or self, narcissists sever consciousness from its living foundation. Instead of functioning as an integrated whole, the personality is split into two parts: an active, observing "I" (the ego), with which the individual identifies, and a passive, observed object (the body). (Lowen, p. 30)

By characterizing this as a cultural condition, Lowen suggests that what holds true in relation to the body also holds true in relation to the body politic. It is our estrangement from and external manipulation of the latter body (of our collective being) that concerns us here.

If we are driven in this alienated state, as Jacques Ellul (1964) has most notably maintained, by a technological imperative (technique) that systematically reduces our collective decision-making to the criteria of technical feasibility and maximum efficiency, then the wider and higher claims of our personhood have already been forfeited to a dissociated and hence sub-human aggregate ego. Something automatic and totalitarian in its implications, mechanical rationality rather than reason, has usurped the place of our integral being.

Our defense establishment, as simply one example of this non-human or mechanistic mode of thinking, has wasted billions on tanks, planes and other equipment that cannot be operated because "human factors" were not considered by the designers before production (Cordes, 1985). This kind of thinking which fails to distinguish between human and mechanical levels of being, extends far beyond weaponry into our defenses against our own higher nature, as the concluding chapter will elaborate. Even with the wide acceptance presently enjoyed by general systems theory, strategic planners still do not calculate

the complex system which we ourselves constitute as part of the larger system that we indwell.

Consequently, if our collective behavior falls beneath the standards of wisdom observable in our most highly realized individuals, if our social organizations behave regressively or mechanically as though they know less than their members, it is at least partly because the body politic--with its awareness cut off beneath the neck--also feels less than its members. This larger pattern in turn, and quite isomorphically, must affect the individual members. It is especially noteworthy in this regard, that Lowen (1983) has observed a dramatic change in his clinical practice over the past forty years:

> The neuroses of earlier times . . . are not commonly seen today. Instead, I see more people who complain of depression; they describe a lack of feeling, an inner emptiness, a deep sense of frustration and unfulfillment. Many are quite successful in their work, which suggests a split between the way they perform in the world and what goes on inside. . . . Their performance--socially, sexually, and in the world--seems too efficient, too mechanical, too perfect to be human. They function more like machines than people. (p. x)

This narcissism of the individual, in Lowen's view, parallels that of the culture, which we shape according to our image and which in turn shapes us. Can it be that the increased incidence of the personality problems Lowen has noted, especially in those counted most successful in this culture, is a sign that we are reaching the

psychological limits of a notion of work divorced from any connection with the intentionality of the human spirit and buttressed solely by external sanctions and rewards? Can it be that the stunning evidence of our outward success in technical mastery and material self-aggrandizement is merely, as Lowen suggests, a joyless, cosmetic gloss ineffectively masking a yawning abyss of emptiness, meaninglessness and depression that, despite our intensified escapism (e.g., the ubiquitous drug and alcohol problems in school and business), increasingly shows through?

If this analysis of our psychic economy is at all accurate, it could well indicate that we are reaching the end of an era, and the collapse of the meanings upon which that era was founded. As Kenneth Boulding (1966, p. 62) has noted, the social image that gives a society its distinct pattern goes through three stages of disintegration. In the first, unself-conscious stage, people believe in it. Later, as alternatives become visible, people now self-consciously believe in believing in it. With strict economic necessity no longer compelling us, this is probably the stage we have now reached in the consumer phase of advanced capitalism with its associated disorders. From here, it is only a short step to not believing in the social image at all (the final stage of disintegration). Only the shell remains.

Lowen does not examine the theological implications of the phenomenon he records, but he does note that along with the rise of narcissistic disorders there has been a correspondingly marked decline of neuroses characterized by guilt and anxiety. These latter afflictions have historically been the psychic fuel upon which the Protestant work ethic has flourished. Prior to the Reformation, those afflictions could be treated by the Church and its sacraments; but once Calvin's doctrine of the elect was accepted, those traditional avenues to grace, in fact all avenues according to Max Weber, were forfeited. Consequently, as Harvey Cox (1966) expands upon Weber:

> There was no way to propitiate God. So now the energy which man had previously poured out in supplication and sacrifice had to be redirected in what Freud would call an act of massive sublimation. Religious fervor was rechanneled into energetic work in the world. Together with the invisible hand of the Laissez-faire market, it provided the motor for the rise of capitalism, and the industrial revolution. (p. 186)

This process of secularization has not, however, completed itself. Instead, the job has taken on a cult value, has become in Cox's view an object of spiritual devotion, in fact a religion, even at a time when it has ceased to make sense as a means of distributing income.

Largely because of increasing automation, "there is lots of work to do but not enough jobs to go around, and . . . there probably never will be again" (Cox, 1966,

p. 182). Why do we not, therefore, discover alternative
means of making an income available to everyone, and why
do we not redefine employment as making what one
considers a worthwhile contribution to society? At the
same time, why don't we eliminate or automate the
drudgery that remains?

> The reason we don't is that the job is our cultus;
> we have the same need to include everyone in it and
> to punish those outside that has characterized the
> true believers in all religions. We must now press
> further the secularization of work . . . when it is
> separated from strictly market requirements, full
> employment immediately becomes a rational possi-
> bility. It means the application of the human
> desire for self-expression, achievement, and
> cooperation to the vast amount of work that still
> needs to be done in education, conservation, social
> work--the areas we now call the "public sector."
> But now this can be done by matching types of
> interest with needful projects, bypassing the
> tyranny of the market. (Cox, p. 187)

What Cox is referring to is a means of reconnecting us,
through work, to a meaningful relationship with each
other and with our world. So long as the job remains a
fetish, an opaque but socially obligatory mask that alone
admits us to the "kingdom of consumption," we have the
basis for the narcissistic situation; for, to the degree
that we are successful, the mask becomes our identity and
relieves us not only of guilt and anxiety inwardly but
also of any genuine relationship between our own inten-
tionalities and the world. This is the situation that,
in its unreality, verges according to Lowen on the
psychotic and, for him, typifies our era. Is this the

situation toward which we still direct our children in our uninformed concern for their future employability, and toward which we still mold our workers as we "train" and "retrain" them? If so, we need to become better informed about the choices that now lie before us.

Even, however, as we have taken this rearward view, both the technological and the religious foundations of work are shifting radically, moving us toward the emergence of new meanings while leaving in their wake an image or paradigm of human endeavor that has lost both validity and vitality and a corresponding set of institutional arrangements that no longer fit an emerging context we have yet to fully recognize and own.

It has been said that whoever first discovered water was most certainly not a fish. To be thoroughly immersed in a situation is to be unconscious of it. Only as one emerges is the situation possible to apprehend. What is novel about the period we are entering is that we are not merely stepping out of an older set of conditions and assumptions with which we were identified and to which we still cling for security. We are not simply exchanging one set of contents or routines for another. Rather, we are entering a period of pervasive and accelerating de-routinization that invites us to become newly identified with the process of emergence itself. This is the shift our title describes, from manpower to mindfulness. While this shift alone may not accomplish the full work of

humanization, it is a large and necessary step in that direction and one that the lines of force now directing our historical path will not easily allow us to forego.

Ours is a society in such swift transition that it has already outpaced its own chief means of socialization and enculturation--its system of schooling. This means that preparation for, is no longer congruent with what is increasingly required for meaningful participation in, the newly central aims and activities becoming embedded in an essentially changed mode of production.

With advancing high technology as its wedge, the widening breach between industrial-age schooling and post-industrial work is leading to almost certain disenfranchisement for those who cannot leap across it; and their numbers can be expected to grow. The spectre of a permanent workless class, lacking the skills necessary for employability, already looms on the horizon. The costs in terms of individual lives wasted, collective human potential unrealized, and social stability endangered are neither difficult to predict nor comforting to contemplate.

Yet these unwelcome indicators are symptomatic of our having reached a point of radical discontinuity in our history that holds some far more hopeful possibilities, if we can overcome what amounts to a momentous cultural lag. We have moved a foot forward; but our weight has not yet shifted from the foot that

remains behind. The required shift must occur (a) at the level of our interpretive framework or paradigm so that we can apprehend clearly, (b) at the level of our typical practices so that we can act appropriately, and (c) at the level of our organizational arrangements so that, in our complex social systems, we can act in concert with one another in ways that are productive and fulfilling.

The paradigm shift called for is from a world viewed in terms of mechanism to one that is understood hierarchically as a process of creative emergence. The practical shift required is from the indoctrinating methods used for rote learning to the heuristic (discovery) process of learning we now associate with science. Finally, the organizational shift needed is from an exclusively bureaucratic framework to the integration within that framework of flexible and democratic communities of learners exercising among themselves and as individuals a large measure of self-control. There are also profound individual changes that need to occur; but these involve the work of inner realization that goes beyond the descriptive scope of this paper.

Our main argument in this paper is that the first three of the above shifts or transformations, which we have italicized, are already in progress and can be especially discerned at the innovative cutting-edge of high technology. For a description of a phenomenological

investigation that supports this thesis, see the report on The Storage Tech/State Education Project, Appendix I. It is this essentially new research and development config- uration, now integral to the process of technological change, which is destabilizing nearly every other form of employment as well. Its distinguishing features are (1) the rapidity of systemic changes issuing from its innovative thrust, (2) the complex nature of its roles and tasks, and (3) the acute interdependence of its participants as they are moved from an adaptive to a collaborative/transformative position by their shared climate of instability. For the isolation of these three factors and an account of their consequences I am indebted to Marshall McLuhan (1964, pp. 300-311).

Taken together, these socio-psychological, as opposed to purely technical, phenomena--i.e., change, complexity and interdependence--account for the driving force behind a nascent culture of emergence. The higher level of integration and consciousness this new culture requires reverses the earlier tendency toward human self-objectification (dehumanization) and mechanicalness that characterized the culture which preceded it.

This latter culture, however, a vestige of the now-receding industrial age, still typifies our schools, rendering them anachronistic and dysfunctional (i.e., de-humanizing) to those they serve. As mass replication or programming efforts, they still fail to distinguish

between the standardized learnings they seek to impart and the process of learning itself, which is of a higher order and constitutes a metacurriculum not yet in place.

Consequently, schools alienate learners not only from themselves and from their own inborn curiosity (Holt, 1964), but also from the concrete world with which they might be creatively interacting if the full cycle of possible learning styles could be made available to them. This full learning cycle, as conceptualized by David Kolb (McCarthy, 1980, pp. 22-23), moves from (a) personal involvement with concrete experience, to (b) reflective observation about that experience, to (c) abstract conceptualization, to (d) active experimentation. The last step begets a new concrete experience; and so the cycle becomes a spiral of discovery and emergence.

Looked at in the round, this cycle demonstrates what Jung (1970, pp. 6-7) saw in all such circular mandalas, i.e., an image of integral human wholeness. Encouraging this kind of development is another way of getting at what we mean by metacurriculum. It leads to what Maslow (1975) called the creative attitude:

> Creating tends to be the act of the whole man (ordinarily); he is then most integrated, unified, all of a piece, one-pointed, totally organized in the service of the fascinating matter-in-hand. Creativeness is therefore systemic; i.e., a whole-- or Gestalt--quality of the whole person; it is not added-to the organism like a coat of paint, or like an invasion of bacteria. It is the opposite of dissociation. Here-now-allness is less dissociated (split) and more one. (p. 69)

However, dissociation, the loss of being, wholeness, spontaneity and presence, is the hallmark of the industrial culture we have been describing. Because the school as the institutional vestige of that culture exclusively favors only the second and third quadrants of the above-mentioned learning cycle, leaving out the person who feels, imagines, intuits and actively experiments, the result of contemporary education is unbalanced development. We are systematically restricted by conventional schooling to a fraction of our available faculties and deprived of the potential for synergy that exists among these faculties when they are permitted to operate in a concerted manner. As with electricity, our own power and aliveness come not from an arc but from the completed circuit, i.e., the movement around the four quadrants, which Jung (1970) (in the alchemical context of human transformation symbolized by the mandala) calls the circulatio.

Compare the following diagnosis, based on a synthesis of Kolb, Piaget, Jung and other learning theorists, with the analysis by Lowen cited earlier:

> The exclusive focus on the intellect (the thinkers) in our schools, and the almost exclusive focus on the reflective (the watchers), has resulted in a false dichotomy, a dichotomy between what minds think and what bodies feel.
> It is almost as if we educators expect our students' brains to separate from their bodies and float outside (and incidentally above) their bodies, to gaze reflectively not at reality but at abstractions.

> This is nonsense, and we all know it is nonsense, yet we continue to attempt it. We continue to ignore the concrete and active dimensions of learning in favor of the abstract and reflective. (McCarthy, 1980, p. 61)

If creativity is indeed the opposite of dissociation, and if changing technology requires us to be creative; if wholeness requires a balance between the abstract and the concrete, we are clearly as humans on the wrong track as far as schools are concerned.

A. N. Whitehead (1953), more than half a century ago, described this same imbalance, "the celibacy of the intellect," as follows:

> What I mean is, that we neglect to strengthen habits of concrete appreciation of the individual facts in their full interplay of emergent values, and that we merely emphasize abstract formulations which ignore this aspect of the interplay of diverse values.
> . . . . The general training should aim at eliciting our concrete apprehensions, and should satisfy the itch of youth to be doing something . . . . In the Garden of Eden Adam saw the animals before he named them: in the traditional system, children named the animals before they saw them. (p. 198)

These insights could be multiplied endlessly from many sources (e.g., Adler, 1982; Bloom, 1981; Dewey, 1926; Freire, 1983; Goodlad, 1984); but they appear thus far to have had little effect on standard practices. Why should this be so? It is because these analyses are based on an understanding of whole persons as active, self-motivated learners, not as programmable units of mechanical intellectual performance. These analyses do

not fit a mechanistic system that continues to leave out the last piece, the human center; and they cannot penetrate a social image or paradigm based upon such a system. The receptivity needed has been lacking.

A paradigm shift, however, cannot be forced. What ultimately undermines a given, particular paradigm is (1) a growing body of anomalous experience that it cannot make sense of, and (2) the simultaneous emergence of a new paradigm which can accommodate such experience and give it meaning. Without a suitable alternative, the old framework, no matter how dysfunctional, will persist. The breakdown of the old and the breakthrough to the new must occur together; and the same dynamic tends to hold true for institutional change.

Thus, it is noteworthy that the old work/education nexus (i.e., employability), in the context of rapid technological change, is becoming a source of problems that schools designed for the uniform and stable requirements of the industrial age cannot resolve. Their reductionistic model of the person as a unit of manpower is inadequate to the new human requirements.

Meanwhile, however, alongside this breakdown in the efficacy of the schools, is an expansive ferment of social innovation that is converting the post-industrial work institution into a prototypical solution--a new kind of school for change agents. The metacurriculum still missing from our traditional schools and, by definition,

from the traditional training functions in business and industry, is now prefigured by this growing culture of emergence whose outlines are just becoming visible in the configuration we call high tech.

We do not mean to indicate that this is more than a beginning. Many elements of fully-human functioning still needed for optimum creativity have yet to be attended to and integrated. However, it is this cultural shift to a higher level of learning, not merely an incremental change in content, that defines the future path of educational change.

There is really no point where schools are concerned in rearranging the elements inside the old box, the old culture, while leaving the latter unchanged. Even though schools are perhaps the most intransigent of all institutions, the box itself is what needs to be substantively transformed: we need to open it in order to open ourselves and realize ourselves in a context of accelerating change. To remain shut up within self-sealing routines under present conditions is, if not suicidal, at least self-defeating.

Let us summarize our argument thus far. The industrial order now in decline was characterized by a social image that reductionistically omitted those characteristics of the fully human which surpass the merely mechanical. It objectified persons, affecting them in the adverse ways we have discussed. The result

has been a psychic and material economy based on the sacrifice of our most essential human attributes.

Our schools are still based on this social image, producing the same adverse consequences. Meanwhile, however, our mode of production has evolved to a higher level of complexity and integration that requires and facilitates the emergence of the more fully human. The dissonance between these two diverging systems is building pressures that must ultimately drive the society as a whole to the higher level unless regressive options are deliberately chosen.

To discern the shift now occurring, we must compare the larger patterns displayed by the mechanistic and emergent cultures at the interrelated levels of (a) interpretive framework (social image or paradigm), (b) typical practices, and (c) organizational arrangements. We will examine each of these levels in turn as we proceed.

While it is the first of these aspects which largely governs what and how we perceive, it is normally the last to be transformed. Behavioral change precedes attitude change; exploration precedes evolutionary adaptation; a critical mass of anomalous experience precedes the shift to a paradigm that can account for it. Meanwhile, the older framework operates as a filter, limiting apprehension of the emergent situation. What we ultimately experience as change is the shift in awareness and sense

of identity that accompanies acceptance of a new
interpretive framework; and the teachable moment when
this change occurs is difficult to predict.

CHAPTER II

REDISCOVERING THE OPEN-ENDED HIERARCHY OF THOUGHT

Our recent intellectual and cultural history has
tended to subvert the mechanistic paradigm of the
industrial age and pave the way for the emergent paradigm
that will replace it. This history itself exemplifies
the phenomenon of emergence, the evolutionary process
through which the inquiring mind progressively dis-
identifies from its previous contents and thus frees
itself of a particular set of self-imposed and self-
limiting boundaries.

We began the preceding chapter by alluding to a
Chinese puzzle. This metaphor applies not only to the
social machinery and social image of the industrial age
but also to the mental model of the world that science
(prior to this century), was able to posit, regard and
manipulate as though it were reality by deftly leaving
out of its construction the scientist herself or himself
as a person. With the absence of this explosive last
piece, the world appeared as a stable, well-regulated
machine whose clockwork behavior could ultimately be
reduced to a set of understandable laws. While the thing

itself, the puzzle, still held its mysteries, it seemed
ultimately solvable and knowable.

Of course, we all know what happened in this, our
own century. The straining for a solution at the sub-
atomic level unwittingly introduced the last piece; and
that last piece was ourselves, which blew the whole thing
in its very "thing-ness," i.e., the notion of a stable
world completely innocent of us, apart. Such a world
might exist, but we could not directly, "objectively,"
encounter it; for the observer always modified the
observed, as did Heisenberg's gamma rays when the
electrons those rays alone could locate were unavoidably
pushed out of orbit by the encounter.

"What we observe," wrote Heisenberg, "is not nature
itself, but nature exposed to our method of questioning"
(Heisenberg, 1958, p. 58). A few years previously
(1938), Einstein had written that " p hysical concepts
are free creations of the human mind, and are not,
however it may seem, uniquely determined by the external
world" (p. 31). What we were seeing, then, was not the
world, which in itself remains ultimately hidden from us,
but ourselves in interaction with it.

Whether we see light as waves or as particles, it
now appears, depends upon our mode of viewing; but
without an interpretive framework we do not perceive at
all. As the art critic, E. H. Gombrich (1969) has
written, "The innocent eye sees nothing" (p. 298).

This growing self-consciousness about our own role in representing the world we perceive, which enables us to emerge from representations we have previously taken for reality, is perhaps what most distinguishes this century from the one that preceded it. At the intellectual level, through a process of progressive dis-identification, we have been making significant advances beyond the mechanical principles which have governed us.

Thus, biological research on brain structure led J. Z. Young (1960) to conclude that " . . . the plain, commonsense world of hard material facts . . . is a construct of our brains" (p. 116). Anthropological research similarly revealed the effects of cultural differences upon our experiences and behavior. The metalinguistics of Benjamin Lee Whorf (1956) disclosed language--the very substance of thinking--as a tacit categorization of experience or "organ of the mind," that functions largely unconsciously to shape our experience. Time, for example, is understood differently by a Navajo and an Englishman because of their differing linguistic orientations to verb tense. "The fact of the matter is that the 'real world' is to a large extent built up on the language habits of the group," wrote Edward Sapir (1963, p. 158), advancing the same thesis as Whorf. Alfréd Korzybski's (1933) comprehensive system of general semantics summarizes this kind of insight with the following premises: (a) the map is not the territory;

(b) the map does not represent all the territory; (c) the map is not a map of the territory but a map of the mapper himself in interaction with the territory. An additional premise ought to be that we live for the most part unconsciously, in our maps, and not in the territory.

This subjectivity lurking behind the practice of science was already glimpsed a century ago by the wife of a prominent Victorian scientist, herself a prominent novelist, known to readers as George Eliot (1968):

> Your pier-glass or extensive surface of polished steel made to be rubbed by a housemaid, will be minutely and multitudinously scratched in all directions; but place now against it a lighted candle as a center of illumination, and lo! the scratches will seem to arrange themselves in a fine series of concentric circles around that little sun. It is demonstrable that the scratches are going everywhere impartially, and it is only your candle which produces the flattering illusion of a concentric arrangement, its light falling with an exclusive optical selection. (pp. 194-5)

This example demonstrates that the history of art is also a cultural history of perception.

The realistic and naturalistic movements in art which, in the last century tried to approximate science and to hold the mirror up to nature, gave way to the self-conscious art that in this century is increasingly about itself, when the mirror, the mimetic act, showed the artist his own or her own reflection. The creative process, which previous artists, intent upon realistic illusions, had hidden from view, is now in this century

deliberately displayed. Art thus is transformed from noun to verb, i.e., work-in-progress.

Pirandello's stage characters are still in search of an author. The hero of the novelist Gide's The Counter-feiters is himself a novelist keeping a journal on the novel he is writing, a novel called The Counterfeiters. The historian hero of Sartre's novel, Nausea, realizes that narrative history is actually fiction, an arbitrary designation of beginnings and endings, so he turns novelist. Meanwhile, introspection, like sub-atomic physics, breaks solid characters and stable worlds of earlier prose fiction into streams of consciousness as in the works of James Joyce and Virginia Woolf. Multiple and conflicting points of view in the works of Henry James, William Faulkner, Joseph Conrad and others force the reader to decide what is real. Everywhere, in painting, fiction, theater, we see the proscenium or boundary between art and reality, the plane between viewer and viewed, the distinction between spectator and participant deliberately obscured. Instead of a comfort-ingly objective and entertaining prospect that we can contemplate at a safe distance, art presents a meta-physical quandary about the nature of reality and our own role in shaping it. Here, as in science, we encounter only ourselves:

> She was the single artificer of the world
> In which she sang. And when she sang, the sea,
> Whatever self it had, became the self
> That was her song, for she was the maker. (Stevens,
> 1959, p. 55)

Thus, Wallace Stevens acknowledges our co-creative role in determining reality.

This self-conscious process in art and in science through which we emerge from our representations, maps, or structures and recognize ourselves as standing above them, either as their creators or as their discoverers, is an emergence of conscious awareness, with which we become increasingly identified. "We are dominated, wrote the psychologist, Roberto Assagioli, "by everything with which our self becomes identified. We can dominate, direct and utilize everything from which we disidentify ourselves" (1976, p. 211).

The rise or expansion of consciousness, in other words, in its hierarchical ascent above the purely mechanical, is co-extensive with an increase in the range of choice. Such an increase for example is the liberating purpose of psychoanalysis, a major breakthrough of this century, through which the dynamic unconscious structure Freud discovered invisibly directing our experience could be brought into the light of understanding.

Freud is perhaps our greatest exemplar of the self-conscious intellectual process we have been examining

through which the latent becomes manifest, and is thus transformed, which we can see repeated in at least a dozen other fields of inquiry in this century (including industrial engineering viewed from the standpoint of its liberating possibility of freeing the human performer from the sub-human routine). This revolutionary tendency, against the conservative background of unconscious resistance that is always present to some degree, renders any given structure or level of structure highly provisional insofar as our identification with it is concerned; and this has major implications regarding social and technological emergence.

We can now see, for example, that society has its own unconscious structure. Michel Foucault (1965) in his structuralist approach to history showed what occurred when the niche of quarantine and confinement occupied by the leprosy foundations throughout the Middle Ages was finally left vacant. As contact with the Middle East waned after the crusades, leprosy disappeared from Europe. The niche in the structure still needed to be filled. Madness at that time was viewed as a pilgrimage or journey beyond earth-bound awareness. Mad people with a foot already in the other world were therefore sent along the European pilgrimage routes on ships of fools. With the Age of Reason, however, madness was viewed not as a transcending of normal reality but rather as its aberration. Thus, the asylum came to occupy the place

previously reserved for the leper, the mad person was confined with the criminal, and the overall structure of society was preserved.

Today, when a South Dakota legislator or a Colorado governor suggests that schools and community colleges which are losing enrollment be converted into prisons, or when a trip through Joliet, Illinois, which is demographically a perfect representative of the U.S. population, reveals two outstanding granite edifices of strikingly identical architecture, the state penitentiary and the Joliet Township High School visually dominating their urban setting, one cannot help wondering about the place education occupies in our social structure. We occasionally still have the adventurous, initiatory pilgrimage or journey, in the Vision Quest for teens or in the Outward Bound experience; but these are noticeable departures from the norm, the more usual place of confinement which symbolizes and concretizes our insular attitude toward learning.

A similar way of approaching the underlying structure of society is through the concept of _paradigm_ or what Boulding (1966), prior to Kuhn (1962), called the _image._ Recognizing that we do not operate independently of a material base, Boulding asserts that " n evertheless, the artifacts, that is, the physical capital of a society must be regarded as the result of the

structuring of the material substance by an image. There
is a close analogy here between the image and the gene"
(p. 58).

The image, like the gene, tends to preserve itself
against the threat of mutation. Jerome Bruner and Leo
Postman (1949) conducted psychological experiments in
which subjects were shown playing cards flashed for very
short times on a screen. Because their shared
expectations and assumptions literally colored what they
saw, subjects did not recognize certain anomalous cards
such as a red ace of spades or a black four of hearts as
being unusual. What these experiments suggest is that "
" . . . our assumptive framework is conservative. it is
quite difficult for us to alter our assumptions even in
the face of compelling evidence. We pay the price of a
certain conservatism and resistance to new input in order
to gain a measure of stability in our personal
consciousness" (Ornstein, 1980, p. 19). This homeostatic
mechanism of the psyche is like the Chinese puzzle with
each higher level of awareness functioning as an ex-
plosive "last piece." Transformation is an explosion in
awareness that shifts the entire system to a higher
logical level.

As messages that might modify the image begin to
multiply, attempts to prove its validity increase, almost
as a symptom that change is imminent. The back-to-basics
movement in our schools, for example, might be such a

symptom. This conservatism is peculiarly evident in the choice of words that Thomas Kuhn (1962), whose conceptualization of the paradigm is both a major step in the process of emergence and means toward its acceleration, uses to describe the conditions for change:

> As in manufacture, so in science--retooling is an extravagance to be reserved for the occasion that demands it. The significance of crises is the indication that an occasion for retooling has arrived. (p. 76)

While Kuhn's analogy here is explicit, it demonstrates our more usually <u>implicit</u> tendency to structure perceptions of many aspects of reality in terms of our dominant mode of production, which functions like a paradigm. Kuhn could just as easily have chosen an organic metaphor for the transformation he describes. In an agricultural society, he probably would have; but his choice here reflects instead the mechanistic predisposition of his immediate social environment. In other words, while the social image structures the material substance of a society, the materialized structure in turn helps to shape the social image.

This latter point is clearly set forth in the following formulation of Marxist theory, which constitutes, through the latent structure it lays here, another major phase of conscious emergence:

> Historical materialism is not at all a psycho-
> logical theory; its main postulate is that the way
> in which a man produces determines his practice of
> life, his way of living, and his practice of life
> determines his thinking and the social and political
> structure of his society. (Fromm, 1962, p. 40)

That external patternings as well as internal drives
shape our experiences is certainly difficult to deny.
McLuhan's invaluable research into the subliminal bias
that accompanies any technological extension of our
faculties, arrived at much the same conclusion: "All
media are metaphors in their power to translate
experience into new forms" (1964, p. 64).

Therefore, technological change that affects both
the mode of production and the behaviors and
relationships encouraged by it should eventually modify
the image.

Some evidence for this latter proposition is
furnished by physiological research:

> In the course of much experimenting, physiologists
> have discovered that in basic movements at least,
> the cells concerned link up on the motor cortex of
> the brain into a shape resembling the body, which
> they refer to as the homunculus. There is thus a
> valid basis for the concept of the "self-image," at
> least in so far as basic movements are concerned.
> We have no similar experimental evidence with regard
> to sensation, feeling, or thought.
>   Our self-image is essentially smaller than it
> might be, for it is built up only of the group of
> cells that we have actually used. Further, the
> various patterns and combinations of cells are
> perhaps more important than their actual number.
>   . . . . There are individuals who know from
> thirty to seventy languages. This indicates that the
> average self-image occupies only about 5 percent of
> its potential. (Feldenkrais, 1972, pp. 14-15)

The self-image imprinted on the motor cortex of a month-old infant is largely restricted to the mouth, since that is the only area subject to voluntary control. As new areas become subject to control, they also are integrated into the self-image. However, a completed self-image is rare or non-existent, and once we reach a socially acceptable plateau of achievement we tend to restrict our movements to the limitations of the image then attained. Environmental change, of course, destabilizes such plateaus, forcing new growth.

If Feldenkrais is correct in asserting that the addition of each new function expands the self-image, then may we not assume the existence of a similar development in the growth of the social image, the possibility that by proactively taking on more complex and fully human functions to transform our productive tasks we might also humanize and transform the mechanistic image that even now continues to bind us?

Certainly, as a society, we have reached no acceptable plateau of achievement. Our exploratory initiative for technological innovation is, if anything, increasing, and needs to increase further. At the same time, automatization as one of its by-products is also increasing. The former of these two tendencies may be altering what biologists call our morphogenetic field. The possibility of such a field existing has led to the

"Hypothesis of Formative Causation," which postulates

that:

> The universe functions not so much by immutable laws
> as by "habits"--patterns created by the repetition
> of events over time.
>   Plant physiologist Rupert Sheldrake, in A New
> Science of Life, proposes that all systems are
> regulated not only by known energy and material
> factors but also by invisible organizing fields.
> These fields have no energy but are nonetheless
> causative because they serve as blueprints for form
> and behavior.
>   According to this hypothesis, whenever one
> member of a species learns a new behavior, the
> causative field for the species is changed, however
> slightly. If the behavior is repeated for long
> enough, its "morphic resonance" affects the entire
> species. ("Special Issue: A New Science of Life,"
> 1981)

As evidence for this hypothesis (which parallels Kuhn's

(1962) paradigm, Boulding's (1966) social image,

Feldenkrais' (1972) self-image, Foucault's (1965) struc-

ture, and Jung's (1968-1) archetype in accounting for

visible configurations in terms of underlying formative

principles), Sheldrake offers examples from chemistry and

animal psychology. In chemistry, after the initial dif-

ficulty of synthesizing an organic compound, successive

crystallizations become progressively easier. In animal

psychology, successive generations of rats acquire a new

learning with increasing rapidity even when the slowest-

learning rats from each previous generation are bred.

Will the study of heuristic new work behaviors in humans

provide similar data regarding their generalized effects

upon the human population?

While Sheldrake's hypothesis illustrates how something like what we have called an image operates at lower levels of organization than our own, what distinguishes us as humans, particularly in this century of rapid change, is our ability self-consciously to reflect upon and emerge from our images. This emergence is both a contributor to and a response to change, i.e., pattern disruption.

What most concerns us here is that emergence is an altogether different dynamic from what we find displayed at the mechanistic level of organization. The latter is characterized by a closed loop of routine functions that continue to repeat themselves without variation. As change disrupts a routine pattern over time, the pattern can no longer function subliminally: it is driven into conscious awareness and thus transformed. If routin-ization throughout the industrial age has encouraged a reductionistic image of ourselves as cogs in the machinery, what Samuel Butler (1955, p. 232) called "machine- tickling aphids," then the accelerating deroutinization of our own time and the collaborative learning practices it almost forces us to adopt in the face of its ripple effects encourage a new recognition of ourselves as the process of emergence.

Routinization is to deroutinization as reductionism is to the process of emergence: completely opposite. If organization can be understood as an open-ended hierarchy

of levels of choice, each more complex and integrated
(i.e., more conscious) than the one beneath it then the
contrast we are making is between movements up and down
that hierarchy in opposite directions, with ourselves now
on the ascendency, reversing the tendency of the
industrial era.

Boulding (1966) has distinguished eight levels of
organization ranging from static structures,
"clockworks," and homeostatic control mechanisms at the
lower mechanistic end of the scale to human beings and
their social organizations at the higher end: "In the
course of the history of the universe, we observe the
record of continually increasing complexity of
organization culminating at the present day in man and
his societies" (p. 19). Parenthetically, so far as
mechanicalness goes, the top of Boulding's hierarchy is
still on the lowest level of the evolutionary scale de-
scribed by the cartographers of possible consciousness:
cf. Gurdjieff's seven levels of man in Ouspensky (1977,
pp. 71-77) and Ken Wilber's (1981, pp. 10-14) seven
levels of "the spectrum of consciousness."

By reductionism we mean a failure to distinguish be-
tween these levels and the consequent misapplication of
images or theoretical constructs derived from lower
levels to the greater complexities of the higher levels.
Our self-objectification as manpower is a prime instance
of such distortion. This failure, a vestige of

of industrial-age thinking, is a confusion of the kind that Bertrand Russell and A. N. Whitehead (1910-1913) hoped to dispel with their Theory of Logical Types, which Bateson (1978) succinctly states as follows:

> The central thesis of this theory is that there is a discontinuity between a class and its members. The class cannot be a member of itself nor can one of the members be the class, since the terms used for class is of a different level of abstraction--a different Logical Type--from terms used for members. (p. 202)

The menu is of a higher order than the meal; and to eat the menu is to collapse the hierarchy of levels, confusing the class with its members. The present day concern with "structural workforce obsolescence," which identifies workers with the routine tasks they have performed, betrays this same kind of confusion, an extension of the mechanistic mental-model with its lack of hierarchy beyond its appropriate context.

A higher level of complexity, integration, or awareness, cannot be explained in terms of a lower level:

> Each higher level has capacities and characteristics not found at lower levels. This fact appears as the phenomenon of creative emergence. It's also behind synergy. But failing to recognize that elemental fact--that the higher cannot be derived from the lower--results in the fallacy of reductionism. Biology cannot be explained only in terms of physics, psychology cannot be explained only in terms of biology and so on. Each senior stage includes its junior stages as components but also transcends them by adding its own defining attributes. (Wilber, 1982, p. 257)

In the cognitive map of contemporary science which now includes us, in the progressive disidentification of mind from its contents which characterizes both the intellectual movement and the self-conscious artistic expression of our era, we can see ourselves reconstituting and ascending this hierarchy, expanding our awareness of ourselves as consciousness. This has been our theme in this deliberately excursive chapter through which we have tried to demonstrate the extent of the phenomenon we are describing.

But that extent is still relatively superficial. The image that lies at the core of our older practice in work and education, and still dominates our planning and decision-making, remains mechanistic, as the next chapter will illustrate. Only as our typical practices change and as our organizational settings change to accommodate those practices, can the image itself be substantially transformed. It remains our burden in the balance of this paper to show that the new mode of production is a practice of emergence, one that necessarily involves the whole person, and that organizational arrangements are shifting to embrace this necessity. This breakdown and breakthrough is the subject of the next chapter.

CHAPTER III

THE DEROUTINIZATION OF WORK AND THE DECLINE OF
INDUSTRIAL ENGINEERING

From the European writers, we can and should pick up
their greater emphasis on what they call "philsophi-
cal anthropology," that is, the attempt to define
man, and the difference between man and any other
species, between man and object, and between man and
robots. What are his unique and defining charac-
teristics? What is so essential to man, that
without it he would no longer be defined as man?
     I think it fair to say that no theory of
psychology will ever be complete which does not
centrally incorporate the concept that man has his
future within him, dynamically active at this
present moment.
     Also we must realize that only the future is in
principle unknown and unknowable, which means that
all habits, defenses and coping mechanisms are
doubtful and ambiguous since they are based on past
experience. Only the flexible creative person can
really manage future, only the one who can face
novelty with confidence and without fear. I am
convinced that much of what we now call psychology
is the study of the tricks we use to avoid the
anxiety of absolute novelty by making believe the
future will be like the past. (Abraham Maslow)

Thus far, this paper has concerned a pervasive

confusion, inherent in the overgeneralized use of the

mechanistic paradigm beyond its appropriate context, a

confusion between persons and things. The reductionistic

fallacy in our decision-making has distorted our

practices in work and in education to a dehumanizing

extent. In the first chapter, the cultural roots of this

peculiarly Western condition, which tends to delete the subjective pole of human experience and shift our center of gravity to the objective pole, were briefly explored. This condition results in a psychological imbalance, a denial of the true self which an equally unbalanced approach to learning continues to reinforce.

The newer cultural roots of what could be a corrective tendency toward humanization, a multi-disciplinary rediscovery of the open-ended hierarchy through which consciousness emerges as a primary force were surveyed in Chapter Two. On a practical level, despite recent changes, the mechanistic paradigm still remains in force, structuring work and learning in ways that newer and equally practical circumstances are rendering dysfunctional. These new circumstances, together forming the pragmatic rather than ideological vanguard of both a new culture and a new paradigm of emergence, must now be examined in some detail.

First, however, as a caption to what follows, a digression is in order. There is a central stage in the sequence of human development, when a potentially regressive self-concern must be overtaken by a larger, adult concern with the establishment and guidance of the next generation. Otherwise, both individual and species become threatened by stagnation. This stage, which Erik Erikson (1963) calls generativity, hierarchically transcends but also includes both productivity and

creativity. It is the critical nexus of individual and
evolutionary development respecting which our economic
and psychological theories both converge and diverge,
since it embraces " . . . man's relationship to his
production as well as to his progeny" (Erikson, 1963, pp.
267-8).

These divergences in theory, which Erikson alludes
to but does not elaborate, reveal us as socially
conflicted at this crucial stage in our human development
between the material (cf. Marx) and psychological (cf.
Freud) aspects of our nature. We have not yet learned to
reconcile this conflict. By failing to distinguish
adequately between our production and our progeny, by
applying the theory and methods derived from the one
inappropriately to the other (as we do both in education
and in what we call manpower development), by allowing
the claims of productivity to separate from, overcome,
and finally diminish the much wider, life-affirming
claims of generativity, we have fallen prey to a
life-denying error. We are thus in great need, as a
society, of a clarified understanding of generativity.

What makes such a clarification now a real
possibility is the unprecedented convergence of the
requirements of both our material and psychic economies
at the forefront of technological change. This is the
principal argument of this paper. The poet Blake and the
philosopher Nietzsche both claimed that any tendency

carried to its extreme reverses itself and becomes its opposite. There is a distinct possibility that our materialistic obsession with technical mastery (having now brought us to the advanced stage of high technology), is bringing about just such a reversal, an historical deus ex machina: our higher powers, which the industrial machine has long submerged, are now required for its own survival and continuing evolution. This dynamic reversal can be seen in the breakdown of our traditional manpower development system where it overlaps with our institutions of education, and in the breakthrough to a new configuration at the high tech frontier.

The current wave of concern about American education reflects the intense economic competition this country faces in a volatile world market tied to an essentially new mode of production, high technology, which in turn requires a new kind of worker, the knowledge worker. The specialized and repetitive jobs that have characterized the now-receding mechanical age are giving way at every level of work organization to complex roles through which empowered individuals, regardless of position, must be able to participate actively and flexibly, heuristically and collaboratively, as intentional agents of change. The logic inherent in high technology industry and in its extensive application to a wider range of social and environmental needs is thus leading to the unfreezing or deroutinization of work and therefore, although most

educators and economists have not yet fully understood this, to a corresponding deroutinization of education.

I arrived at this general overview, which summarizes the main thrust of this paper, initially through my experience as a consultant to representatives of our nation's manpower development system. That troubled system has historically operated on directly contrary assumptions that equate both work and education with the routinization or standardization of human activity.

This older set of assumptions was functional so long as industry was fairly stable, standardized and segmented in its work processes; but the new configuration of high technology (c.f. The Storage Tek-State Education Project, Appendix II), is distinguished instead by complexity, continuous change and acute interdependence manifesting in a highly diverse set of endeavors. Vocational educators are federally mandated to prepare students for entry into the workforce; but how are they to approach the problem of entry now that the vehicle to be entered has been set in motion?

This was the dilemma that concerned my clients, the research and development section of a large state department of adult, vocational and technical education. Just as the whole world looks like a nail to those whose only tool is a hammer, they did not see themselves as needing substantive revisioning; they only knew, along with their critics, that they were no longer hitting the

mark. Lacking the concept of "deroutinization," which would have helped them to the pattern recognition I hope to establish in this paper, they still perceived their mission as the replication of skills; and this committed them to fostering that species of learning which automates the learner. They viewed students as durable products, and they were organizationally patterned after the production model of education which mirrors the declining industrial system it historically helped to maintain. How could the "delivery system" be adjusted to meet the changing market: this was their concern.

With emergent occupations now proliferating in a bewildering burst of not only diversity but also complexity, covering all the occupational bases with specialized training programs and in sufficient depth seemed an almost impossible task. Even if such a prohibitively expensive and difficult effort should once succeed, it would have to be renewed again and again if currency with today's technology were to be continuously maintained; and lag time would need to be built into each cycle of the game of catch-up, adding to its futility.

Meanwhile, programs currently on line in secondary and post-secondary schools were preparing candidates for tomorrow's jobs with skills that either were or soon would be obsolete, even while leading-edge skills in high demand remained in short supply and beyond the scope of present delivery systems. R. D. McCage, in his

presidential address to the American Vocational Education Research Association during a year (1982) of record high unemployment, stated:

> We do not have an unemployment problem in this country. We have a serious mismatch between the skills possessed by potential and active workers and the skills required by the jobs that exist. In other words, there is a near statistical balance between the number of jobs going vacant and the number of persons desiring to hold those jobs. Obviously much of this mismatch has been brought about because technology has progressed at a more rapid rate than our institutional capability for educating and training persons to work in today's technological world. (p. 2)

That educators hold the only key to full employment is a dubious proposition I will comment on in the next chapter. If accepted, it is a sure prescription for scapegoating and for self-flagellation. Nevertheless, the situation is in part perpetuated by funding arrangements based on enrollments in courses irrespective of market demand for skills being taught, and by self-serving survival interests of those now employed by the system. These ought to be relatively simple administrative problems.

More difficult to address is the phenomenon of "structural workforce obsolescence," which is entirely eliminating some established occupations (such as those in the steel industry) and, for the first time, cycling large numbers of adults back into an already burdened training system. Thus, at a time in its history when it

is least able to fulfill expectations, the system is being subjected (now at the post-secondary level) to greater demands than it has ever yet had to bear. The promise that either training or retraining will lead to related and continuing employment is increasingly difficult to maintain, although these are the logical criteria for judging a manpower development system. See Wilms' (1980) negative prognosis respecting occupational training in relation to rapid technological change, supported by Goodlad (1984): "Ironically, research increasingly leads to the conclusion that vocational education in the schools is virtually irrelevant to job fate" (p. 145).

An ideal system from the standpoint of the larger economy would be able quickly to overcome technological hurdles and respond to emergent employer needs as they arise. With formidable obstacles in the path of such market-driven performance, vocational educators for the most part continue to see their chief problem as basically tactical in nature: acquiring state-of-the-art templates (competency models and equipment) from which to replicate new skills. These must be freshly lifted from the private sector where innovation takes place.

Such collaboration with, or dependence on, the private sector raises legal issues of safeguarding proprietary information, of ensuring access and equity

where private learning resources are shared, and of
seeing that public funds do not directly subsidize
private interests; but these are relatively minor
considerations. The major issue is seen as discovering a
mechanism for continuously updating instructor knowledge,
curricula (that is increasingly difficult to
formularize), and equipment (that is hopelessly expensive
and subject to rapid obsolescence).

What has not been questioned is the assumption that
the solution to the problem of employability in the
context of changing technology is simply to obtain and
propagate on the public's behalf an ever newer set of
self-obsoleting routines. That routinization itself, as
an exclusive educational focus, might be the major
obstacle to dealing effectively with technological
change has yet to be seriously considered.

Literal replicators (task analysts) attend to the
particle--the particular work station at a frozen moment
in time--while the wave, the pattern of interaction and
change in the complex system, entirely escapes their
notice. The predictable result is a series of ephemeral
content solutions to what is fundamentally a process
problem.

What I am suggesting here, by way of preliminary
analysis, is that the industrial engineering approach to
manpower development is no longer sufficient. The
prototype of this approach, known as scientific

management, was developed by Frederick W. Taylor and his associate, Frank B. Gilbreth near the turn of the century. "Taylorism," in the words of Siegfried Giedion (1969), "demands of the mass of workers, not initiative but automatization. Human movements become levers in the machine" (p. 99). A graphic illustration that reveals the dehumanizing tendency of this approach is Gilbreth's motion study entitled "Girl Folding a Handkerchief." Neither a girl nor a handkerchief remains visible in this curvolinear abstraction; and the subtitle explains that "All the unconscious intricacies of a motion's progress is registered in curves of light." That, as Giedion observes of this illustration, " . . . the motion means everything, the object performing it nothing" (p. 111), follows from a definition of work as consisting in automated (unconscious) activity directed from without rather than conscious action directed from within.

This notion of work had already been articulated in ancient times by Aristotle, for whom workers and robots were equivalent in function and hence as equally removed from decision making as he considered body to be from mind. The 1979 translation of The Politics reads:

> Tools may be animate as well as inanimate; a ship's captain uses a lifeless rudder, but a living man for a watch; for the worker in a craft is, from the point of view of the craft, one of its tools. So any piece of property can be regarded as a tool enabling a man to live; and his property is an assemblage of such tools, including his slaves; and a slave being a living creature like any other

> servant, is a tool worth many tools. For suppose
> that every tool we had could perform its function,
> either at our bidding or itself perceiving the need,
> like the statues made by Daedalus or the wheeled
> tripods of Hephaestus . . . and suppose that
> shuttles in a loom could fly to and fro and plucker
> play on a lyre all self-moved, then manufacturers
> would have no need of workers nor masters of slaves.
> (p. 31)

Both Gilbreth and Aristotle delete from their
accounts of work the human agency that springs from an
interior dimension not easily portrayed. What can be
detached from human performers and replicated can
ultimately be automated; and this is already occurring in
our society. But as the subhuman role of the worker is
thus gradually eclipsed by more pure forms of instru-
mentality, a new, more distinctly human role is emerging.

This emergence is well illustrated by Tom Wolfe's
(1980) account of the American space effort that placed a
man on the moon. It is noteworthy that, from a purely
technical standpoint, direct human participation in what
is considered the supreme technological achievement of
our era was irrelevant. Rockets did not need pilots.
The first Mercury astronauts, however, unwilling to be
superseded, insisted that their vehicle be called a
spacecraft rather than a capsule, asked that a window be
placed in the craft even though engineers felt such an
addition might invite rupture due to pressure changes,
and demanded a hatch they could open themselves:

> And why? Because Pilots had windows in their
> cockpits and hatches they could open on their own.
> That was what it was all about: being a pilot as
> opposed to a guinea pig. The men hadn't stopped
> with the window and the hatch either. Not for
> a moment. Now they wanted . . . manual control of
> the rocket! They weren't kidding! This was to take
> the form of an override system: if the astronaut
> believed, in his judgment, as captain of the ship
> (not capsule), that the booster rocket engine was
> malfunctioning, he could take over and guide it
> himself--like any proper pilot. (Wolfe, p. 161)

The window here is representative of the distinctly

human act of discovery for which the technology serves

merely as means; and the override system represents the

conscious, distinctly human ability to transcend

automaticity in order to seek alternative paths to human

ends. These acts of discovery and conscious choice are

different in kind from servomechanistic work routines

that machines can perform by themselves, that students of

motion can depict in reductive terms, and that industrial

engineers can replicate through training. The astronauts

are no longer encapsulated by their technology; they

indwell it and extend their own inquiring nature through

it; and thus, in a historically important reversal, they

begin to reveal not only the earth, which for the first

time is grasped as a visible unity, but also something of

their own, and our own, essential nature.

The new role of the human worker is exploratory,

emergent. Whether we are speaking of the astronaut at

his window or the research and development (R&D) worker

in a high-tech industry, the situation parallels the

biological   transformation   of   our

remote ancestors when a major ganglion was formed at the

forward tip of the body. Using the earthworm to

exemplify this transformation, Michael Polanyi (1964)

writes that:

> The segment which first meets and tries out the
> unknown world into which the animal is advancing
> thus acquired a controlling position. . . . Within
> this active center the animal's personhood is
> intensified in relation to a subservient body. (p.
> 388)

Meeting and trying out the unknown world into which she

or he is advancing from an active center of self-control

and intensified personhood is the essence of the

heuristic activity that characterizes high-tech work. To

instrumentalize persons, to regress them--as does

industrial engineering--to the status of tools, is to

render them (as Polanyi has noted) unconscious and

therefore useless for such work. The paradox thus

emerges that instrumentalizing humans in the context of

changing high technology, is no longer instrumental.

The terms "routinization," "automatization," and

"unconsciousness," as I have been using them, are all

synonymous, can be achieved by rote learning, and are

appropriate to circumstances that do not vary. Change,

on the other hand, requires appropriate rather than stock

response--what the I Ching calls the superior rather than

inferior, rule-bound person--and the former is achieved

by unlearning, "learning-how-to-learn" or consciousness.

As Arthur Koestler (1976), a seminal thinker on the

subject of creativity, has noted:

> The process of condensation into habit goes on all
> the time, and amounts to a continual transformation
> of "mental" into "mechanical" activity--of "mind
> processes" into "machine-processes." Thus
> consciousness may be described in a negative way as
> the quality accompanying an activity which decreases
> in proportion to habit formation. . . . This shift
> of control of an ongoing activity from . . .
> "mechanical" to "mindful" behavior--seems to be of
> the essence of conscious decision making and of the
> subjective experience of free will. (pp. 207-8)

A contemporary Eastern philosopher, making the same dis-

tinction as Koestler's, remarks that "Learning something

new means it has been transferred from consciousness to

the robot . . . now the unconscious can do it" (Rajneesh,

1983, p. 317).

Just as the geological forces of erosion would long

ago have flattened and submerged beneath sea level the

great land masses of the earth if there had been no

countervailing forces to periodically lift up new land

formations, so in the human sphere would learning lead

to inevitable stagnation if it were not offset by the

countervailing force of consciousness.

Tacit recognition of this principle and its

accommodation in practice is what gives high technology,

as I shall demonstrate in the next chapter, its unique

adaptability and its emergent form. Conversely, the

absence of this recognition on the part of educators and

economic policy makers concerned with education who are

still positioned on the learning side of the equation, renders their attempts at interfacing our educational institutions with emergent realms of employment consistently inadequate.

The new socio-technical and socio-economic importance of consciousness, without which more product can be lost in a moment than a worker can pay for with a lifetime's earnings, means that a long-standing dichotomy regarding the mission of education could be on the verge of being transcended. The instrumental values that have equated social return on investment in schools with improved economic performance, and the humanistic values that have emphasized the growth of the individual learner, is his or her own right, through an activity valued for its own sake, are no longer--at least in principal--in a conflicting relationship.

Instead, these previously opposed orientations are beginning to constellate the objective and subjective (environment-centered and person-centered) poles of a synergistic new cultural equation with immense implications for the future of both work and education. Economic development is now tied to human development.

Because the new mode of production, as will be shown, reverses the process of fragmentation and automatization (on the human side) that characterized its mechanistic predecessor, because high technology is not an aggregation of compartmentalized sub-routines but an

acutely interdependent system of conscious centers mutually and instantaneously adjusting to one another at all times, it operates as a wholizing force upon the individuals who participate in it, while their own emergent processes of individuation contribute in turn to the system's process of emergence.

As bottom-line profits are seen to rely on an expanded range of work behaviors that approach what psychologists have described as the fully human functioning of the integrated personality, powerful political leverage on behalf of human (as opposed to manpower) development could arise. Such recognition, however, is still in its earliest stages:

> There is at present no strong pressure to change the ways schools conduct the business of schooling. . . . There appears to be limited public awareness of the need for greater stress on a wider range of behavior and therefore on the kinds of pedagogical approaches relevant to their cultivation. (Goodlad, 1984, p. 269)

As described by Abraham Maslow, Carl Rogers and other personality theorists reviewed by Julius Seeman (1983) the qualities of high integration include: permeability to the full range of one's inner and outer experience, trust in one's own organismic guidance, environmental contact, ease of communication with other persons, autonomy, spontaneity, curiosity, wish to learn, probe, and explore the unknown, problem centering that carries one beyond self to common concerns,

appropriateness, democratic character structure, free-flowing awareness (pp. 205-207).   None of these are rigid, machine-like operations.

Routine tasks can now, to a great extent, be either automated or exported to cheaper sources of labor. What remains is the frontier of innovation. The cybernetic Law of Requisite Variety states that in any system of human beings or machines, the element in that system with the widest range of variability will be the controlling element. To restrict behavior is therefore to lose requisite variety. The United States and other advanced, post-industrial societies with volatile market environments can no longer, for strictly pragmatic reasons, afford to lend their educational institutions to the debilitating restriction of human behavior that characterizes the industrial engineering approach. Requisite variety is now essential, and this implies a reorientation of our principal means of socialization-- our system of schooling.

Alfred North Whitehead (1953) used similar terms to describe the professionalization of knowledge, producing "minds in a groove," several decades ago:

> The rate of progress is such that an individual
> human being, of ordinary length of life, will be
> called upon to face novel situations which find no
> parallel in his past. The fixed person for fixed
> duties, who in older societies was such a godsend,
> in the future will be a public danger. (p. 196)

Today, the rate of change has greatly accelerated beyond even Whitehead's experience.

I do not mean to suggest, however, that the corrective to the vocational education emphasis on specialized technical skills is to revert to what general educators now call "basic skills," although the statutory transfer of resources in this direction is already occurring. The dichotomy is false in that the core problem of routinization is not being addressed on either side. Vocational education at least has to bear the reality test of the employment market, whereas the applicability of general education to anything other than more of the same is increasingly open to doubt.

Repeated national assessments (cf. Stake, 1978) and the extensive study of schools conducted by John Goodlad and his associates (1984) have all underscored the passive rote learning that characterizes our system of education, with little or no concern for application and with students holding low opinions of themselves as change agents:

> If teachers in the talking mode and students in the
> listening mode is what we want, rest assured we have
> it. . . . Not even 1% of instruction time
> required some kind of open response involving
> reasoning or perhaps an opinion from students. . . .
> (Goodlad, p. 229)

Summarizing a remarkable series of case studies sponsored by the National Science Foundation, the author of the final report concludes that:

> Seldom was science taught as scientific inquiry . . . subjects were taught as what experts had found to be true. . . . The textbook usually was seen as the authority on knowledge and the guide to learning. . . . Though relatively free to depart from district syllabus or community expectation, the teachers seldom exercised either freedom. (Stake, 1978, p. 14)

Regarding the heuristic, inquiry approaches to education that were introduced to no avail in the 1960s (i.e., the creative "messing around" that normally precedes the verification steps in science), Stake (1978) remarks that:

> Inquiry does not appear to work . . . we found that many teachers feel that higher level study is hard work, life is full of hard work, the children need to learn that learning is hard work. It should be remembered that the science experience of most high school teachers was largely confined to the rather rigorous, authoritarian undergraduate courses in universities. (p. 107)

Active experimentation and inquiry, which are somewhat playful departures from the more rigid and restrictive Protestant work ethic, now define the nature of work in high technology; but school "work" is still viewed as regimentation and control, even in the science curricula where empiricism would logically be expected to prevail. Obedience, however, as Marilyn Ferguson (1980) has written, is a "learning disability" (p. 280).

This disability cannot be overcome piecemeal while leaving the overall system that embodies it intact; for it is the culture, not the consciously espoused curriculum, which constitutes the principal competence conveyed to students. Regarding this last point, Seymour B. Sarason (1971) has made a particularly seminal contribution to our understanding of how the school operates as a complex social system. He has carefully examined the "behavioral regularities" (such as patterns of teacher questioning that elicit straight recall responses) which are often unperceived but nevertheless pervasive in their influences. Benjamin S. Bloom (1981) has used the term "latent curriculum" to convey the same concept:

> Its lessons are experienced daily and learned firmly. It is probable that the lessons of the latent curriculum are learned well because they are spelled out in the behavior of students and adults in the school and are only rarely verbalized or justified. (p. 23)

We have just seen how the subject of science is converted by the latent curriculum into an exercise in obedience to authority from which the activity of science is nearly absent. Such routinization of behavior and attitude is a feature not of specific course content, so much as of the pervasive ecological influence of the school in the manner critically addressed by Sarason, Goodlad and Bloom. To treat employability as an outcome

of education viewed in terms of subject matter, while
ignoring the basic incongruence between the school as a
culture and the much different culture now emerging as
high technology is short-sighted.

While the culture of our schools is systematically
impeding higher-level human functioning, such full
functioning is becoming recognized as vital to advanced
technological society. An influential book on The Work
Revolution by Schwartz and Neikirk (1983), maintains
that:

> Our present educational system is set up to
> prepare intellectual shepherds, nothing else, with
> the emphasis on rote learning of facts. . . . We
> are in danger of compounding that problem because of
> the big new push to educate everyone for technical
> skills. . . . Not that more technical education is
> bad, but an overemphasis on it will inhibit the
> United States in its effort to develop an
> educational system that will properly train students
> for the work revolution. (p. 148)

The problem, continues this same passage, is that "We
have no standards for every citizen learning to
comprehend, be enlightened, or understand what is going
on in the physical, political and social worlds" (p.
148).

This last quotation is surely an astonishing
statement to come from the pen of an economist writing on
employment issues. From the reductive notion of work
held by Aristotle and by scientific management to an
ideal of citizenship and enlightenment (the fullest
possible extent of conscious awareness) as means, is a

considerable journey, even if the outcomes now being sought are still not recognized as ends in themselves.

However, the inability to distinguish means from ends creates its own unrecognized set of contradictions; and these obstruct the possibility of real solutions to the problems being posed. Here, to clarify my point, is another passage from Schwartz and Neikirk (1983). Its language is characteristic, in ways that I will now discuss, of the public policy rhetoric now being addressed to the work/education interface:

> In an information--and knowledge--based economy, education is the primary industry, supporting all other industries. Beyond that it is the key to national economic survival, because innovation and discovery are the only activities in which a rich nation can outperform poorer nations. (p. 141)

What I would emphasize here is that the language pattern of this superficially reasonable assertion constitutes a contradiction in terms, unconsciously representing a clash between opposing worldviews.

On the one hand there is the all-too-familiar industrial metaphor for education which by implication objectifies human beings (i.e., student as product of the delivery system, curriculum as programming). On the other hand there is an emphasis on innovation and discovery as the important outputs of education. The mechanistic and organic vocabularies simply don't mix. Things, products, do not innovate or discover; only

persons, as free and intentional agents in charge of their own faculties and destinies can do so. The industrial engineering metaphor blinds those who use it to the biological, psychological, anthropological and ethical understandings needed for the cultivation of what, by its very nature cannot be engineered (cf. Maslow, 1968, p. 193: "the person, insofar as he is a real person, is his own main determinant. Every person is, in part, 'his own project' and makes himself"). Creativity, as the studies of Maslow and other psychologists have shown, is achieved by self-actualization and self-transcendence emanating from an internal locus of control. The industrial metaphor, on the other hand, implies regimentation from an external locus of control, conformity (the reverse of creativity) rather than emergence. The means of expression in the passage I have cited and the end being sought are thus fundamentally at odds.

The sources of confusion here need to be sorted out if clear policies are to be formulated. One such source is the exclusively economic frame of reference from which persons always appear as instrumental, as the means of their own means, while human ends--always awaiting discovery and the exertion of man's creative powers--are simply not accounted for. We have already discussed the paradox that instrumentalism, because it renders its objects unconscious, has ceased under

conditions that require conscious creativity to be instrumental: it falsifies in its representation and in its mode of operation, the essential nature of that--the human spirit--upon which it has come to depend for its fulfillment.

The related source of confusion in the passage under discussion is its positivistic, external view of the human condition, the objective stance that characterized the physical sciences in the two centuries preceding our own. Hannah Arendt has characterized this stance as the Archimedean point of view. Copernicus, in her example, advanced the state of science by attaining a universal viewpoint outside the human condition. This has given science the leverage that Archimedes dreamed of. But in the process we have acquired the ability to operate upon ourselves from the outside as well, to behave toward ourselves as externally as though, to use Aldous Huxley's phrase, we were our own invading horde of Martians. In alienating ourselves from ourselves we have become toward ourselves our own aliens (Arendt, 1958).

This is the practical significance of Taylorism in the work place and the molecularization of knowledge in the schools. It disintegrates human beings instead of integrating them, thus reversing the centering process of psychological maturation through which personhood is achieved. "It is not truly speaking, the labor that is divided;" wrote the Victorian critic, John Ruskin (1957),

"but the men:--divided into mere segments of men--broken into small fragments and crumbs of life" (p. 514). High technology, in marked contrast, requires for its execution and continued emergence a conscious center within the human condition.

I am arguing that the solution to the new problems posed by advanced technology may not be a traditional technical fix. Unless this is recognized, we will simply go on repeating the same errors we have been making all along. Our policy makers and planners are using language that sounds very hard and objective but in fact gives only an illusion of control. There is clearly a difference between the technical problem, "What do we now do with people (or to them)?" and the human problem "What do we now, in the spirit of cooperation and discovery and celebration, do with ourselves?" The latter is far more complex and requires far more for its resolution than can be derived from the narrow domain of economics or even from the wider domain of knowledge itself.

"In a similar way," wrote Martin Heidegger (1977) in his difficult but precise phrasing about the nature of technology,

> the unconcealment in accordance with which nature presents itself as a calculable complex of the effects of forces can indeed permit correct determinations; but precisely through these successes the danger can remain that in the midst of all that is correct the true will withdraw. (p. 26)

From Gilbreth's (Giedion, 1969, p. 111) portrait of "A
Girl Folding a Handkerchief," for example,the true girl
herself has withdrawn. What we forget in the exaltation
of our ability to reveal and thus command, the working of
both the world and our- selves, is that we are not what
is thus revealed, the contents of our consciousness, but
rather--according to Heidegger--"the act of revealing
itself." It is this fundamental process of inquiry, of
heuristic groping beyond the confines of the known, this
questioning rather than the artifacts it creates, that
constitutes the living element of technological existence
and, for Heidegger, "the piety of thought" (p. 35). In
this sense, there is a truth to Gilbreth's portrait; for
it is a self-portrait of a brilliant conscious motion of
thought that is distinctly human and is an emergence
from, rather than identification with, the unconscious
motion it renders vivid with its own light.

This light is what the habit of objectification in
the policy rhetoric leaves out of the picture. Here,
from A Nation at Risk, the 1983 report of the National
Commission on Excellence in Education, is self-contra-
dictory language that exactly parallels the Schwartz and
Neikirk passage cited on page 64: "Our nation is at
risk. Our once unchallenged preeminence in commerce, in-
dustry, sciences, and technological innovation is being
overtaken by competitors throughout the world. . . . We

have, in effect, been committing an act of unthinking, unilateral educational disarmament." The emphasis on innovation as outcome of education is reiterated here, the only new addition being a <u>military</u> industrial metaphor which implicitly characterizes schools as munition plants or arsenals and the nation's youth as its ammunition. The result is the same contradiction in terms already mentioned, objectified persons called upon to perform self-transcendent functions of which objects are incapable.

This is no mere idiosyncracy or accidental turn of expression. Rather it is evidence of the need for new and clearer ways of thinking about the problems we now face. Here, in support of this assertion, is one final passage from an unpublished policy paper entitled "Issue Paper: Vocational Education and Training to the Year 2000," prepared by Scott Woodard for the Colorado Governor's High Technology Cabinet Council in February, 1985:

> Colorado is presently pursuing an aggressive economic development program, of which one strategy is the recruitment of high technology industries to the state. The rapid technological changes that occur in these industries necessitate the need sic for a highly trained, highly flexible labor force--one that can respond to such changes in a timely fashion. In order to maintain its competitiveness in recruiting and retaining high tech industries, Colorado has a large stake in the availability of a competent and flexible workforce. This will require a significant investment in human capital.

> SRI International [Stanford Research Institute], in an issue paper on economic development, noted that such an investment in human capital is a significant departure from traditional economic strategies which focused primarily on the physical capital requirements of manufacturing industries. Current economic development efforts recognize improvements in education and training as more important than tax breaks for industries. (p. 1)

Mr. Woodard's language, in what is a basically careful and discerning analysis, is again representative of the struggle to capture a fundamentally changed reality in conceptually inadequate language. The objectification "human capital" cancels out in advance the free agency upon which human flexibility depends; yet such flexibility is what Mr. Woodard and the Stanford Research Institute now recognize as essential to the new socio-technical economic configuration known as high tech.

The phrase "human capital," in positive terms, could be viewed as a transfer of wealth from the domain of physical reality to the domain of psychology, concealed in the harder language of an older physical science objectivity that permits quantification and a sense of control. Until this transfer is accompanied, however, by psychological understanding of the requirements for human development by policy makers the mechanistic (and hence fragmenting) approach to education that currently exists, even though it runs counter to such development, will simply be given additional resources. In the name of

growing people we will thus be expanding our chief means
of shrinking them.

The mechanized approach to education has been ably
criticized by our best educators on humanistic grounds.
What is needed now is a similar awareness by economic
developers. Benjamin Bloom (1981), for example, noting
that the continuous development of students from year to
year is frustrated by the manner in which learning tasks
are sequenced, postulates that "This undoubtedly is an
organizational problem arising from the assembly-line
notion of education. . . ." (p. 109). In the same vein,
John Goodlad (1984) has reflected that:

> A definition of education stressing personal growth,
> the desire for further growth, and the understand-
> ing of what is required for that growth does not
> lend itself to a neat means-end model of how schools
> should improve their performance. And because of
> the production model of schooling with the ends
> being defined without consideration of the process,
> it is difficult even to think about schools that are
> not derived from empirical tests of goal attainment.
> (p. 41)

Growth, and this is what we still fail to understand, is
an organic, not a mechanistic, concept: it happens from
the inside out.

What Bloom calls the "assembly-line notion," and
Goodlad the "production model," of education is a
cultural anachronism and form of automaticity embodying
an industrial mode of organization that industry
itself--as the next chapter will demonstrate--has

increasingly had to abandon. The net result of this divergence is a radical cultural discontinuity between what schools implicitly teach and what working persons in complex, unstable and interdependent work environments must know.

At issue then, and here I come back to my starting point with the vocational educators, is not just the flow of technical information from the domain of work to the domain of education, although that problem now occupies most of the attention being given to education/industry partnerships. Far more significant from the standpoint of human compatibility with rapid technological change are the social innovations that are giving high-tech industry its emergent form even while education remains fixed--and fixating--in its habitual mechanistic pattern. The new social arrangement, with its own implicit curriculum, is the subject of the chapter that now follows.

CHAPTER IV

THE CULTURE OF EMERGENCE: THE
METHODOLOGICAL ISSUE, THE
STRUCTURE OF GROWTH, AND
THE EVASION OF GROWTH

The Methodological Issue: From Destructive
Analysis to Phenomenological Inquiry

Prior to consulting with the vocational educators
mentioned in the last chapter and learning about their
problems in adapting to change, I had already been much
encouraged by a new development that had revolutionized
Japanese industry and was now transforming American
industry as well. This grass-roots phenomenon was
putting decades of theory and research in the applied
behavioral sciences into actual, widespread practice,
placing the individual employee in a proactive,
synergistic relationship to the work group that allowed
for both personal growth and increased productivity while
contributing to technical advancement.

Here was neither a submerged conformity nor an
exaggerated autonomy but rather a healthy inter-
dependence between the individual, the group and the work
itself. I am referring to what impressed me at the time
as a major breakthrough, the advent of the small,
democratic/scientific problem-solving group known as the

quality circle. In the paper, "The Politics of Quality: Restoring the Within of Work," Appendix A, I placed this important social innovation in a theoretical and historical perspective.

With this background, and with the systems orientation acquired through the theory and practice of organizational development, it was easy when I met with the vocational educators to discover the limitations of their perspective. I saw that their difficulties in keeping pace with technological change were due not to practical difficulties but to their assumptive framework. The mechanistic paradigm implicit in their industrial engineering methodology was inadequate for what was a human problem--the problem of continuing growth. With their attention on technical innovation, they were overlooking the major social innovation through which those at the leading edge of emergent technology were managing their own steep learning curves on a daily basis.

Quality circles were solving the problem of continuing and coordinated growth at the shop-floor level by engaging workers as free, active, collaborative agents of change, not as passive subjects needing to be reworked by an upgraded delivery system. Circle participants were being socialized into the full learning spiral described in the first chapter, and thus rendered competent as action researchers.

Meanwhile, as though in a time warp, the vocational educators were viewing retraining as the counterpart of retooling, overlooking the more complex theory and methodology needed to facilitate human development in the context of rapid change.

A black-box approach to the human individual and an innocence of theory regarding the complex, open systems in which the individual is socialized, were not, in my view, the unique shortcomings of the vocational educators. They were simply an extreme instance of these handicaps and therefore particularly worth studying. The same mechanistic, asocial, atomistic assumptions about learning governed all of education. Furthermore, the employability of the learner was also of general concern to the entire educational establishment, where, in the face of changing technology, a conspicuous breakdown in effectiveness was evident.

To challenge the limiting and outmoded assumptions that were proving dysfunctional, so that the newer action-learning configuration represented by quality circles at the small group level might be paralleled rather than prepared for by education, I felt that a demonstration was needed. Educators and economic developers concerned with education needed, as grounds for comparison, to be guided through a participant/observer investigation of the high tech workplace where human change was keeping abreast of, in fact leading,

technological change on a daily basis. I was fortunate to be able to design and direct such an investigation, The Storage Tek/State Education Project, which confirmed the importance of a new, collaborative, R&D competence that educators had overlooked. The final report, Appendix I, shows the same heuristic learning spiral, a kind of cognitive DNA, operating not only with individual learners but at the small group and organizational levels as well. It is the congruence at all three levels of aggregation, i.e., the individual, small group, and organizational levels of this heuristic spiral, that constitutes what is here being called a culture of emergence. The assimilation of this culture, which transcends the particular and ephemeral specializations it contains at any given moment, is now the competence that defines employability. Educational tactics that ignore this basic truth, that the culture is the competence, cannot achieve a comprehensive strategy for dealing with change.

Given its instrumental aim, the segment of our educational system with the greatest stake in staying current with changing technology is vocational education. This subsystem is the most clearly visible stress point between education and work--the exposed tip of an iceberg of concerns and issues about the future of employability that involve general education as well. Because its own survival is now threatened, and because it is an easier

political target for economic development pressures that demand quick results than is the more highly resistant K-12 system or higher education, vocational education may be presumed to have strong motives for changing and to therefore be open to experimental action. Other than attempting to update its blueprints for replicating specific technical skills, however, what can vocational education do differently? That response to a rapidly changing environment requires not blueprints but flexible strategies is an alien, almost incomprehensible concept to a system where the blueprint mentality is deeply embedded.

The Storage Tek Project accepted as a presenting problem (i.e., as the symptom or surface indicator of larger, underlying issues) the strain vocational education has been experiencing with replicating entry level skills now that the vehicle to be entered--the workforce in its particular functional set of requirements--is no longer stationary and neatly compartmentalized. Taking this superficial tactical concern as the starting point was meeting the situation where it already stood in the minds of its protagonists.

However, as was indicated in the previous chapter, the problem thus stated is manifestly insoluble. As Zeno's paradox of Achilles and the tortoise demonstrated long ago, incremental steps toward a moving target are futile; you can't get there from here in stages because

"there"--the target rather than the places it successively occupies--will have moved "elsewhere" each time you arrive. So long as this dilemma is not consciously recognized, the vocational system can be expected to restrict its efforts to single-loop learning--to more or less of the same--rather than to examining its basic assumptions.

What this impossible game of catch-up, in which specialized skills are always found necessary but never prove to be sufficient, reveals is an underlying habit of mind that confuses persons with demonstrable skills. This confusion is what the business of skill replication implies. Replication is a manufacturing notion which, applied to human beings, objectifies, routinizes, fixates what would otherwise be seen as quite capable of moving freely on its own--the human potential for discovery and invention. Reductively collapsing the identity of persons into the particular repertoire of skills they possess freezes the domain of human experience by deleting from its representation the person who experiences.

The challenge of the Storage Tek Project, a species of cross-cultural dialogue, was to shift the context for viewing emergent technology from the particular changes it generates to the process of change itself. That process is an heuristic spiral, not a closed, homeostatic loop.

In anticipation of the second section of this chapter that will describe in more detail the structure of growth, a preliminary contrast between the scholastic and emergent cultures as learning systems can be drawn as follows (Figure 2).

At issue in this contrast are conditions that either disempower or empower the learner for effective response to ongoing change. Between these two extremes there is little neutral ground: the situation is essentially binary. Depending on the presence or absence of empowerment, the locus of control for resolving conflicts and doubts associated with change will be perceived as residing either inside or outside the individual or group of individuals who are confronted by them.

The phenomenon addressed here is what Kenneth D. Benne (1979) calls the "methodological character" of the individuals concerned--a character learned through the processes of socialization and enculturation:

> My methodological character will have much to do with how assiduously I will seek to learn my way through conflicts and doubts, how able I will be to see and turn to others different from myself as resources in learning a "new" substantive character, if and when necessary. Alternatively, my methodological character will influence how readily and ardently I will adopt non-learning ways of coping with doubts and discrepancies in my lived world--defensiveness, dependence on authority, aggression, denial or evasion, among others. Those who wish better to understand the learner stance should be focally concerned with the ways in which persons build and rebuild, learn and re-learn their methodological characters. (p. 10)

Scholastic Learning	High Technology
Competitive	Collaborative
Authoritarian	Democratic
Atomistic--focus on individuals	Social--focus on groups
Prescriptive	Heuristic
Passive	Participative
Rote learning	Experiential learning
Left brain--linear thinking	Whole brain--systems thinking
Graded by test scores	Guided by feedback
Conflict between manifest and latent curricula; incongruence	Structure and behavioral regularities aligned with goals
Homeostasis/maintenance	Growth/emergence
Reductionistic (objectifies persons)	Person-centered (dialogical)

Figure 2. Scholastic versus high tech learning cultures.

Because traditional schooling does not develop the learner stance, while the rapid change associated with high technology demands such a stance even at the shop floor level, a major conflict is developing in our society of which structural workforce obsolescence is only an early symptom.

Appropriate social inventions facilitating a relatively high degree of proactive and participative problem-solving are being developed by high tech industries and modernized traditional industries to cultivate the learner stance. These inventions, however, described more fully further on in this chapter, have yet to be perceived, valued and adopted by public education where the emphasis is still myopically on specific skills and on individual learners.

Schooling is based on the assumption that what must be learned is already known by those who control the educational process. Applied science, on the other hand, proceeds on the assumption that much of what must be learned has yet to be discovered or invented. These differing assumptions make for highly contrasting practices and result in equally distinct methodological characters. Transition from traditional schooling to the R&D activity that typifies high technology at every level of its organization thus necessitates a major task of relearning.

The anthropologist Margaret Mead (1980), who studied the experiences of American immigrants in order to better understand the processes of relearning, arrived at a useful distinction between post-figurational cultures where tradition is passed on by the elders, co-figurational cultures where peer learning of a new way of life (e.g., in a new country) begins to supercede tradition-directed patterns of enculturation, and pre-figurational culture in which, according to Mead, we are all now living. The pre-figurational culture demands more than a substitution of one set of traditions by another. Rather, as Kenneth D. Benne (1979) writes in his discussion of Mead, "We are all now immigrants in an alien land. We must seek and develop patterns of learning in which young and old will collaborate in the invention of a future way of life, if there is to be a future way of life" (p. 37).

Pre-figurational culture, and high technology as an instance and model of such culture, are alike defined by the heuristic process of emergence and discovery. Contemporary schooling, however, like the older industrial system it mirrors, remains in a stationary holding pattern that is product-centered and process-blind. Learning at the institutional level does not occur, and the individual learner is still objectified as a unit to be programmed with an

established set of standardized learnings. The emphasis is on behavior that can be subjected to detached measurement rather than on intentional action originating from within persons. The shift from the standardization model to a pattern of heuristic emergence requires an unfreezing first of the reductionistic mind-set that objectifies learners. Objects do not emerge and discover, whereas persons, in the process of becoming conscious, do.

Having boxed workers in fixed routines and learners in prescribed learnings, the industrial age distorted reality by deleting human agency from its description. Change became that which had to be externally engineered, as when--in today's context--retraining is viewed as the analog of retooling. The institutional consequence has been the production model educational "delivery system" described in the previous chapter, processing persons as things to be standardized, black boxes with inputs to be programmed and outputs to be measured. Through this objectification, the source within those persons of the creativity upon which our collective future now depends was obscured: it was not met, engaged and called forth.

There are other ways of describing this problem. Malcolm Knowles (1978) saw it residing in what he called the content model of education which " . . . is concerned with transmitting information and skills whereas the process model is concerned with providing procedures

and resources for helping learners acquire information and skills" (p. 109). Paulo Freire (1983) attributed the same problem to what he called " . . . the 'banking' concept of education in which the scope of action allowed to the students extends only so far as receiving, filing, and storing the deposits" (p. 58).

If education has been thus nominalized (turned into a noun) by a system focused on learnings while work in the high tech configuration has been denominalized into the active process of learning, how might the cultural incongruity between the two domains be rendered visible to decision-makers and actionable by them in terms of new policies and practices that can bridge the gap? This is a congruence problem, not an incremental articulation problem. How might education thus be aligned with the process wisdom of the ancient Chinese for whom, as Hellmut Wilhelm (1973) writes, "The concept of change is not an external normative principle that imprints itself upon phenomena; it is an inner tendency according to which development takes place naturally and spontaneously" (p. 19).

The Storage Tek Project, in response to this question, was intended as an active demonstration rather than as a detached form of scientific inquiry. The principal investigator's objective was to describe the dynamics of the high tech learning environment that

contribute to the ongoing process of change while such change was occurring, and to involve key decision makers in that descriptive task.

It was hoped that this phenomenological attempt to model and reflect the process of the complex system in motion might yield clues for educators concerned with employability skills, policy makers concerned with economic development, employers concerned with human resource development,and private citizens concerned with the broader humanistic implications of the transformation of work now in progress.

An advisory committee reflecting these heterogeneous concerns with the interface of work and education was organized and invited to share in an heuristic probe. The aim here was to use the process of inquiry to surface patterns and themes that might provide occasions for dialogue among committee members so that common understandings about the nature of high tech competencies and a common language for sharing such understanding might develop.

The action setting was provided by Storage Technology Corporation (Storage Tek), a producer of electronic data storage equipment and, at the time of the investigation, Colorado's second largest employer. Its survival and its ability to meet its manpower needs locally were considered by involved public officials to be in the State's interest. The product of this corporation was

memory, but its method was attention, and imaginative response, to change.

The first phase of the project, a phenomenological approach to needs assessment, was situated in the Thin Film Operations area, where a new technology had already taken root without state training assistance (and thus with added start-up cost to the employer). The second, application phase was targeted to develop cooperative training for a new optical disk product just in the development phase for which the same host company had already requested state assistance. This earlier request had not been met by the state because the corporate representatives had not been able to state clearly their training needs, provide guarantees of employment, or allocate sufficient resources.

Clarity about these additional agendas was gained by representatives of both the state college system and the Optical Storage Operations Division during the course of the initial phase; and their joint approval for the application phase outlined in Appendix A of the final report (Appendix I) was gained. Unfortunately, as was alluded to earlier, the company filed a Chapter 11 bankruptcy petition before the second phase could begin and the optical program, as an occasion for developing a heuristic competence, was abandoned.

What was confirmed by direct observation and validated by the representatives of two very different

technologies, thin film and laser optics, was a common set of non-specialized, high tech R&D competencies (Appendix I, pp. 163-165) that relate to the heuristic and integrative needs of the complex system in which they are embedded.

In the case of high technology, as becomes clearer in the balance of this chapter, even though differentiated tasks remain important, there is a larger, wholistic sense in which--for all participants--the culture itself is the competence to be internalized; and that culture is a collaborative and heuristic process of continuing emergence. The novel concept "R&D manufacturing" used to designate this configuration is particularly expressive of the high tech synchronization of learning and action.

That high technology is still, in this regard, surrounded with mystification from the public sector's perspective is an indicator that attention has not yet been directed toward the discovery of meaningful patterns in its overall organization and movement. This is at least partly due to a procedural error. Rather than attempting direct, phenomenological observation of the process of high technology, public agencies have asked for analytical data. Exchange of information has taken place, but mediated through a format that falls far short of dialogue. Neither apprehension nor comprehension has occurred because the terms of the questioning have not

permitted employers to reflect on and give reasoned, comprehensive accounts of their systemic needs. Instead they have been asked for particularized manpower projections, turnover statistics and help in validating task lists for vocational programs.

They have not been asked more open-ended, qualitative questions about what, beyond the narrow terms of job descriptions, constitutes competence in the high tech domain and how such competence is attained. In the few, non-bureaucratic instances experienced by this writer where such questions have been asked (e.g., at the annual meetings of the Colorado Alliance for Science), the private sector presenters from high tech firms have repeatedly described their need for psychologically well-integrated, self-directed learners. They have stated their preference for persons who are "well-rounded," curious," "interpersonally competent," and pro-actively experimental in their approach to new developments. They showed no evidence of knowing how the persons they select acquire the desired traits; and, unfortunately, their practical suggestions to educators were phrased in terms that merely suggest a renewed emphasis on basic skills. In fact, however, a more discerning listener could understand that what was being called for was the education of the whole person, which is quite different.

So far as forecasting goes, statistics do not disclose which new occupations will arise tomorrow; and with respect to guiding long-range planning, they are virtually meaningless. Labor projections and task lists give only an atomized and ephemeral view of the workplace, when what is needed for general guidance is the living phenomenology of the transformation now in progress. Those who see their business as merely the replication of skills understandably want hard numbers and clear descriptions upon which to base their efforts; but while attempting thus to get in formation with today's market, they continue with respect to the larger patterns of change now occurring to proceed off course. Rearranging the deck furniture on the Titanic will not avert the impending collision.

The error here, as was indicated in the previous chapter, resides in the industrial engineering orientation to work which the scientist-philosopher Michael Polanyi has described as destructive analysis-- the attempt to account for skillful performance purely in terms of its particulars rather than considering also its teleological aim or intention (Polanyi, 1964, p. 50). At the level of the employment system, this means to ask about the fixed positions of jobs being currently performed. At the level of the individual performer, it means to break down the performance into discrete tasks, knowledge components and decision points. This is the

task analysis approach to developing occupational curricula (cf., Blank, 1982). Once specified, these components can be sequenced, prescribed, replicated through training and ultimately mechanized. Mechanization is achieved by the fragmentation of whole processes (McLuhan, 1964, p. 306); and task analysis applies the same principle to persons in order to arrive at a blueprint of the one best way of performing a routine task.

Whatever cannot thus be specified can only be learned by direct example, experientially. The activity of applied science, as opposed to its contents, falls into the category of the unspecifiable as Polanyi has noted (1964, p. 53). Yet it is this research and development competence that is potentially the new common code for linking work and education; and it was this that the Storage Tek Project sought to observe in its cultural setting--the high tech configuration it now essentially defines. How was this heuristic activity, this conscious and intuitive reaching through and beyond the particulars toward the unknown, being generalized among a broad base of participants in the high tech setting to form a fundamentally new cultural pattern?

To have asked this question already presupposes having lifted the inquiry into competence to a higher level of complexity than the usual task analysis methodology can accommodate. It requires a perspective that can embrace entire learning systems and their

processes of socialization and enculturation. To intervene on this latter level clearly entails more than training. What is known in this regard, the transformation of complex systems, is still at a primitive stage of development; but the contrast between the scholastic and high tech learning systems can be a useful step by permitting some necessary distinctions to be drawn.

Here, the point to be made is that a hierarchy of perspectives is available from which to view the processes of learning and work (which are increasingly synonymous), ranging from the instrumental through the personal to the social and cultural, each requiring a different methodology and yielding qualitatively different kinds of insight. When, for example, at the instrumental level the Storage Tek workers were subjected to task analysis, they responded as directed by describing the purely procedural aspects of their jobs. They spoke as functions rather than as persons. One worker at a time was questioned while the others remained silent, visibly bored and restless. All were in some measure, sometimes vocally, expressing frustration with the mode of questioning. Getting at the specifics in this linear fashion was, as far as they and the managers present were concerned, missing the point: it was entirely overlooking what they were to universally agree to be the essential nature of their work.

When, in contrast, the group as a whole was addressed dialogically as persons about their shared socio-psychological reality, there was a sudden and dramatic shift. They became energetically involved in providing rich, self-descriptive data about the intersubjective aspects of their work (Appendix I, pp. 163-165), that approximates the general psychological description of fully human functioning summarized previously (pages 58-59) with an added transpersonal dimension as well.

The first set of data could have been directly lifted from the procedural manuals that changed almost daily. The second set, arrived at through shared interpretation rather than through detached analysis, could only have come from conscious persons sharing a common set of meanings and purposes.

Each set of responses corresponded to a different evolutionary level of reality; and the higher could not have been explained in terms of the lower. This hier-archical principle of logic has been stated earlier in this paper.

Task lists do not include intentionality, which transcends them. Culture and consciousness, the socio-psychological dimensions of work, cannot be ex-plained by the analytical methods of industrial engineering any more than the meaning of a telephone message can be understood by measuring the amount of electricity required for its transmission. This does not

render the higher dimensions of negligible importance to our understanding of work. Quite the reverse is true. Unfortunately, however, the fallacy of reductionism--the dehumanized black-box view of workers--that stems from lack of a phenomenological methodology does render those higher dimensions invisible to those who design and practice education for employment.

"Organisms are not machines," wrote Ludwig von Bertalanffy (1952), "but they can to a certain extent congeal into machines. Never completely, however, for a thoroughly mechanized organism would be incapable of reacting to the incessantly changing condition of the outside world" (pp. 17-18). The continuous and unprecedented pressure of change in the high tech setting prevents it from congealing into mechanism. Procedures change daily, and each change generates ripple effects that require collaborative, problem-solving responses. Persons must be permeable, in this context, to each other and to their environment as well as to their own internal processes. Intentional, group-based learning activities such as quality circles and engineering "rip-up" sessions that subject experiments to careful scrutiny have thus become a conspicuous feature of high tech settings. They bring the ill-formed problems that are the fuel of creativity together with those who share the competence, motivation and legitimacy for solving them. These learning forums are occasions for scattered information

to be shared, for mindfulness to be recovered, and for persons to emerge from their limiting contexts as agents of change.

This situation fits the following propositions set forth by Arthur Koestler (1976):

> Other things being equal, a monotonous environment facilitates mechanization.
>   Conversely, new or unexpected contingencies require decisions to be referred to higher levels of the hierarchy, an upward shift of controls from "mechanistic" to "mindful" activities.
>   Each upward shift is reflected by a more vivid and precise consciousness of the ongoing activity; and since the variety of alternative choices increases with the increasing complexity on higher levels, each upward shift is accompanied by the subjective experience of freedom of decision. (pp. 346-347)

The upward shift described by Koestler--the emergent, integrative tendency of consciousness--is at once the essence of the high tech professional competence and the essence of personal growth. The work and the worker emerge simultaneously, in interdependence, as the objective and subjective poles of a single phenomenon. From this perspective, high technology can be regarded as a force favoring humanization, the recovery of human centrality to the process of production, and therefore as worthy of moral as well as technocratic interest.

"Work," in this regard, begins to take on the qualities which in its historic meaning were reserved for "action." The former is normally defined as purely

instrumental to its end product, whereas action entails
the disclosure of its agent as a unique person. In its
ancient usage, according to Hannah Arendt (1958) action
meant both to begin or to rule and to act or to execute.
Plato separated these two aspects, making the first the
province of the slave. This Platonic separation of
knowing from doing which, as Arendt explains, is the root
of all theories of domination, was achieved by
substituting the idea of making or fabrication (work) for
the idea of acting--a substitution which we have
perpetuated in our approach to education referred to
above as the production model:

> It is indeed true--and Plato, who had taken the key
> word of his philosophy, the term "idea," from ex-
> periences in the realm of fabrication, must have
> been the first to notice it--that the division
> between knowing and doing, so alien to the realm of
> action, whose validity and meaningfulness are
> destroyed the moment thought and action part
> company, is an everyday experience in fabrication,
> whose processes obviously fall into two parts:
> first, perceiving the image or shape (eidos) of the
> product-to-be, and then organizing the means and
> starting the execution. (Arendt, p. 225)

This two-part division no longer makes sense in R&D manu-
facturing, where design and execution arise as one
movement.

High tech work, which is heuristic, participative,
experimental, reunites thinking and acting. The
blueprint is here rendered provisional and subject to the
need for workers to continuously reflect upon and respond

to changing conditions in collaboration with others. As working is thus transformed by the context of a learning community, it transcends in its own sphere the oppressive dichotomies that have separated world from humanity, ruler from ruled, teacher from learner. Heuristic work partakes of that "problem-posing" form of education that Paulo Freire (1983) has called the "practice of freedom," "the emergence of consciousness and critical intervention in reality," " . . . a praxis: the action and reflection of men upon their world in order to transform it" (pp. 66-69).

This new, knowledge mode of production presents a formidable challenge to the fallacy of reductionism that has treated both work and learning as means, in line with the utilitarian philosophy that has guided the industrial revolution since the eighteenth century. As the dynamic process of change which characterizes high technology, in order to be managed, must be internalized by its workers as an "owned" force, through acquisition of what Warren L. Ziegler (1979) has called the "learning stance," work becomes liberating and humanizing even while remaining instrumental. This potential for humanization is already being actualized, to some extent, but not nearly to the degree it could be if made an explicit intention of policy. The lines of force are there to be recognized and utilized.

The challenge of the Storage Tek Project was to communicate the new, post-industrial, post-reductionist configuration to decision-makers at the work/education interface by giving them an experience of it. This meant involving them as heuristic learners in the high tech setting, where the reality of day-to-day technological change, the need for continuous learning, and the consequent limits to routinization could directly confront the usual assumptions that guide educational policy formulation. The strategic question was, could the same heuristic process that is deroutinizing high tech work also unfreeze the attitudes and motivations of those responsible for manpower development policies and practices. Could the very concept of "manpower," in a context that now requires mindfulness, thus be brought into question?

As a learning forum in a laboratory context, the project participants--the principal investigator, members of the advisory committee and personnel of the host company were engaged (to borrow Friere's terminology) in a process of conscientization about the process of conscientization. Through this dialogical process--how do we know what we think until we see what we say?--persons " . . . emerge from their submersion and acquire the ability to intervene in reality as it is unveiled" (Freire, 1983, p. 100). To quote Ziegler (1979):

The methodology for unpacking the concept of the
learning stance and the methodology for practicing
the learning stance share the same moral and
heuristic qualities. This is because the concept
itself is "actionable." That is to say, the
dimensions of its meanings are uncovered by the
learner in the very acts of learning which the
concept encompasses: those which are
self-initiated, deliberate, chosen, proactive,
consequential acts of assigning meanings to
experience in such a way as to modify or transform
it. (p. 10)

The bridge from homeostatic to heuristic learning

is, in other words, heuristic learning itself. The

intervention and the end to be achieved are identical.

The problem is that the individuals who, at the levels of

policy formulation and institutional practice, must

function as agents of organizational learning are

typically themselves immersed in homeostatic, single-loop

learning systems. Therefore, as Argyris and Schon (1978)

relate:

the probability is high that they will tend not to
know how to invent a model whose basic as- sumptions
and governing values question the existing
organizational assumptions and governing values. If
they knew how to do this, they would already have
the skills for double-loop learning. (p. 169)

The Storage Tek Project was simply one occasion for

interfacing the double-loop model in its high tech

manifestation with representatives of the agencies and

institutions it has thus far outpaced and destabilized.

The intervention was designed to provoke increased

awareness in a climate of creativity. Cross-cultural

dialogue of this sort enables its participants to step outside their own cultures and see them from a different vantage point. A single-loop system, seen from such a new vantage point, is clearly at an inferior stage of evolution. A choice of moves is of far less magnitude than is a choice of rules or of games. The high tech worker has been acquiring the latter power.

The virtue of pattern disruption is that it blocks an automatic or habitual response from completing itself and thus drives it into conscious awareness. High technology, with the rapid and systemic changes it generates, constitutes a major pattern disruption of single-loop, homeostatic learning. Internally, high tech is responding by developing organizational arrangements that are heuristic. Externally, however, the institutional components of the educational infrastructure that serves it have not yet adjusted, even though the "same old ways," first-order changes (e.g., in course content), are no longer sufficient.

The more general need for a learning society has been widely felt and publicly proclaimed for several decades; but until we learn how to learn at the institutional level such an attainment is unlikely. More than the awareness of a few key decision-makers will be needed. But further recommendations, which of course will demand greater resources than were available to the

Storage Tek Project, in order to execute, await discussion in the final section of this paper.

High tech emergence, to bring this section to a close, is not an automatic consequence of a blueprint designed at its outset. Rather, it is the objective manifestation of human emergence through mindful, intentional action which, as has been suggested, is a fundamentally liberating and creative activity. Through this heuristic process, head is reunited with hand, reflection is joined to action, and persons enter a reciprocal relationship with each other and with their work. Humanization and automatization are opposite, although potentially complementary, tendencies.

Because high tech work, as _phenomenologically_ observed at Storage Tek, cannot proceed without conscious presence, continuous problem-solving and deliberate experimentation, it connects the subjective and objective poles of human existence in a manner that demonstrates the reciprocity between them. This conclusion, which could not have been arrived at by destructive analysis, expands the parameters for public policy formulation at the work/education nexus from an either/or with respect to humanistic versus economic concerns to explicit acknowledgment of their interdependence. The shift from single-loop to double-loop learning is a shift to consciousness and hence to the growth toward full humanness of individual persons.

The Structure of Growth

Just as the biological shift from an exoskeleton to an endoskeleton has given far greater flexibility, adaptability and growth potential to vertebrates than is available to mollusks, so the shift in high tech organizations from the rigid, bureaucratic pyramid to a flat structure--polycentric groups of individuals flexibly oriented toward their work in common as a ground for experimental action--has been transformative. The theory that accompanies this practical shift stems chiefly from the path-taking work of Kurt Lewin (1952) and his school of social psychologists, whose work in the post-World War II period generated a sizable literature and the development of the National Training Laboratories. The structural and cultural changes that concern us here cannot, however, be attributed to the rise of this body of theory so much as to the rise of a new mode of production.

Because of the ill-formedness of the problems it continually creates in a climate of intensified change, complexity and interdependence, high technology requires the more versatile structure appropriate to a mode of knowing even though it retains aspects of the rigid structure associated with a mode of fabrication. The basic unit of this newer structure is the small,

problem-solving reference group which at the shop-floor level is known as the quality circle or quality control circle. It is the vehicle, at the individual and organizational levels, for a broad-based movement toward heuristic learning. To suggest that structural change alone can bring about cultural change would be overly simplistic. However, the structures according to which humans interact do condition their behavior which in turn, over a period of time, conditions their attitude and beliefs.

Quality circles were introduced to Japan by W. E. Deming shortly after World War II. Using statistical methods and scientific practice, production-level employees thus became responsible for quality control. Ouchi (1982, pp. 223-4) records that the average Japanese Q-C circle produces fifty to sixty implemented suggestions per year for each worker, that more than one hundred thousand Q-C circles were officially registered in 1979 with the Union of Japanese Scientists and Engineers, and that an additional one million unregistered circles were estimated to exist.

Accompanying this structural change is a philosophical intention that Ouchi (1982) cites as follows from the Union of Japanese Scientists and Engineers handbook:

No matter how much factories are mechanized, so far
as there are people still working there, they should
be treated as human individuals. But this aspect is
seriously neglected these days. Those companies
that do not give due consideration to humanity will
lose their best people sooner or later. There was
ample evidence of this in such countries as the
United States in the past twenty years or so. There
can be no excuse for disregarding individual person-
ality, slighting a man's ability, regarding people
as machinery and discriminating against them.
. . . .People spend much of their lifetime at
their working place. It would be much more
desirable to work in a pleasant place where humanity
is paid due respect and where people feel their work
has some real meaning. That is what Q-C circle aims
to achieve. . . . A mechanized factory still
requires control by a workshop of people. As people
are driven by a desire to study more, they acquire
an ability far beyond their previous expectations.
It is doubtful whether the mechanism known as
meritocracy, a system that rates people based on
their current performance and already acquired
ability, can draw out their hidden ability. (pp.
227-228)

To participate effectively in these groups, the
average Japanese employee receives approximately 500 days
of training in the first ten years of employment.
Japanese technical schools are beginning to use the same
practices, which generalize the patterns of ongoing
inquiry, experimental innovation and high quality
production. I would strongly recommend that our own
vocational educators follow suit (see pages 182-186).

Since the quality circle practice was introduced
into the American context in 1973 by Lockheed, it has
become increasingly widespread in this country, with
companies typically reporting high returns on investment
in the forms of innovative and cost-saving ideas,
increased worker satisfaction and commitment, and

improved quality. Former Work Bank manager John Simmons

(1983) cited a New York Stock Exchange survey of 7000

companies that found 43% had implemented some form of

quality circle, and only 3% said it was a fad.

At a time when those calling for the development of

a learning society appear innocent of any theory of

cultural change that might lead to coherent action on its

behalf; when, to the contrary, their recommendations

reflect an implicit theory of learning that is asocial,

incremental and non-experiential, the quality circle

movement worldwide, with its antithetical assumptions, is

surely a phenomenon of some significance. A new

environment, as Drucker (1974) observed, requires a new

synthesis of human capacities:

> A primary task of management in the developed
> countries in the decades ahead will be to make
> knowledge productive. The manual worker is
> yesterday--and all we can fight on that front is a
> rearguard action. There can be no divorce of
> planning from doing in knowledge work. On the
> contrary, the knowledge worker must be able to plan
> himself. Present entrance jobs, by and large, do
> not make this possible. They are based on the
> assumption . . . that an outside expert such as the
> industrial engineer or the work-study specialist can
> objectively determine the one best way for any kind
> of work to be done. (pp. 32-33)

The quality circle is one means of uniting planning

with doing that enfranchises job performers as job

designers, thus releasing their innovative potential. It

constitutes a social invention of major importance to the

organization of continuous learning; and yet it has not impacted the way we conduct education in schools, which remain structurally hierarchical with respect to authority.

The function of hierarchy ought to be synthesis, not dominance; a healthy organization requires differentiation as well as integration. Pyramidical structures tend to suffer from over-control. An exception is the symbolic pyramid on the dollar bill where the apex is discontinuous with the base and therefore exists not as a fixed position but as an open-ended orientation shared by each stone in common--like an orientation to truth among scientists or toward quality among workers.

To demonstrate the high tech challenge to the authoritarian notion of hierarchy, the following incident can be related from among the numerous observations that I made note of during the Storage Tek Project. What is central in the illustration is the clash it demonstrates between two very different notions of organizational structure, each yielding a different mode of behavior:

> The principal investigator as participant/observer was contracted both to observe and to facilitate the initiation of a quality circle program in a high tech setting where formalized learning arrangements were crucial to effective operations. At an early meeting, a newly-formed circle exercised its freedom to consult with resource experts from anywhere in the company. A senior engineer from their department was invited to review and respond to several of their improvement suggestions.

One of their suggestions was to either correct or abandon the wave-soldering process that was causing much scrap and re-work in their area. The entire production process dependent on the sub-assembly they produced was falling behind schedule due to their difficulties. They believed at least as an interim solution, that they could demonstrate better results with manual soldering under a microscope--the technique they already used for re-work; and they wanted to collect data to see which technique was presently most effective.

The engineer, unaccustomed to quality circle operations, remained visibly the prisoner of the bureaucratic chain of command and strict division of labor between head and hand. He lectured sternly down to the group about wave-soldering as the "state of the art" which their own efforts could not hope to equal. He gave a few patronizing suggestions voiced as commands, and dismissively left the room.

The investigator remained, and he asked the group for further instruction. They escorted him to their work area and explained their situation. He encouraged them to go forward with their investigation, pledging his support.

One month later, with excellent charts and graphs on color transparencies, the group was ready to present its findings to the same engineer consulted previously. "I don't know what you're going to suggest," he said with his arms defensively folded across his chest and scowling, "but I can already tell you what the response is going to be; and it's not going to be positive. That machine can put out x parts per day with 98% acceptability; and there's no way that you can equal that manually."

There was a shocked silence in the conference room, bringing the meeting seemingly to an abrupt end. The investigator here intervened to say that much effort had gone into the presentation, that it would not occupy much time, and that a fair hearing was surely deserved.

With the engineer's begrudging assent, the group lit up their graph on the screen. They showed the machine in question putting out little more than half of the engineer's figure per day with only 35% acceptability even with their technician's best corrective efforts. The rest was scrap and re-work. Meanwhile, having taken care to choose only average performers of the manual technique, the group had been able to demonstrate greater productivity and 100% acceptability.

The engineer was astonished and outraged. Why, he asked, had he not been informed earlier? He was evidently unconscious of his role in having discouraged their attempts at communication. Just then, a junior engineer, his subordinate, stepped into the room, was ordered to drop all other projects and told to fix the wave-solder machine. Together, without acknowledging the group for surfacing the problem, the engineers left the room.

The circle members appeared both shaken and encouraged by their success. Even in this new context, power could not finally be given; it had to be taken. Together, they had done so, with critical thinking constructively exercised.

Yet they deserved, and the success of the program required, some further acknowledgment other than their own and the investigator's. The latter intervened to arrange a formal presentation to the department's higher-level managers and to the company's top engineer. The other two engineers were also invited.

This time, as was more properly the norm, the circle members were carefully listened to and respectfully thanked. The serious problems with the wave-soldering machine had not been solved. However, the manual alternative might not be acceptable. The circle's investigation had provoked a discussion at higher levels about temperature of soldering in relation to electronic performance. The members would be kept informed, they were promised, as of the results of an engineering study now to begin.

To be accepted as colleagues was an extraordinary rise in stature for the circle members. The promise was kept, again with a full contingent of managers and engineers. Electron microscopic photographs had been blown up to illustrate a problem that neither circle members nor their superiors had anticipated. Soldering at the relatively low temperatures used in the manual technique, it was shown, could result in "cold" solder joints. These could not be detected under an ordinary microscope used by operators.

In the complex circuitry of a data storage device that sold for nearly $100,000, there were a large number of such joints; and if even one or two were "cold," although the problem would not surface for two or three years, a failure could then occur that would ruin both the equipment and the valuable data it held.

The precision-crafted magnetic head, built up in molecule thicknesses of layered metals and flying

at an altitude of fourteen microns--a fraction of the thickness of a human hair--over a disk revolving at 200 miles per hour, would crash, bringing a remarkable triumph of technology and coordinated human effort to a shattering halt.

Because of the length of time required for such a problem to surface, detecting it in advance while the equipment was still being floor-tested by the manufacturer would not be possible. Yet, should a number of such failures occur out in the field, the negative impact upon customers and Wall Street investors could easily seal the fate of the entire company. In the instance here cited, because the quality circle process itself was not short-circuited, such a fate--the crash of a sizable corporation--was averted.

The acute interdependence characteristic of high technology illustrated by the above incident makes every position in its organization crucial to the survival of the whole. This makes for an unprecedented degree of horizontal equality among positions that must now accompany the still-necessary persistence of bureaucratic hierarchy. Taylor's separation of head from hand, on the assumption that problems could be anticipated and solved in advance while all the rest was routine execution, no longer holds. Problem-solving ability and responsibility must now be distributed throughout the organization. With the body politic as with the body as understood by bodymind psychologist Wilhelm Reich (1972) and his followers, cf. Lowen (1975) and Brown (1966), pp. 126-140, cutting off awareness below the neck is a defensive holding pattern that results in unconsciousness. Had the engineer and the line workers in the above incident strictly adhered to their

specialized job descriptions rather than acting as agents of organizational learning, the result could have been disastrous.

The conflict evident in the obstructive, nearly fatal non-listening behavior of the senior engineer is symptomatic of a failure, widely shared in our society, to distinguish between two radically different organizational contexts--the <u>mechanistic</u> and the <u>emergent</u>--each corresponding to a different level of learning and requiring a different type of structure. Organization is informed by its underlying learning principal to the same extent that organism is informed by its genetic coding.

The <u>mechanistic</u> context is defined by a bureaucratic structure and by homeostatic learning. Its function is maintenance of a steady state. The <u>emergent</u> context is defined by a flat, horizontal, organizational structure and by collaborative heuristic learning. Its function is growth. In the former context, the line operators cited above could only do more or less work or re-work according to the functioning of the wave-solder machine: they were tied to its rhythms. In the latter context, the same workers could emerge as full, discerning persons and call the machine itself into question from a critical perspective.

The second type of learning is what was earlier described as emergence or consciousness as distinguished

from habit. It has also been called heuristic, double-loop (Argyris and Schon, 1978), Learning II (Bateson, 1978), "the learning stance" and "learning your way into the future" (Ziegler, 1979), and "learning how to learn" (Shah, 1981). Defined by Paul Watzlawick (1974) as "second order change," it is the shift to a higher logical level of choice permitting " . . . a corrective change in the set of alternatives from which change is made" (p. 293). Roberto Assagioli (1976) had the same distinction in mind in the following:

> Gustave Le Bon, in his book La Psychologie de L'Education, goes so far as to state that "education is the art of making the conscious pass into the unconscious." While this is true of learning and skills, it is certainly not the aim of all education. One might say just the contrary in regard to its higher aspects. The etymology of "education" (e-ducere) expresses its true purpose and function: to "draw out" the latent possibilities from the unconscious, to activate the energies dormant in it, particularly in its higher sphere, the superconscious. (pp. 57-58)

The distinction we have been drawing between bureaucratic hierarchy and routine on the one hand and democracy and science on the other extends beyond the small group context we have already discussed to organizations as a whole. A number of theorists have drawn this same distinction. Burns and Stalker (1961) in Britain distinguished between "mechanistic" organizations appropriate to routine functioning and "organic" organizations appropriate to less stable

conditions such as those associated with knowledge work, as shown in Figure 3.

Mechanistic	Organic
Closed, hierarchic	Open, situational
Specialized tasks	Flexible roles
Communication through established channels	Communication in all directions
Tasks stable and routine	Adjustment to frequent change is necessary
Centralized decision-making	Decentralized authority

Figure 3. Mechanistic versus organic forms of organization.

Zand (1978) distinguished between an "authority/ production" mode of organization and a "knowledge/ problem" mode with which it can coexist. The former deals with well-structured problems, while the latter is better suited to ill-structured problems. The relationship drawn by Zand is shown in Figure 4.

Elements	Authority/ Production	Knowledge/ Problem
1. Levels of authority	Many	Few
2. Division of labor	High	Low
3. Links to others in the organization	Few	Many
4. Source of influence and power	Position in the hierarchy	Ability to identify and and solve problem
5. Use of rules and procedures	High	Low
6. Primary purpose	Maximize output	Analyze or invent knowledge for problem-solving

Figure 4. Collateral modes of organization.

Kanter and Stein (1980) distinguish the "bureaucratic" or "mechanistic" organization from the "parallel" organization as follows:

> The main function of the mechanistic organization is the maintenance of production and the systems that support it--that is, the continuing routinization of useful procedures. The organic organization, on the other hand, is change oriented and embodied in a parallel structure. People are grouped temporarily in a number of different ways as appropriate to the problem-solving tasks at hand. They are not limited by their position in the hierarchy. . . . The main task of the parallel organization is the continued re-examination of routines. (p. 385)

The bureaucratic organization is like the rigid skeleton that holds the body up while the complementary parallel

organization is like the muscles and soft tissues that enable the body to move and grow. A naked skeleton is a symbol of death.

Concerns about overeducation resulting in underemployment are based on the bureaucratic notion of hierarchy, where only a fixed number of desirable positions allowing opportunity for growth exist. With respect to levels of available opportunity and power, buraucracy is a scarcity model. Kanter and Stein's notion of the parallel organization, on the other hand, is an abundance model that expands those levels beyond the limitations of hierarchical position:

> Opportunity, in addition to its standard definition as "access to advancement," means challenge to grow (increase competence and skills) and contribute to the central goals of the organization. Power means access to resources, the capacity to mobilize them and the tools to accomplish tasks efficiently. (p. 373)

The full social implications of the parallel organization, above and beyond the corporate context, have yet to be explored; but they surely must be if the severe conflicts implicit in a scarcity model of opportunity and power are to be averted.

In the Storage Tek incident described earlier (pages 105-108), quality circle members were operating in the context of the parallel organization. Not only were they empowered to access new resources, gain knowledge, and solve organizational problems, they were also able to display abilities that might otherwise have remained

hidden not only from fellow workers and managers but also from themselves. Their elevation in stature, self-esteem, and competence were as much outcomes to be reckoned as was the contribution they made to their corporate mission.

What the organizational theories cited above have called "organic," "collateral," and "parallel" organization conforms to what Polanyi and Prosch (1975) had earlier understood as the polycentric system of mutual adjustment characteristic not only of scientific communities, but of free society in general. The members of such a society are freed from mere self-assertion by adherence to central and supra-personal goals, values or ideals which can, nevertheless, not be concretely defined: "Truth, for instance, is given specific form only as a community of scientists is free to work out what its form is--and this task is never finished" (p. 204). Polanyi and Prosch refer to such communities as "enclaves of freedom," "autonomous circles" of persons working out their problems through mutual adjustment and authority, and as "little republics of their own."

While justification for the bureaucratic principle of hierarchical authority remains on organizational maintenance grounds, and while more horizontal arrangements are justified chiefly on learning grounds, there is also evidence to suggest that horizontal, person-to-person relationships are conducive to healthy

psychological integration of individual persons, while the reverse is true of authoritarian relationships. Julius Seemen (1983) who has devoted decades to the study of personality integration in the fully functioning person, conducted measurements along with his associates using Kuethe's free-placement felt figures technique:

> This technique permits persons to project their perception of interpersonal distance by placing pairs of figures on a large rectangular board at distances they chose. . . . In this study the decision became self-relevant because in each instance one member of the felt figure pair was specified as a self figure. (p. 153)

This study, replicated among various age groups and populations, showed that high-integration persons utilize the horizontal plane in positioning pairs while the non-high persons used the vertical plane. Respondents who used the horizontal placements reported a sense of equality, while placements by other respondents of one figure higher than another were accompanied by reported feelings of superiority or inferiority.

Direct observations of interpersonal behavior confirmed " . . . the high integration person's ability to relate to others in peer-like, noncontrolling, and nonhierarchical ways" (Cooley and Seeman, 1979, p. 290). Children were no exception; relating to adults even at seven or eight years old in peer-like ways. A further study found that high integration children came from families that related in more egalitarian ways than was the case for families of lower integration children.

What Seeman's studies illustrate is that high integration persons have an internal organization map that is flat or democratic while less fully functioning persons have as their internal organizational map a hierarchical, authoritarian structure. That these interior maps are related to the ecological influence of the family structure suggests that they are products of socialization in which the structure of schools and other organizations also play a part. Parents themselves, after all, are products of socialization.

That the organizational context needed for technological innovation is also the communication context needed for healthy integration of the personality has been further confirmed by Virginia Satir in her work on family systems. In a workshop given in March, 1980 near Lyons, Colorado, she proposed that the behavior of persons and of human systems could be predicted on the basis of four phenomena related to ways of perceiving the world. Her model, Figure 5, is illustrated on the following page.

The overlapping conceptualizations discussed in this section correspond to the dichotomy drawn at the outset of this chapter between the scholastic and high tech models of learning. Taken together, they support the proposition that high levels of collaboration, heuristic learning, personality integration and innovation are produced by a known set of organizational arrangements

Hierarchic Model	Phenomena	Organic Model
Hierarchical. Role same as identity, natural feelings that follow include: resentment, submission, anxiety, aggression, inadequacy.	Definition of Relationships	Equality. People are people. Everyone is a manifestation of life force.
Conformity to a box of oughts and shoulds. Cuts off unique feelings and thoughts. Natural feelings that follow include: isolation, rejection, unworthiness, feeling like hiding, manipulating, lying.	Definition of Person	Uniqueness of each person. Differentness, as with fingerprints is natural.
Left brain, linear thinking. "A" causes "B." Stereotypical thinking (always and never). Generalizations are accepted as true. Leads to mental retardation and to feelings (where exceptions to rules are perceived) of humiliation and shame.	Definition of Events	Whole brain, systems thinking. Many variables are interacting in the complex system. More linkages are at work than are presently manifest. Look under the surface for hidden relationships. Discover there is no right way.
Change is perceived as abnormal Reject change, maintain status quo. Survival is threatened by change. Leads to denial, projection, and ignoring of facts. Compel and judge.	Attitude toward Change	Acknowledges change. Security means taking risks. Prepare for the unknown--accept ambiguity. Negatives are steps along the way. Center is in the life force, not in the particular situation that is changing. Choice and discovery.

Figure 5. Alternative models of experiencing

and corresponding attitudes which are quite distinct from those found in most schools and in other conventional institutions. Perpetuating these latter arrangements, which are hierarchical, bureaucratic, and mechanistic, while calling for the development of a learning society that requires contrary processes of socialization and enculturation is operating at cross purposes.

High tech as described in this paper is a force that favors the growth of a learning society. It is instructive as a working model of the R&D competence and of the kind of learning environment that fosters it. Even in its developed phase, "R&D manufacturing," high tech remains an ongoing process of collaborative learning and experimental risk-taking. Its law is grow or die. The model of high tech emergence (Figure 9, p. 173) shows an heuristic spiral that (a) at the macro-level moves from initial R&D through prototype and manufacturing phases on to internal or external spinoffs that resume R&D efforts once again; and (b) at the meso-level of small problem- solving groups constitutes a parallel organization. A third, micro-level of the spiral is also implied, for the individual who participates in the overall macro-movement and in the group process is himself or herself likewise carried through an experiential learning spiral that moves from practice to reflection, to theory formation, application of theory, and thus to a new level of practice from which the spiral

resumes its movement. All three levels are isomorphic with this movement, and the entire high tech configuration is thus in motion: its pattern is emergent.

The shift in our society as a whole from the homeostatic circularity exemplified by scholastic learning to the heuristic spiral of growth exemplified by high technology is entirely feasible once their differences are widely understood. The deep psychological barriers to such a shift, however, are considerable, as the next section elaborates.

The Evasion of Growth

The movement toward increasing humanization thus far described in this paper is by no means inevitable. Nevertheless, in the private sector, as we have seen, high tech is already taking us a considerable step beyond the sacrifice model of work that disturbed Pius XI in our earlier citation, when he observed that " . . . from the factory dead matter goes out improved whereas men there are corrupted and degraded" (Schumacher, 1975, p. 39). We have not yet reached the high level of perception and functioning predicted for technologically advanced society by Willis Harmon (1979) where ". . . employment exists primarily for self-development, and is only secondarily concerned with production of goods and services" (p. 59). However, we may very well be nearing at least a midway point with respect to technical and

economic feasibility, where the forced trade-offs between person-centered and instrumental concerns related to work are no longer binding and where a principle of complementarity can be established between them.

Despite its reliance on technological and economic arguments, the Storage Tek Project's focus on high tech as a potential guide for education was not intended as support for a purely market-driven educational system or for the wholesale abandonment of traditional focus. In fact, to abdicate human intentionality to the invisible hand of the market or to a perceived technological imperative would be less a policy than a surrender of the wisdom needed to actualize human potential and to choose the ends towards which it and technology are directed.

However, in a more selective sense, the market's new insistence on innovative capacity has become a powerful factor favoring the humanization of technology--the shift of the worker from an adaptive to a transformative role-- especially if education can be directed toward the same shift with respect to students (i.e., with a new role for the student as change agent). Time and the ascent of a scientific society in which, to use Sir Julian Huxley's (1969) phrase, evolution is becoming "conscious of itself" (p. 21), may be ultimately favoring such a transformation; but history provides no guarantees without our conscious cooperation. "Time," as the poet T. S. Eliot (1970, p. 187) wrote, "is no healer: the

patient is no longer there." The opportunity that now presents itself needs to be recognized and seized through deliberate initiatives in the definition and in the design of work and education if we as a society are to benefit. We must also understand that regressive options remain open as well.

This last point to which we now turn our attention, may be anecdotally illustrated by an exchange between the Storage Tek Project's director and a senior vocational education administrator shortly after the project's final report was issued. The integrative competencies described in that report, conceded the vocational education administrator, were "appropriate enough for high tech; but what about the authoritarian, Theory X managers" among the system's clients who merely wanted, to take the example he offered, "a docile and minimally skilled welder?" His manpower projections showed "a sharply increasing demand for janitors and fast-food workers. How would learning how to learn be helpful to them? Why not just meet the minimum entry-level requirements for the available jobs?"

It is precisely this lack of ecological thinking about human resources that evades the question of continuing employability and leads to "structural workforce obsolescence." The worker who enters an occupation without a competence for ongoing learning and collaborative effort is in jeopardy. Welding, to use the

example offered by the vocational education administrator, is already being roboticized and has little remaining future as an occupation. To focus exclusively on such short-term, job-specific skills is a policy of deliberate undereducation.

If the market were suddenly to require 10,000 crippled workers and only 1,000 were in supply, it would surely not be the vocational system's task to cripple 9,000 more individuals to meet the demand. The analogy is far-fetched; but to neglect the empowerment of learners in a world of rapid change is to inflict, by omission, a grave handicap on those who will need to work under such conditions and also assume wider, more responsible roles as citizens. Such is the implicit cruelty of a purely reactive stance to the perceived short-term needs of the employment market, a logic that myopically leads to institutionalized violence against whole persons.

An overeducated workforce presents problems; but however attractive a more docile workforce might be from the standpoint of social control, a deliberate policy of undereducation (disempowerment) as a means of insuring domestic tranquility is hardly consistent with democratic values of social well-being. However compassionate the justification, stunting the growth of those who might otherwise grow dissatisfied cannot be considered humane or even useful.

Moreover, the non-learning alternatives to empowerment previously cited from Benne (1979, p. 10), "defensiveness, dependence on authority, aggression, denial or evasion, among others" are far more threatening to the individual and to society than is the prospect of dissatisfaction due to limited opportunity. In fact, when appropriately legitimated, the "learning stance" as a methodological character is more likely to discover new opportunities than to be stifled by apparently existing limits. We have surely no shortage of social and environmental problems to provide <u>fuel</u> for creativity. Why therefore restrict the development of problem-solving capability which thrives on such fuel?

Willis Harmon (1979) is among those who have equated overeducation with underemployment: "Having educated its citizens to fuller awareness of their potentialities, a society is in trouble if it does not provide for the exercise of those capabilities" (p. 53). Our unconscious tendency may be to react against this danger by treating the labor market, narrowly conceived, as a Procrustean bed of necessity upon which to sacrifice the higher aims of education. Where its human requirements have increased, we naturally want people stretched; but where they have diminished or appear limited, we may wish to permit the chopping off of the excess.

It is worth noting in this regard that the smith god or archetypal craftsman in many mythological traditions,

from Greece to Scandinavia to West Africa, is crippled. Those same peoples in primitive times may have deliberately lamed their metal craftsmen to keep them from running away (Graves, 1973, p. 88). Similarly, by tying human development efforts to the narrowest terms required for economic survival, our ability to move beyond those terms is impaired. This is not to suggest that even a limited competence cannot instill confidence, perform a valuable function and yield satisfaction, so long as it is freely chosen. But ought there to be artificial ceilings placed on those who must choose in the form of benign neglect? The labor market as it is currently defined offers insufficient scope for the full human potential to be realized. Extensive underemployment already exists. Does this commit us to an elitism in education that for the majority will require the repression of their higher nature? If so, the current system may be more than adequate for the purpose.

The following rationale is offered by the Illinois State Board of Education, Department of Adult, Vocational and Technical Education, for an activity solicited by its 1986 request for proposals brochure:

> A mismatch between workers' job-related skills and the actual skills required by the job often result in job dissatisfaction, poor health, and low productivity. This, in turn, affects the economic performance of individuals and firms as well as the U.S. economy in general (R. W. Rumberger, 1984. Phi Delta Kappan 65, 343-346). This imbalance is often

described by such phrases as "overeducation,"
"underutilization," "underemployment," "deskilling."

While some technical occupations will be among
the fastest growing occupations during the 1980s,
these specialties will provide few new jobs. To the
contrary, the ten occupations that will produce the
greatest numbers of new jobs in the future are
unrelated to high-technology. Most of these new
jobs are in service and clerical areas.

Technology decreases the skills that many of
these service and clerical jobs require as it begins
to displace mental as well as physical labor. With
such displacement many middle-level and semi-skilled
jobs are also likely to be displaced. With such a
"deskilling" trend, the imbalance between education
obtained and the skills actually required to perform
a job could become more severe, exacerbating job
dissatisfaction, leading to reduced productivity and
lower mental health. The worker will have a set of
expectations about his or her abilities which the
job cannot satisfy.

This activity is designed to assess the
severity of this imbalance in Illinois, and, if
warranted, to recommend what educational steps can
be taken to address this imbalance.

Should the assessment indeed show that future

workers are being overeducated, what "educational steps"

might be recommended? Perhaps it would be more

reasonable not to look exclusively to the educational

systems for solutions to the imbalance between high

expectations and limited opportunities. Perhaps instead

the wider society needs to concern itself with opening

new opportunities and rewards for contributions from its

members in areas of social and environmental need

commensurate with the energies an empowering educational

system could release.

The goal of such a system would be to help actualize

the fully human, that great embarrassment of riches which

our present society is so ill-prepared to accommodate.

Such a suggestion is likely to provoke unconscious resistance, even though its acceptance could vastly expand the source of value added to our economy. Abraham Maslow (1968) dealt with the psychological dimensions of the limits we place on actualizing our human potential in his essay on "The Need to Know and the Fear of Knowing:"

> it is precisely the god-like in ourselves that we are ambivalent about, fascinated by and fearful of, motivated to and defensive against. This is one aspect of the human predicament, that we are simultaneously worms and gods. Every one of our great creators, our god-like people, has testified to the element of courage that is needed in the lonely moment of creation, affirming something new (contradictory to the old). (p. 61)

Despite our human ability to transcend circumstances, movement across the boundary between the known (however confining) and the unknown (however liberating) is fraught with taboos. Simply to credit one's own faculties, to emerge in one's own personhood, is to invite the punishment suffered by Prometheus, Adam and Eve, or Faust. These myths depict the parental restraints we all internalize in some degree at an early age.

For creativity and the emergence of the true self to occur, as Maslow (1972) understood, such restraints must be overcome: "Learning to break through one's repressions, to know one's self, to hear the impulse voices, to uncover the triumphant nature, to reach knowledge, insight, and the truth--these are the requirements" (p. 52). How can society, which by its very nature tends

to impede such development, be reconstituted as its facilitator? How can children learn not simply about a world that is mediated for them, but about their own equipment for relating to it directly?

Jerome Bruner (1965) has asserted on the basis of experimental studies that children can be quickly led to the skillful problem finding that engages their natural tendency toward independent problem-solving. This does not occur, according to Bruner, because schools, which children perceive in terms of aribtrary and meaningless demands imposed by adults, do not foster such empowerment:

> The need for this instruction and encouragement and its relatively swift success relates, I suspect, to what psychoanalysts refer to as the guilt-ridden oversuppression of primary process and its public replacement by secondary process. Children, like adults, need reassurance that it is all right to entertain and express highly subjective ideas, to treat a task as a problem where you invent an answer rather than finding one in the book or on the blackboard. (p. 463)

Where such encouragement is lacking and conformity is urged instead, a split occurs between inner identity and outer activity. The latter becomes a kind of false identity divorced from the source of power and creativity which resides in the true self. This dissociation of who we are in our wholeness from what we do is what Alexander Lowen (1983), as previously discussed, diagnosed as our "cultural narcissism."

If, despite our recent public rhetoric urging creativity and innovation, our educational institutions continue to put people in boxes rather than empowering them, the reasons may thus run deeper than institutional inertia or a reductive and outworn instrumentalism. There may be a kind of Pandora principle at work here--a fear of opening the box--that operates as an affective barrier at the social level to broad-based human development efforts.

Erich Fromm (1962) has termed this affective barrier the "social unconscious." We have already dealt at length with how a mechanistic paradigm and its attendant reductionistic fallacy has operated at the cognitive level as a social filter, obscuring higher order, logically superior, human truths. At a much deeper or more resistant level, however, lies the filter created by our universal fear of isolation and ostracism, which Fromm described as follows:

> Man as man is afraid of insanity, just as man as animal is afraid of death. Man has to be related, he has to find union with others, in order to be sane. This need to be one with others is his strongest passion, stronger than sex and often even stronger than his wish to live. It is this fear of isolation and ostracism, rather than the "castration fear," that makes people repress the awareness of that which is taboo since such awareness would mean being different, separate, and hence to be ostracized. For this reason the individual must blind himself from seeing that which his group claims does not exist,or accept as truth that which the majority says is true, even if his own eyes could convince him that it is false. . . . What man

considers true, real, sane, are the cliches accepted
by his society, and much that does not fit in with
these cliches is excluded from awareness, is
unconscious. (pp. 126-127)

If there were no natural corrective or counterforce

to this tendency, we would all be somnambulists all the

time, victims of the social trance. Fortunately,

however, to be thus isolated from the humanity <u>within</u> us

represented by our conscience and our reason is just as

painful as to be isolated from our social group.

Betrayal of the self carries its own heavy costs. At

issue, as Fromm (1962) noted, is the balance of forces

favoring individuation and those favoring relationship to

others:

The more human a society is the less need there is
for the individual to choose between isolation from
society or from humanity. The greater the conflict
between the social aims and the human aims, the more
is the individual torn between the dangerous poles
of isolation. (p. 127)

To mitigate this conflict should be the explicit aim

of contemporary education. Where creativity and social

progress have become synonymous, as is now the case, the

either/or with respect to the individual versus society

no longer applies: conformity to the known, in the face

of a horizon of perpetual flux, places both the group and

its members at equal risk. What is called for, in a

context where neither maps nor memory provide adequate

guidance, is what Maslow (1972) describes as a new,

Heraclitian type of human being: "The society which can

turn out such people will survive; the societies that
cannot turn out such people will die" (p. 59). Maslow's
far-reaching agenda for education covers:

> . . . the job of trying to make ourselves over into
> people who don't need to staticize the world, who
> don't need to freeze it and make it stable, who
> don't need to do what their daddies did, who are
> able confidently to face tomorrow not knowing what
> will happen, with confidence enough in ourselves
> that we will be able to improvise in that situation
> which has never existed before. (p. 59)

The educational mission here approaches what prior
cultures have understood as initiation, the deliberately
induced dissolution of the social filter in order to
recover human wholeness. In traditional cultures, the
individual who successfully withstands such an ordeal or
rite of passage returns to his or her society as a
potential healer, one who can assist in restoring a more
complete vision to his or her social group.

In a culture such as ours, where referential guides
for comprehending such experience are lacking, it can
take the extreme form of a schizophrenic breakdown.
Nevertheless, the path that other cultures described by
mythographer Joseph Campbell (1979), such as the Sioux
with their vision quest, have recognized as necessary to
spiritual development is still possible to discern even
here:

> The usual pattern is, first, of a break away or
> departure from the local social order and context;
> next, a long, deep retreat inward and backward, as
> it were, in time, and inward, deep into the psyche;
> a chaotic series of encounters there, darkly

terrifying experiences, and presently (if the victim is fortunate) encounters of a centering kind, fulfilling, harmonizing, giving new courage; and then finally, in such fortunate cases, a return journey of rebirth to life. And that is the universal formula also of the mythological hero journey . . . : 1) separation, 2) initiation, and 3) return. (p. 195)

While such a journey in this intense form may be reserved for the few, to be a hero in the words of Ortega y Gasset simply " . . . means to be one out of the many, to be oneself" (Campbell, 1977, p. 605). The emergence of the individual is a process that has been taking centuries of cultural evolution to realize, although the formula for this emergence can already be glimpsed in the famous sentence from the twelfth-century hermetic Book of the Twenty-Four Philosophers, "God is an intelligible sphere, whose center is everywhere and circumference nowhere" (Campbell, 1977, p. 31).

Insofar as initiation into this holographic mystery of individuation requires the dissolution of cultural blinders, the advent of the scientific method has had an initiatory effect:

. . . the application of science to the fields of practical life has now dissolved all cultural horizons, so that no separate civilization can ever develop again--each individual is the center of a mythology of his own, of which his own intelligible character is the Incarnate God, so to say, whom his empirically questing consciousness is to find. (Campbell, 1977, p. 36)

Given the relativity introduced by science, the hold of any local mental set over the individual psyche has been considerably lessened.

> Moreover, not only in the sciences but in every
> department of life the will and courage to credit
> one's own senses and to honor one's own decisions,
> to name one's own virtues and to claim one's own
> vision of truth, have been the generative forces of
> the new age. . . . (Campbell, p. 30)

These are the competencies for negotiating that "pathless way" which Campbell, as a cultural historian, claims is the only way now before us.

For contemporary education to align itself with this historical emergence of the empowered individual certainly means an expansion of its mission beyond the present emphasis on "basic skills." Consciousness and creativity as outcomes will require organizational transformation. Schools will need to be set free to begin to embody, structurally, behaviorally and attitudinally among their populations the culture of emergence that this paper has already described. Towards this end, the insular boundary between the school and its environment will need to be rendered permeable, so that real problems are provided as concrete stimuli for learning and as occasions, whenever possible, for community-based action research. The boundary between student and teacher will need to give way to shared partnerships in the enterprise of learning, with all participants performing both teaching and learning roles. And finally, the boundary between inner and outer will need to be transcended so that self-knowledge can become

as much a goal and outcome of education as the more peripheral skills that are now the dominant focus.

For schools thus to shift from the closed, segmented context of the production model delivery system to the open, interactive context of the R&D laboratory devoted to human growth, in the probable face of regressive, sectarian fears about "secular humanism" and other such shibboleths, will be no easy matter. Yet, in concluding this paper, it is clear (in our present context of increasing complexity, accelerating change, and global interdependence) that we as a nation stand poised at the verge of a vital choice between growth and fear.

Once the distinction between the mechanistic culture of the industrial era and the culture of emergence that increasingly defines the leading edge of our post-industrial age is understood, the "how to" of realizing the latter ought not to present much difficulty. The models, as we have shown, are already there to give direction. In fact, with specific regard to educational settings, the laboratory school as a structure for emergence is not a new idea (cf. Goodlad, 1984, pp. 299-301). As an heuristic institution, however, it has yet to become a model for our general system of schooling where change remains a threat rather than an internal operating principle.

The present process for organizational learning in schools, externally conducted educational research

followed by dissemination and staff development efforts followed by little or no significant change, is only too familiar to most educators in this country. Despite the great cost of these efforts, few if any would argue for their effectiveness in shifting school norms.

The laboratory model, on the other hand, succeeds by empowering those who will be affected by change to function as <u>agents</u> of change. Ownership, as behavioral science has demonstrated time and again, is the key to change. What now lends powerful <u>economic</u> (as opposed to purely pedagogical) impetus for adopting this model is its widespread adoption by business and industry.

In the year following my report on the Storage Tek/State Education Project, the Committee for Economic Development (1985), with a host of distinguished educators and business leaders as participants, arrived at nearly the same conclusions in its report entitled <u>Investing in Our Children</u>. They looked for guidance regarding educational reform to the changing work environment:

> An example provided by The Procter & Gamble Company offers an instructive lesson in how significantly the nature of work is changing. According to the company, employees who entered manufacturing in the past generally encountered low-skilled tasks in narrowly defined jobs. Detailed operating instructions for equipment and processes changed little over the course of the employee's work life.

administrative functions. Frequently, they perform
their own quality control inspections. Partici-
pation in goal setting, budgeting, and other
processes formerly viewed as the exclusive domain of
management is also expected of workers. Employees
work in largely self-directed teams, and problem
solving and decision making are important parts of
the job.

The company provides training in many of the
higher-level skills needed for these jobs. But,
first, prospective employees must demonstrate strong
foundations in literacy and number skills and, above
all, the ability to learn.

Despite considerable uncertainty as to the
actual impact of technology on future jobs, the fact
remains that the more rewarding tasks done by people
will become nonroutine, placing greater demands on
workers to be able to think critically, respond to
changes in the environment with reasoned judgment,
communicate effectively, and take part in a
continuing learning process throughout their
careers. Even in the routine jobs, it is likely
that these characteristics will become more
necessary. At the same time, the increased
importance of the individual worker and of the
necessity for teamwork requires self-discipline,
reliability, and interpersonal skills. But are
these the skills and habits that the public schools
are teaching our children? The evidence suggests
that they are not. (pp. 16-17)

An in-depth assessment of the employment needs of

industry conducted by the Committee arrived at the

following conclusions:

First, for entry-level positions, employers are
looking for young people who demonstrate a set of
attitudes, abilities, and behaviors associated with
a sense of responsibility, self-discipline, pride,
teamwork and enthusiasm.
Second, employers put a strong value on learning
ability and problem-solving skills.
Third, employers do not think the schools are doing
a good job of developing these much need abilities.
(p. 17)

Measured against the above description of fully

human functioning, it is not surprising that the

Committee, bolstered by its interpretation of the U.S.

Labor Department's Bureau of Labor Statistics, found vocational education in particular to be a very ineffective response to student and employer needs. Further invalidating the vocational program, in the Committee's analysis, was its perpetuation of sex role stereotyping and tracking of minorities into inferior programs. A considerable gap was also apparent to the authors of the report with respect to the practices and outcomes of general education and the new needs cited by employers for empowered individuals capable of collaborative learning.

This gap, largely attributable to a disparity between two radically distinct types of culture, one characterized by automaticity and the other by mindfulness, ought to suggest a very clear agenda for educational change and development over the remainder of this century--an agenda of cultural change. For school populations to enter the heuristic process of emergence, school settings must be treated as occasions for action research by staff and students alike. The focus of change must shift from this or that element to the entire organization viewed as a complex system. The effort called for is organization development on an unprecedented scale.

This implication of the gap between employer needs and school performance is at least partly grasped by the Committee for Economic Development (1985):

> Staff development should be designed to improve teaching and should grow out of the needs of the teachers and of the school. Salary increments for staff development should be given for activities related to increasing the effectiveness of the teacher and the school. In order for staff development to contribute to a change in the school's culture, it must focus on teacher behavior, attitudes, and expectations, as well as on developing specific teaching skills. This implies that the process used in staff development is as important as the content.
>
> One successful technique, peer teaching, is embodied in the concept of the "teacher center," in which teachers teach teachers. Very popular in Japan, teacher centers involve groups of peers who work on problems and issues in schools, analogous to quality circles in industry. They can provide a structure for the expansion of the teacher's role from one of an isolated classroom practitioner to one of a participant in a schoolwide and school-based process. Unfortunately, teacher centers have lost financial support in this country. We believe that teacher centers have promise for enriching and expanding the professionalism of teachers. They should be revived and encouraged. (p. 70)

This is only one element of the needed change, to be sure, but here we come back to the learning circle, or rather to the heuristic spiral with which this paper began. It is this cognitive DNA at the individual small group and organizational levels that establishes what we have called the culture of emergence: concrete experience followed by shared opportunities for reflection, conceptualization, experimental application, and the resulting modification of experience that leads to a new cycle of learning.

One cautionary note may be useful to contemplate. Much of the support for the kind of shift being advocated here is derived from new business practices and newly

articulated employer needs. However, in surveying the realm of employment, depending upon where attention is placed, arguments can be made for either progressive or regressive stances toward human development efforts. The growth choice and the fear choice can both find ammunition.

On the one hand organizations have evolved to a new level of complexity, a strategic mode capable of mobilizing innovative and entrepreneurial capacities toward competitive advantage in the market place. An excellent historical overview of this evolution from scientific management to the strategically organized diversified firm typified today by Texas Instruments is provided by Mariann Jelinek (1979). Referencing the synchronization of objectives, strategies and tactics (OST) at Texas Instruments in terms of the theory of logical types, Dr. Jelinek sees a leap beyond even the coordination exemplified by diversified firms such as DuPont:

> The OST System is . . . concerned with a higher logical level. Rather than coordinating multiple routine tasks, the OST is focused on generating new tasks which may eventually themselves become routine. Equally as important, it is concerned with generalizing a shared frame of reference, a means of acquiring new knowledge. As a system, the OST generalizes a procedure for acquiring the requisite new knowledge, creating a shared pattern of thought regarding innovation in much the same way that DuPont or General Motors created shared frames of reference about ongoing businesses . . . the OST makes it possible for Texas Instruments to acquire

not only new products, but new paradigms or identities. (p. 141)

This represents a distinct shift of the large organization from automaticity toward mindfulness, dictated by an ever-growing need to be environmentally aware and responsive.

The rationale for this higher-level form of organization is usually framed in purely economic terms. A major voice in the growing literature of strategic management, Harvard's Michael E. Porter (1985), writes as follows:

> Differentiation of products may be facilitated by a culture encouraging innovation, individuality, and risk-taking (Hewlett-Packard), while cost leadership may be facilitated by frugality, discipline, and attention to detail (Emerson Electric). Culture can powerfully reinforce the competitive advantage a generic strategy seeks to achieve, if the culture is an appropriate one. There is no such thing as a good or bad culture per se. Culture is a means of achieving competitive advantage, not an end in itself. (p. 24)

Professor Porter, who is clearly neither an anthropologist, humanist, nor educator thus offers a highly idiosyncratic definition of culture. Leaving its determination (if that is possible) purely to market considerations fails to assess the human and social costs of cultures (like Porter's cost leadership culture) which overly routinize human behavior. Such cultures also risk becoming dinosaurs, vulnerable to extinction when market conditions change, regardless of the cost advantages they may enjoy over the relatively short term.

Educational vision and strategy, in order to be viable over the long term, must certainly take such shorter-term market conditions and strategies into consideration; but what is ultimately at stake is the competitive advantage of our society as a whole in the face of a growing list of planetary crises. Here, what is clearly called for is increased consciousness and the ability of individuals to respond appropriately as proactive learners in collaboration with others, not mindless regimentation, despite its short-term appearance of efficiency.

At the aggregate levels of human endeavor, social and organizational, automaticity is no longer a sustainable mode of operation. Holding companies, however, can create pockets of automaticity, machine-like businesses, that yield an economy derived from task repetition by individuals. The advent of robotics and automation does not guarantee that such repetitive tasks will be performed by non-humans. An excellent review of five new books on robotics challenges this assumption. Robots will, according to the reviewer, Roger Draper (1985):

> create as well as eliminate a lot of mind- numbing toil because the engineers who design robots try to ensure that they make use of the cheapest human labor possible, if they use any at all. American Machinist reports that a twenty-eight year old retarded man runs the numerical control machines installed at a shop in Lincoln, Nebraska, "because his limitations afford him the level of patience and persistence" necessary for the position. Many workers in the factory of the future will do nothing

> but "bring parts to the robots and then take them away again," and the pace at which they do so will be monitored electronically. (p. 52)

Over the long haul, Draper continues ,the likelihood is that much, or even most, of what now constitutes work will be displaced by automation:

> The optimists insist that middle-class work will continue to be available. But the present state of our educational system makes one doubt that many members of the workless class will be prepared for it. Besides, what middle-class work will they turn to? By the early decades of the twenty-first century, as industrial labor is disappearing, the kind of middle-class employment that consists chiefly of gathering information and making routine decisions will be under pressure as well. Who knows what kinds of work will emerge? If artificial intelligence enthusiasts like Minsky are correct, the very concept of work will be economically meaningless within a couple of generations. (p. 52)

Human emergence, the definition of new roles for ourselves and the invention of new institutional supports for these roles--not the minimal definition of work as wage labor--is what education should be aligning itself with. Otherwise, it is headed toward a cul-de-sac. Arguments for minimal competencies can still be made as remedies to overeducation/underemployment, but the costs of an undereducated workless class make such arguments frivolous. Annual cost per individual in our mushrooming prison system is estimated at $25,000, or three times the average cost of a year in university; and the latter ultimately results in value added to society, while the former is simply a drain. Our creative

potential much exceeds the opportunities defined by the market; but where it is dammed rather than channeled, it grows toxic and dangerous. Education, by taking a positive, unequivocal stance toward the cultivation of human creativity, can drive the future of work rather than reacting to what it perceives as present trends.

The political dimensions of limiting personal growth opportunities to the perceived demands of the employment market can be expected to intensify in the relatively near future as the employment market shrinks. The mechanization of agriculture has left only 3% of our work force feeding much of the world as well as ourselves and still, despite awesome productivity, needing government subsidy to remain economically viable.

A similar pattern is projected for the electronic revolution: " . . . it promises to raise output higher and higher with fewer and fewer people" (Schwarz and Neikirk, 1983, p. 28). The need to safeguard the environment and to conserve diminishing resources can be expected to operate as a further limit to full employment. The first jobs to be eliminated, and this is already happening, will be routinized jobs that can either be automated or exported to cheaper sources of labor. "Whenever mechanization reaches the point where the worker is engineered to be a machine part, we can automate" (Drucker, 1974, p. 227). Devoting expensive educational resources to such limited, trailing-edge

manpower functions is wasteful and short-sighted. Innovative and heuristic abilities, however, will be needed not only to sustain high technology and move it forward, but also to define new, life-enhancing, environment-enhancing and socially legitimate channels for human capabilities which, because they inwardly demand expression, are also human needs.

"If the economic problem the struggle for subsistence is solved," warned John Maynard Keynes in 1930, "mankind will be faced with his real, his permanent problem--how to use his freedom from pressing economic cares. . . . There is no country and no people, I think, who can look forward to the age of leisure and abundance without dread" (Harmon, 1979, p. 52). As the social structure externally imposed by economic necessity is lifted, an internal structure located within individual persons and oriented toward suprapersonal, synergistic ends will be the only viable alternative to what Erich Fromm (1969) has called the "escape from freedom" in the extremes of anarchy or totalitarianism.

Regardless of present or future market conditions, and regardless of how many or how few people high technology can employ, the maximal definition of work as an expression of enlightened, creative and responsible citizenship provides the best long-term guidance for education if the evolutionary frontier we are now

approaching is to be met resourcefully. The creative leading edge of the high tech spectrum is worth examining in this regard because it already demonstrates a deliberate evolutionary process of emergence centered in the spontaneous activity of relatively empowered, interdependent, mutually responsible persons. Whatever its more tangible and durable products may be, the collaborative endeavor described here as high tech or the culture of emergence is of general interest because it serves as a platform for human growth; and this may be not only its most promising, but also its most disturbing feature.

APPENDIX I

THE STORAGE TEK-STATE EDUCATION PROJECT:

FINAL REPORT

THE STORAGE TEK-STATE EDUCATION PROJECT

A PUBLIC/PRIVATE SECTOR PARTNERSHIP
TO ASSESS WORKFORCE COMPETENCIES
RELEVANT TO CHANGING TECHNOLOGY

JOINTLY SPONSORED BY
GOVERNOR'S JOB TRAIN-
ING OFFICE, STORAGE
TECHNOLOGY CORPORATION,
AND FRONT RANGE COMMUNI-
TY COLLEGE

FINAL REPORT OF THE PROJECT SUBSTAN-
TIATING THE NEED FOR HEURISTIC
COMPETENCIES TO OFFSET WORKFORCE
OBSOLESCENCE

PROJECT DIRECTOR & PRINCIPAL
INVESTIGATOR

GORDON DVEIRIN
AUGUST, 1984

PROJECT ADVISORY COMMITTEE:

George Baran, Optical Disk Division,
Storage Tek

Stephan Andrade, Depart-
ment of Commerce and
Development

John Brennan, Assistant to the
President, Regis College

Leonard Hergenrater,
State Director of
Vocational Education

Richard Hulsart, State Department
of Education

Don Mankenburg, Dean
of Instruction, Front
Range Community College

James D. Moore, (former) Acting
Director, Governor's Job Training
Office

Ivo Roospold, Director,
Colorado First Program

Don Scheel, Principal, Boulder
Valley Area Vocational Technical
Center

James W. Tuttle, Manag-
er, Thin Film Opera-
tions, Storage Tek

Warren Ziegler, Futures
Invention Associates

STORAGE TEK-STATE EDUCATION PROJECT

CHAPTER I

Introduction

Swiftly changing technology and worldwide market competition are demanding increasingly sophisticated and continuously updated skills from this nation's work force. Structural unemployment, now a common fact of life, is creating an additional set of pressures upon our learning resources. The ability, therefore, of our educational institutions and employment training delivery systems to respond has understandably become a matter of critical public concern.

Meanwhile, high student dropout rates, graduates lacking basic skills, standardized achievement test scores falling below those of our rivals in trade, and outdated vocational programs offering preparation for jobs that no longer exist while skills in high demand remain in short supply, are only some of the more acute indicators of a need for new solutions. Taken together, they are symptoms of an educational mission not so much lost sight of, perhaps, as urgently needing redefinition in the light of changing historical conditions.

Just what are these new conditions? What, in particular, are the new cultural and human resource requirements that are being spearheaded by emergent high technology; and how can those requirements best me met? Is there even a discernible pattern; or are erratic, short-term adjustments the best that can be hoped for?

To answer these large questions requires the active collaboration of both the public and private sectors. Yet, despite their obvious interdependence with respect to manpower issues, an effective and mutually satisfying means of interfacing these two sectors has not been developed.

Purpose

To help fill this void and thus facilitate needed dialogue has been a major goal and outcome of the multifaceted project which is described in the following report. The primary purpose of this project was to develop and test a model for public sector/private sector cooperation that might reduce the lag time between the emergence of new manpower needs and the availability of a work force prepared to meet those needs.

This project was guided by several operating assumptions:

1. The better equipped the labor pool from which employers draw their manpower, the lower will be their own direct start-up costs.

2. The more guidance and cooperation employers provide public education, the better their manpower needs will be served.

3. The lower the start-up costs of training, the more favorable will be the climate for new industry to locate and for new jobs to be developed.

4. The more comprehensive the understanding that educators and policy makers can gain about new competency requirements, the more effective will be their strategies for meeting them.

These assumptions merely add emphasis to the point already made that dialogue is needed. While there are numerous factors that hinder such exchange, none are insurmountable provided that <u>clear and immediate benefits</u> can be demonstrated to <u>both sides</u>. This common-sense realization is what gave the project now under discussion its unique and successful point of departure.

The typical approach in the past has been for government to seek information <u>from</u> representatives of private business. The flow has been one way, <u>from</u> advisory councils or through government paid task analysts to government agencies. But this is uneconomical. The same information, properly understood, can be used <u>in two directions at once</u>. The same data used to frame a subject for an external viewer (in this case, state government) can also be available as feedback

to the subject (in this case, the host industry), increasing the subject's self-awareness and control. The investigator's role is to maintain a dual focus so that the information gathered can benefit both sides.

A second and equally major point of departure for this project concerns the kind of information actually focused upon. Vocational educators, hoping to maintain enrollments by keeping courses relevant to existing job markets, have naturally tended to seek job-specific data. Internal training departments within industry have shown the same orientation. Given the frequency with which jobs are changing, this narrow focus makes for erratic, short-term adjustments.

However necessary, the limitations of the short-term approach can be seen in an operation like V-TECS, a consortium of fifteen states which includes New York and Ilinois. Each member state produces two competency models of specific occupations per year at an annual cost to each state of $100,000, to guide vocational curriculum. The director of this program concedes that only the most rudimentary of occupations can be effectively modeled; and even for these the models are frequently obsolete by the time they are in print.

The alternative, or at least the balance, to this exclusive concentration upon particular jobs at particular points in time, is to regard the larger systems in which those jobs are continuously being

transformed. Shifting focus from the <u>fixed positions</u> to the wider <u>patterns of movement</u> now observable within industry <u>can lead to a much more comprehensive and integrated response on the part of the educational community than has yet been possible.</u>

In summary, the thrust of this project has been: 1) to adopt an open systems orientation to the high tech work place; and 2) To make the observations thus obtained simultaneously available to both the sponsoring government agency (the Governor's Job Training Office) and to the host industry (Storage Technology Corporation) to the mutual advantage of both parties.

The most durable products, now to be discussed, have been:

1. A methodological model for public sector/private sector interfacing;
2. An explanatory model of human resource utilization in emergent high technology industry;
3. An heuristic or ongoing learning model that potentially impacts all levels of education.

CHAPTER TWO

Methodological Model, the Problem of Entry, Roles, Activities, and Results

What follows is an example of action research: thinking while acting and learning while doing. Its chief result has been to reveal high tech industry as essentially this same activity. High tech industry could not exist solely on the basis of expert analysis and formularized information. It cannot be entirely programmed. There remains the daily, practical need for experimental action in the face of the unknown and for acute sensitivity to concrete experience, elements of fully human functioning that our school systems as they now exist tend more to suppress than to develop.

Entry and Contracting

The pivot of this project was the highly complex role assumed by the person who served as intermediary, researcher and transfer agent. That role can hopefully now, as a result of this completed experiment, be duplicated or modified for future efforts with greater ease and understanding. However, in the present instance, simply legitimating the function to be performed became in itself a major function.

In a preliminary discussion to which individuals were invited from the State Department of Education and

from the Center for Public-Private Sector Cooperation, the question was raised as to how a researcher "gets in the door" of private industry and how contracting is arranged for such a partnership as that now under discussion. The interest in this question transcends this particular experiment, and therefore merits discussion. The State Department of Education, for example, when conducting its own Employability Skills Survey, was generally not able to get closer to actual work processes than speaking with personnel officers. Yet empirical validity requires direct observation of systems in operation. Secondary sources are of questionable and limited value.

The appropriate level for approaching the task of linking two subsystems is from a subordinate position in the larger system of which both are parts. That position might be an actual office in a bureaucratic hierarchy, a common goal, or it can be fulfilled by an external consultant who is not identified with either subsystem but is dedicated to the larger interests of both.

In the present instance, the project was designed and initiated by an independent consultant acting as an interested doctoral scholar and as an entrepreneur. This mode of initiation was novel and carried with it a unique set of problems.

The first problem was how to get an innovative but unsolicited idea accessed within a government system when

the originator is not a part of that system. Dealing with a contractor who is the originator and sole source of a new idea runs counter to the habitual practice in government of putting out generic requests for proposals and receiving competitive bids in return. Adhered to rigidly, this latter practice would effectively restrict a system to internally generated ideas and would thus lower its innovative potential.

In the present case, the Governor's Job Training Office invested its sponsorship in the new idea but required the further exercise of much creativity in order to gain and maintain the necessary support. The decision was carried forward through a maze of bureaucratic complexities and through a succession of three GJTO directors within a six-month period.

The second and actually concurrent phase of contracting involved first the selection of an emergent technology industry where change was continuous and where in response, ongoing learning activities such as quality circles were in evidence. Quality circles are indicators of a new cultural configuration that equips workers to deal with change by enabling them to pro-actively participate as agents of change. The skills required of members are highly transferable, and thus provide important clues to the alleviation of structural work force obsolescence.

Mr. Lloyd Casey, now president of the Front Range Chapter of the International Association of Quality Circles, proved to be a valuable liaison with the company where he is personally employed as Corporate Facilitator. The timing was right, and Mr. Casey established a connection with Mr. James W. Tuttle, Manager of the world-leading Thin Film technology at Storage Technology Corporation (Storage-Tek). Thin film heads are the key to a new generation of disk drives that only one other company in the world, amidst intense competition, has been able to successfully bring to market. Insights gained from the study of a world-class winning team, it was felt, would have especially high validity.

For the first time, Mr. Tuttle was experimenting with the installation of fifteen new quality circles in his department. This was a critical mass (one third of the direct labor) sufficient for systemic change, part of a vital effort to increase production yield; and start-up was an excellent time for entry.

Mr. Tuttle and the Project Director were in agreement that concern for the continuing growth of workers and concern for high quality production were twin sides of a single equation with larger social implications. This value overlap gave synergy to their efforts. The Project Director agreed to assist in the further development of a learning environment that had already "home grown" a Colorado work force with Silicon

Valley skills, while also observing that environment in action. The state thus acquired a laboratory and the corporation a consultant for its change efforts.

With the support of Mr. Michael Aguirre, Thin Film's Vice President, and with higher corporate endorsement, a non-disclosure agreement was signed to protect trade secrets; and the project was approved.

But the Project Director's position was then complicated by a confusion of logical levels that occurred for a time on the government side. Once the Governor approved the project, certain staff members felt that a request for involvement should come from his counterpart on the private sector side to demonstrate a mutuality of interest.

In fact, the Governor's counterpart on the private sector side, representing a polis comprised of corporate rather than individual citizens, does not exist. This is in itself a problem. No collective body that clearly represents the employers in this state exists to articulate their needs except for the state itself in certain of its capacities.

Thus, with an assumed mutuality of interests, the burden of gathering information passes by default to the state, which has nevertheless lacked an effective means of entry that also fairly distributes the costs. So we are back to our starting point, the problem of entry. Contracting has been an ongoing activity throughout this

project; and the tolerance of everyone concerned for ambiguity has been usefully stretched.

Roles

The following roles were fulfilled by the intermediary: 1) Project Director; 2) Principal Investigator (participant observer); 3) Informal Departmental Quality Circle Facilitator; 4) Legitimate Agent of State Government; 5) Task Analyst; 6) Organization Development Consultant to Thin Film Manager; 7) Reporting Relationship (for control purposes) to Thin Film Manager with Staff and Management Quality Improvement Team assignments.

Activities

The activities conducted by the Project Director included:

--Process observation of groups and worker interactions.

--Interviews with all levels of personnel.

--Review of written job descriptions.

--Project Advisory Committee meetings.

--Extended task analysis with an integral quality circle whose members represented the core Thin Film disciplines.

--Administering to that same quality circle and to a group of their managers the learning style inventory

and brain dominance instruments which are included in the appendix.

--Assistance with the production of a video tape about high tech learning which has a dual purpose as in-house orientation tool and as a vehicle for informing the public.

--Developing an interface between Storage Tek's Optical Disk Division, now in its start-up phase, and Front Range Community College to develop a program in optics using the combined resources of both institutions and integrating technical and non-technical competencies (see Appendix A).

Results

The results of any intervention into a complex system are usually of two kinds, intended and unintended. Both kinds of results can be valuable for learning, but the second kind are not always possible to show on a balance sheet. Key results of the project, however, are as follows:

1. Process observation provided a wealth of data. The vantage point of being a neutral investigator actively involved with quality circles was exceptional; and, for their part, every effort was made by Storage Tek personnel to render their system transparent. The key observations that emerged

were: a) The <u>high degree of interaction</u> that takes place continuously between all levels of personnel, b) The <u>high degree of learning</u> that results from this interaction, and c) The centrality of management style to the maintenance of an open learning environment.

2. During the first two months of the Project Director's involvement with the quality circle installation, he was able to make several <u>critical interventions</u>, to <u>assist in the overall implementation</u>, and to lend a <u>Hawthorne effect of government interest</u> to the process. Following this period, the Project Director was gratefully informed by the Thin Film manager that production yield had risen appreciably, that the project had contributed to this result, and that the financial gain may well have considerably offset the costs of the project directly borne by the company.

3. Interviews in the Wafer Fabrication area, which is particularly process oriented, revealed a surprisingly high incidence of managers with background in music and the performing arts. This is a local insight, but still worth noting. Written job descriptions favored technical, science, mechanical and math skills, but these factors alone were not decisive. The kind of worker most carefully sought,

according to managers, was an "intuitive" rather than rule-bound person. This key attribute acquires more specificity in what follows.

4. The first of three four-hour task analysis sessions yielded two discrete and different sets of data which illustrated, respectively, the need for both precision and flexibility.

   A) The first set of data dealing with precision tasks, was largely job specific; and much of it was procedural and proprietary. This was elicited in the first two-hour segment by extended task analysis, an interviewing process that breaks down tasks into knowledge components. The process is linear and somewhat tedious.

   The most obvious result of this half of the session was the <u>incongruity between the complexity of tasks performed</u> (which the Thin Film manager calls "manipulating molecules") and the relative <u>innocence of theory on the part of the performers</u>. <u>Practice preceded theory</u>, in other words, just as with engineers in the same department who did not understand the magnetics upon which their whole effort depended. An electro-plater, for example,

related that he had not understood how his process relied upon the interaction between anodes and cathodes with opposite electrical charges until once, inadvertently, he had reversed the charges and observed the results. From the standpoint of industrial engineering, which develops automated routines guided by feedbacks, this operator had made a mistake; whereas, from the standpoint of learning, he had made a significant discovery that advanced his career.

The operator mentioned was following the <u>cycle of experiential learning which moves from practice to theory and on to more sophisticated practice</u> as a result of leverage obtained from theory. This evolution benefits both the learner who grows, and the system which gains a more highly developed employee.

Industrial engineering does <u>not</u> facilitate this growth and, with its function of routinizing, actually impedes such growth. <u>The challenge for industry is therefore how to routinize tasks without routinizing those who perform them.</u> This will be explored further. The managers in Thin Film were well aware of this

tension and concerned about providing adequate learning opportunities.

Industrial engineering does <u>not</u> facilitate this growth and, with its function of routinizing, actually impedes such growth. <u>The challenge for industry is therefore how to routinize tasks without routinizing those who perform them.</u> This will be explored further. The managers in Thin Film were well aware of this tension and concerned about providing adequate learning opportunities.

One of the most significant of these learning opportunities is the necessary transference of mastered skills from veterans to newcomers. Start-ups are a race to create a critical mass of qualified veterans as swiftly as possible, to reduce the likelihood of error during a"ramp," or production increase. This need and the climate of shared teaching/learning it creates contributes to a remarkably rapid escalation of precision skill acquisition.

A predicted and substantiated result of the task analysis format was that those who were asked to articulate their knowledge were

thereby enabled to locate the boundaries of
their ignorance and thus to learn. The vacuum
operator, for example, who routinely deposits
insulation layers on titanium carbide wafers,
learned for the first time what insulation is.
Thus, task analysis can be a diagnostic and a
learning tool within the experiential learning
cycle, as well as a vehicle for curriculum
design, especially if linked as a bridge to
appropriate learning resources. This in itself
is an important finding.

B)   The second two-hour segment was dramatically
different due to a change in format. This
time, questions were addressed to persons
rather than to functions. The entire group was
involved in describing not their differences
but the shared experience of their clean room
environment. (Clean rooms, a feature of high
tech operations, are tightly controlled
environments with dangerous chemicals often in
use, governed by rigorous safety precautions,
and with surgical garb worn to protect product
from contamination. Investment in such a
facility is typically in the multi-million
dollar range.) The whole group responded in
this segment with considerable animation in

dramatic contrast to their earlier, more subdued behavior.

Using their descriptors, here is a summary of the competencies they considered crucial:

Attention: Descriptors included "alertness," "ability to focus," "close attention to nuances," "consciousness," "mentality in a tightly controlled environment." (Attention is a different approach to learning than is memorization; and it is more likely to yield an appropriate, rather than a stock, response.)

Perception: Descriptors included "increased powers of perception." Respondents mentioned pattern recognition and their "intuitive" response to microscopic variation from specifications that might be difficult to pinpoint and verbalize.

Field Perception and Interdependence: Field perception necessarily complements the tight focus on individual tasks. With "many things to think about at once," respondents mentioned "group consciousness," "shared space," "inter-dependence," "cooperation," "trust," "safety," "body language," "psychic sensitivity," and

"moods" that are transmitted quickly throughout the room.

Autonomy: Individuals had well-defined responsibilities and mentioned the need to balance "self-responsibility" and assertiveness with group awareness and receptivity.

Flexibility: Descriptors included "timing," rhythm," "organization," "planning ahead and thinking behind," ability to adjust to "daily changes in procedure." There was a shared sense of the importance of divergent thinking in decision making, and a consensus that the group was ruled by "self-discipline" rather than by regimentation.

Problem-Solving: The consensus in the group was that they were hired to "solve problems." This included the ability to recognize problems, to analyze them, and to involve others when appropriate. Quality circles were acknowledged as assisting this process.

Communication: Emphasis here was on the ability to be precise in speech and in writing, and to recognize appropriate channels. Organizational awareness or systems awareness ties in here, such as sensitivity to needs of

other shifts and departments. Reading comprehension and listening skills were also considered important.

Personalization: The cleanroom is highly de-personalizing. Uniforms permit only eyes to be visible to others. This has an opposite, compensatory effect. Workers become freed of usual inhibitions, "unselfconscious," "self-expressive," "appreciative of differences," and in a "halloween" state of mind. As in sensory deprivation cases, the workers supply with their own personalities the color that is otherwise missing.

<u>Dysfunctional Traits</u>: Asked about what kind of people did not perform well in the clean room, respondents mentioned those who were solitary, non-communicative, and especially those who demanded fixed routine.

In summarizing this spontaneous group response, the qualities that were most at a premium were those which were least mechanistic, least egocentric, and most fully human. Taken together, they constitute a set of <u>integrative competencies</u> that balance the <u>specialized competencies</u> defined for individuals by their job descriptions and procedures.

4. Because the two distinct set of competencies that emerged from the task analysis session conformed so clearly in their differences to the distinction between hemispheric functions of the brain (see Figure 6), and because of learning style implications (see Figure 7), a brain dominance test and also a learning style inventory based on a recent synthesis of learning theory (McCarthy, 1980) were later administered to the group and to several of their managers (see Appendix B, pp. 188-194).

Twelve individuals were tested, including the Thin Film manager, Mr. Tuttle, his second level manager and the first level manager now in charge of training, and all of the members of the quality circle under review including technicians and quality assurance inspectors. The results were as shown in Figure 8.

Three additional brain dominance tests were administered by the second level manager to other Wafer Fabrication managers. The results (2, 0, and -1) were all Integrated.

A statistical approach was not attempted. The results, however, do support the contention by Thin Film staff that "intuitiveness" is a selection criterion for hiring. The results also complement

Figure 6.   Left, right, integrated brain
             dominance characteristics.

LEFT, RIGHT, INTEGRATED BRAIN DOMINANCE CHARACTERISTICS

Left	Right	Integrated
• Intellectual	• Intuitive	Equally facile at both
• Remembers names	• Remembers faces	Equally facile at both
• Responds to verbal instructions and explanations	• Responds to demonstrated, illustrated or symbolic instructions	Equally facile at both
• Experiments systematically and with control	• Experiments randomly and with less restraint	Equally facile at both
• Prefers solving problems by breaking them down into parts, then approaching the problem sequentially, using logic	• Prefers solving problems by looking at the whole, the configurations, then approaching the problem through patterns, using hunches	Equally facile at both
• Makes objective judgments, extrinsic to person, looks at otherness	• Makes subjective judgment, intrinsic to person, looks at sameness	Equally facile at both
• Planned and structured	• Fluid and spontaneous	Equally facile at both
• Prefers established, certain information	• Prefers elusive, uncertain information	Equally facile at both
• Analytic reader	• Synthesizing reader	Equally facile at both
• Primary reliance on language in thinking and remembering	• Primary reliance on images in thinking and remembering	Equally facile at both
• Prefers talking and writing	• Prefers drawing and manipulating objects	Equally facile at both
• Prefers multiple choice tests	• Prefers open-ended questions	Equally facile at both
• Prefers work and/or studies carefully planned	• Prefers work and/or studies open-ended	Equally facile at both
• Prefers hierarchical (ranked) authority structures	• Prefers collegial (participative) authority structures	Equally facile at both
• Controls feelings	• More free with feelings	Equally facile at both
• Responds best to auditory, visual stimuli	• Responds best to kinetic stimuli (movement, action)	Equally facile at both
• Not facile in interpreting body language	• Good at interpreting body language	Equally facile at both
• Responsive to structure of environment	• Essentially self acting	Equally facile at both
• Rarely uses metaphors and analogies	• Frequently uses metaphors and analogies	Equally facile at both
• Favors logical problem solving	• Favors intuitive problem solving	Equally facile at both
• Prefers single variable research	• Prefers multi-variable research	Equally facile at both

Adapted from *Your Style of Learning and Thinking, Forms B and C* by E. Paul Torrance[9], University of Georgia, Athens, GA. 30602

Figure 7.   Learning styles.

TYPE FOUR LEARNER

Integrates experience and application.
Seeks hidden possibilities, excitement.
Needs to know what can be done with things.
Exercises authority through common vision.
Leads by energizing people. Learns by trial and error,
self-discovery. Seeks influence and solidarity. Enriches
reality. Perceives information concretely and processes
it actively. Is adaptable to change and relishes it;
likes variety and excels in situations calling for
flexibility. Tends to take risks, at ease with people,
sometimes seen as pushy. Often reaches accurate conclu-
sions in the absence of logical justification.
Functions by acting and testing experience.
Strength: Action, carrying out plans.
Goals: To make things happen, to bring action to
concepts.
Favorite question: IF?
Careers: Marketing, sales, action-oriented managerial
jobs, education, social professions.

TYPE ONE LEARNER

Integrates experience with the "Self".
Seeks meaning, clarity, and integrity.
Needs to be personally involved. Seeks commitment.
Exercises authority with participation and trust.
Learns by listening and sharing ideas. Values insight
thinking, works for harmony. Leads by bringing about
cooperation among people. Absorbs reality.
Perceives information concretely and processes it reflectively.
Interested in people and culture. Divergent thinkers who
believe in their own experience, and excel in viewing concrete
situations from many perspectives.
Model themselves on those they respect.
Strength: Innovation and imagination. They are idea people.
They function through social integration and value
clarification.
Goals: Self-involvement in important issues, bringing
unity to diversity
Favorite question: WHY?
Careers: Counseling, personnel, teaching, organizational
development, humanities, and social sciences.

DOING

WATCHING

TYPE THREE LEARNER

Practices and personalizes.
Seeks usability, utility, solvency, results.
Needs to know how things work. Exercises authority by
reward and punishment. Leads by inspiring quality,
the best product. Learns by testing theories in ways
that seem most sensible. Values strategic thinking, is
skills oriented. Edits reality. Perceives information
abstractly and processes it actively. Uses factual data
to build designed concepts, needs hands-on experiences,
enjoys solving problems, resents being given answers.
Restricts judgment to concrete things, has limited
tolerance for "fuzzy" ideas. Needs to know how things
they are asked to do will help in real life.
Functions through inferences drawn from their bodies.
They are decision makers.
Strength: Practical application of ideas.
Goals: To bring their view of the present into line with
future security.
Favorite question: HOW DOES THIS WORK?
Careers: Engineering, applied sciences.

TYPE TWO LEARNER

Forms theories and concepts.
Seeks facts and continuity. Needs to know what the experts
think. Seeks goal attainment and personal effectiveness.
Exercises authority with assertive persuasion. As leaders
they are brave and protective. Learns by thinking through
ideas. Values sequential thinking, needs details. Forms
reality. Perceives information abstractly and processes it
reflectively. Less interested in people than ideas.
Critiques information and collects data. Thorough and
industrious, reexamines facts if situations are perplexing.
Enjoys traditional classrooms. Schools are designed for
these learners. Functions by thinking things through and
adapting to experts.
Strength: Creating concepts and models.
Goals: Self-satisfaction and intellectual recognition.
Favorite question: WHAT?
Careers: Natural sciences, math, research, planning
departments.

THINKING

Person	Brain Dominance	Learning Style
1. Thin Film Manager	+7 (Right)	Type 4
2. Manager	+10 (Right)	Type 1
3. Manager	+1 (Integrated)	Type 2
4. Quality Circle Member	+3 (Integrated)	Type 4
5. Quality Circle Member	0 (Integrated)	Type 4
6. Quality Circle Member	0 (Integrated)	Type 4
7. Quality Circle Member	+3 (Integrated)	Type 4
8. Quality Circle Member	-1 (Integrated)	Type 4
9. Quality Circle Member	+4 (Integrated)	Type 4
10. Quality Circle Member	+2 (Integrated)	Type 3
11. Quality Circle Member	+8 (Right)	Type 4
12. Quality Circle Member	-9 (Left)	Type 3

Totals

Right Dominant - 3   Type 1 - 1

Integrated - 8   Type 2 - 1

Left Dominant - 1   Type 3 - 2

                            Type 4 - 8

Figure 8. Brain dominance and learning style scores for
           Thin Film group.

the task analysis findings that specialized and integrative skills are both necessary; and they reflect the learning style of the Thin Film manager, which favors active experimentation--the learning style least favored by traditional schools. The capacity of work design and management style to influence brain dominance pattern or learning style remains to be tested.

5. A later session with the same participants and their managers revealed the relationship between perceived power and effective learning. Learning, in this environment, flows toward initiative; and those individuals who are least intimidated about asking questions are able to advance most rapidly. The quality circles encouraged the less assertive workers by providing them with legitimacy and the security of a group context as well as the advantage of presenting management with well-stated problems and data that has been analyzed in advance.

Teaching quality circle practice in schools could greatly assist students personally while increasing their abilities to actively contribute in the workplace. Without the common code of scientific practice, workers are locked in a "culture of silence" that separates them from a wider system which requires their involvement.

6. The Advisory Committee, at a different level of project activity, was principally a vehicle for learning on the part of its members. Issues surfaced by the committee included the following:

A) The problem of industry/education linkage for training where on-site lab is needed. Conditions implicit include guarantees of employment or guarantees of access to non-employees, and proprietary issues.

B) Training for small companies.

C) Creation of incentives for new methods of collaboration versus each domain seeking only its own survival.

D) Work behaviors as part of curriculum.

E) The student as manager of own learning; adult learning model for minors.

F) Continuous exchange network for students/workers to access inputs (rather than courses).

G) The role of the high school.

H) Entry assessment of work behaviors.

7. The project coincided with a time of major departmental reorganization.

The consulting relationship between Project Director and the Thin Film manager assisted the department in understanding its position and in fine-tuning decisions already being made. The still-developing explanatory model which now follows was of help.

CHAPTER THREE

Explanatory Model

The model illustrated in Figure 9 emphasizes in its three-phase development the fundamental fact about high technology industry; its emergent form. This form, an attribute of open, living systems/ springs from an intention to aim for a given market window and from an action committing resources to hit that window within a given period of time (usually a period of a few years). Thus, the first step in what will be a continuing spiral of learning is a risk in the face of the unknown. James W. Tuttle (personal communication, June, 1984) postulates an 80/20 rule, with 20% of the learning up front before commitment and 80% of the learning still remaining. Learning the business, in this configuration, becomes the business of learning.

1. R&D/Prototype Phase: This phase has been labeled (following a Storage Tek engineer) a black art, because it is an exploratory phase still in pursuit of a method that can be repeated at will and thus

R&D New Product

CYCLE TESTED H.R.

AUTOMATION

R&D Mfg.   Developed Process

ROUTINIZATION   DEROUTINIZATION
Authority/Production   Knowledge/Problem
        Mode   Mode

Uniformity of Output   Flexibility of Response

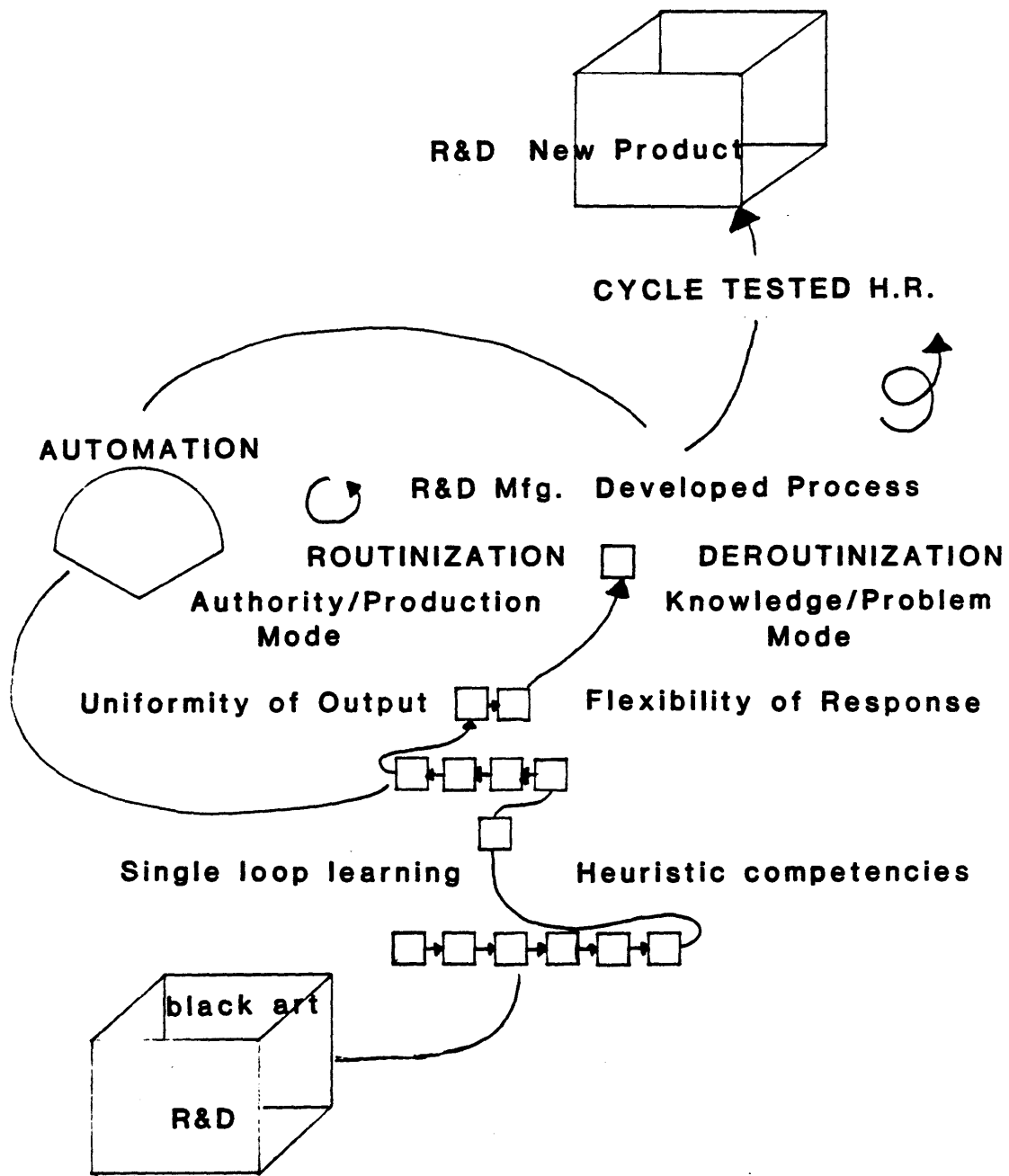Single loop learning   Heuristic competencies

black art

R&D

Figure 9.   Emergent form of high tech industry.

owned. The tension in this first phase is between two distinct kinds of learning which have been called (Argyris, 1978) single loop and double loop learning. The first kind is like that of a thermostat which can only do more or less of the same (content learning): it cannot evolve. Double loop learning, in contrast, can move to whole new sets and levels of options: it can do something entirely different.

In the R&D process, the goal is to accelerate the second, experimentalist kind of learning in order to leave the first or routinized kind behind as its product. The goal is to reduce mystery to method, but the challenge comes from the uncertainty.

This phase is very stimulating for the relatively small number of people involved. There is a high degree of interdisciplinary collaboration and roles are fluid. The degree of individual learning and opportunity for personal advancement are at a peak. The climate is personal. And although "overqualified" people are often hired at this stage, their talents are put to good use.

2. Developed Process--R&D Manufacturing: Once sufficient reliability has been demonstrated, a decision (and another risk) is made to start

shipping product. Not until this decision is made is the company officially in business with a chance of recovering its investment and turning a profit.

The ramp up to a production mode does not end the learning process, it accelerates it for a time. A whole new set of problems now exists not only on the shop floor but in the field as well. New people are being hired and trained at a remarkable pace, new equipment is being tested, and new procedures are being developed. With technological hurdles remaining, challenging production schedules are set in a race against time.

As the work succeeds, however, the triumph of method begins to outweigh the continuing but ever diminishing role of innovation. The R&D competencies are replaced by reduced tasks with specific skills, procedures and outcomes. These latter jobs do not open career paths, because they do not by themselves increase theoretical understanding. Each by itself is a potential dead end, pushing a button until the robot arrives, <u>unless it becomes a platform for learning</u>. Reduced sense of opportunity and challenge at this stage threatens loss of talent.

From a systems standpoint, meanwhile, should the drive for method win out completely, the flexibility

of response upon which quality depends would be lost, and the margin for error is not great. Thus, the challenge of management at this stage is to offset the stagnation that routinization and bureaucratization can cause with renewed efforts to facilitate double loop learning. A means toward this end is to develop a complementary mode of organizing, the organizational equivalent of what were earlier called integrative competencies. This mode, which groups people for problem solving outside of normal reporting relationships, has been called collateral (Zand, 1978) or parallel (Kanter, 1980) organization.

Quality circles are the shop floor aspect of the parallel organization. They are small democratic and scientific problem-solving teams. At the individual level, they offset dead-end routines by developing R&D and management skills always required at the cutting edge of advancing technology. They constitute an experiential education in the activity of applied science. As behaviorally based "reference groups," they are transmitters of wider cultural change toward a scientific democracy. Behavioral change precedes attitude change. Meanwhile they enhance the immediate effectiveness of the companies where they exist; and their long

range effect is the ecological development (rather than depletion) of human resources, a renewable energy strategy.

But unless individuals as well as groups can access needed inputs as part of a self-directed learning process, the potential for personal growth is still limited. How private industry with its vast learning resources together with public education institutions can provide mechanisms for individualized, continuing learning is now an issue that must be faced.

How public education and public policies can increase the probabilities of continuing, self-directed, and collaborative learning within industry is another set of issues to be faced. An emphasis in public schools on active learning skills would greatly help.

3. Automated Phase: Meanwhile, method ultimately triumphs with the introduction of automation. Here, perhaps 40% of the workforce is retained in considerably enriched jobs for which their previous jobs were important platforms. The average product life span, however, is only about six years. There is no job security apart from continuing learning: competence, not seniority, is what counts.

The remaining workers and managers have been "cycle tested" and are valuable to new product start-ups either within the same companies or as spin-offs to new companies (see Appendix C, p. 193 for spin-off chart). Whether the humans have here reached a stage where they eject the mechanical as automation, or whether the mechanical has grown so powerful as to eject the human as unnecessary, depends upon how well the trajectory has served as a vehicle of human growth and learning.

CONCLUSION

In its active, collaborative and heuristic aspects the configuration shown here to define the movement of emergent high technology industry is a powerful contrast to the culture of our schools, which still favor passive rote learning. Yet, implicit in what has been presented here is an heuristic model ready to be transferred to our educational systems, where it can be substantially refined and enriched to the benefit of work and learning

The recommendations of the "Nation at Risk" report of the National Committee on Excellence in Education, however substantial, amount to a call for more of the same: more money, more teachers, more hours and more days. This is single-loop learning, and will not overcome the cultural discontinuity between our schools and the frontiers of new technology, which demand

double-loop learning. The time has come for trying something different, for an era of educational experimentation in the blending of theory and action, self-reliance and cooperation, precision and creativity.

How this translates into policy and meaningful action should be taken up and explored by the State Board of Community Colleges and Occupational Education, and by the State Department of Education.

Meanwhile, as one concrete and practical application of the learnings generated by this project, a proposal for an additional, prototype phase is here included as an appendix to this document.

BIBLIOGRAPHY

Argyris, Chris and Schon, Donald A. Organizational
    Learning: A Theory of Action Perspective. Reading,
    Mass.: Addison-Wesley, 1978, p. 9. A parallel
    distinction between "first," and "second order change"
    is made in Watzlawick, Paul; Weakland, John; and
    Fisch, Richard. Change: Principles of Problem
    Formation and Problem Resolution. New York: W. W.
    Norton, 1974.

Kanter, Rosabeth Moss and Stein, Barry A., Building the
    Parallel Organization: Creating Mechanisms for
    Permanent Quality of Work Life. The Journal of
    Applied Behavioral Science, 1980, 1 (3), 371-384.

McCarthy, Bernice. The 4Mat System: Teaching to Learning
    Styles with Right/Left Mode Techniques. Oak Brook,
    Illinois: Excel, Inc., 1980.

Zand, Dale E. Collateral Organization: A New Change
    Strategy. In Wendell L. French et al. (Eds.),
    Organization Development: Theory, Practice and
    Research. Dallas: Business Publications,Inc., 1978.

APPENDIX A

PROPOSAL

STORAGE TEK PROJECT

I.   First Phase: Summary

The first phase of this project has been an action research intervention into the Thin Film Operations areas of Storage Tek to identify transferable competencies and learning strategies for the public sector concerned with training. This phase will conclude at the end of June with a formal report prepared for the Project Advisory Committee by the Project Director and with final editing of a video tape available for public use provisionally entitled "The Business of Learning."

The Thin Film development was chosen as the project site because it exemplifies the configuration of manpower issues and requirements generated by new technology start-ups that make interfacing with public education institutions problematic:

1.   The developed production process is actually R&D manufacturing, with job procedures changing daily. Yesterday's training is obsolete today; learning must be continuous.

2.   The equipment required for the work is too expensive to duplicate in classrooms.

3. Proprietary issues impede a full exchange of information between industry and education; and clearly authorized channels for such exchange do not yet exist.

4. Much of the purely technical expertise must be internally developed by industry (e.g., there are no public training programs in vacuum systems, electroplating or photo lithography-- skills basic to the semi-conductor industry). Rapid learning abilities are thus a premium.

5. The focus on technical skill items by vocational educators obscures the crucial role of problem solving, communication, and other "active worker" competencies needed to function effectively in the industrial learning environment.

6. The hiring process emerging in industry deliberately favors those persons who can respond with both rigor and flexibility to the demands of a complex, interdependent system. This holds especially true for clean room environments.

7. Public education has yet to develop an adequate response to the new job requirements.

The above generalizations have been confirmed by direct observation, interviews, participation,with all levels of personnel in the Quality Circle process, and a lengthy, group-based task analysis. A learning style inventory will be administered in June to give another dimension to the study.

More tangibly, as a parallel step, the Project Director has facilitated the development of an interface between Storage Tek's Optical Disk Division and Front Range Community College. The immediate goal is to meet the manpower requirements for Optical Disk production, and develop an AAS degree. Eventually Storage Tek would like the AAS degree tied to a four year, articulated degree program with one of Colorado's universities.

Meanwhile, the opportunity for more general learnings about high tech/public education interface should not be lost; and the first-phase findings of this project deserve a practical test.

Optical Disk has already indicated through Mr. Doyle Johnson, that they require the same kinds of non-technical competencies already described for Thin Film: problem solving, communication, and management skills at all levels of the organization.

II. <u>Next Steps: Statement of Work</u>

Indicators now point to the need for an effective integration of technical and non-technical competencies at all levels of the high tech work force. Industry has thus far been able to manage its own steep learning curves by facilitating such integration within a total learning environment. The Optical Disk/Front Range Community College connection presents an opportunity to <u>parallel</u>, rather than to simply <u>prepare for</u>, this industrial environment by building an <u>integrated</u> curriculum. Incremental approaches to learning currently used by public education are often segmented, routinized, non-participatory, and may thus actually de-skill the worker for the thinking/ acting demands of the job. The shift required is from a teaching environment to a learning environment.

Contingent upon the developing relationship between Storage Tek's Optical Disk Division and Front Range Community College, and subject to further input from the Project Advisory Committee, the Project Director will dedicate three months of actual working time distributed over six months to:

1. Facilitate joint curriculum development by Optical Disk personnel and FRCC staff.

2. Analyze the proposed technical portions of the curriculum prepared by and for Optical Disk.

3. Identify additional learning experiences relevant to job performance.

4. Help modify the technical curriculum to simulate the demands of the work place.

5. Develop a problem-posing stance on the part of instructors that confronts students with real issues in the learning process.

6. Interject opportunities for the demonstration of work place competencies so that instructors can evaluate total performance; that is, both the acquisition of technical skills and necessary work behavior skills.

This phase of the project is a transfer of the high tech learning model into a public education context. Once success can be demonstrated, an additional step--the development of a delivery model for dissemination--will logically follow.

APPENDIX B

INSTRUMENTS

Section II   THE LEARNING STYLE INVENTORY

This survey is to determine the way you learn best. There are nine sets of four descriptions listed below.
On the answer sheet provided, mark the words in each set that are most like you, second most like you, third
most like you and least like you. Assign (4) to the description that is most like you, (3) to the quality
that is second most like you, (2) for the description that is third most like you, and (1) for the description
that is least like you. High = (4) most like you Low = (1) least like you. There are no wrong/right answers.

CE	RO	AC	AE
1. get involved	take my time before acting	particular about what I like	like things to be useful
2. open to new experiences	look at all sides of issues	like to analyze things, break them down into their parts	like to try things out
3. like to deal with my feelings	like to watch	like to think about ideas	like to be doing things
4. accept people and situations the way they are	aware of what's going on around me	evaluate things	take risks
5. have gut feelings and hunches	have a lot of questions	am logical	am hard working and get things done
6. like concrete things, things I can see and touch	like to observe	like ideas and theories	like to be active
7. prefer learning in the here and now	like to consider things and reflect about them	tend to think about the future	like to see results from my work
8. rely on my feelings	rely on my observations	rely on my ideas	have to try things out for myself
9. am energetic and enthusiastic	am quiet and reserved	tend to reason things out	am responsible about things

SECTION II Your Style of Thinking and Learning Put an X on the answer sheet in the appropriate column,
A, B or C for the description that is most like you.
Mark only one X for each question.

	A	B	C
1. I remember best...	names	faces	both names and faces.
2. I prefer to have things explained to me...	with words	by showing them to me	both ways.
3. I prefer classes	with one assignment at a time	where I work on many things at once	both ways.
4. I prefer...	multiple choice tests	essay tests	both kinds of tests.
5. I am...	not good at body language, I prefer to listen to what people say	good at body language	sometimes good, but other times not good.
6. I am...	not good at thinking of funny things to say and do	good at thinking of funny things to say and do	sometimes good.
7. I prefer classes...	where I listen to "experts"	in which I move around and try things	where I listen and also try things.
8. I decide what I think about things..	by looking at the facts	based on my experience	both ways.
9. I tend to solve problems...	with a serious, business-like approach	with a playful approach	with both approaches.
10. I like...	to use proper materials to get jobs done	to use whatever is available to get jobs done	a little of both.
11. I like my classes or work to be..	planned so I know exactly what to do	open with opportunities for changes as I go along	both planned and open to changes.
12. I am...	never inventive	very inventive	occasionally inventive
13. I prefer classes when I am expected..	to learn about things I can use in the future	to learn things I can use right away	both kinds of classes.
14. I...	would rather not guess or play hunches	like to play hunches and guess	sometimes make guesses and play hunches.
15. I like to express feelings and ideas..	in plain language	in poetry, song, dance, art	both ways.
16. I get insights from poetry, symbols, etc...	rarely	usually	sometimes.
17. I prefer...	solving one problem at a time	solving more than one problem at a time	both equally.

189

Section II(continued)

		A	B	C
18.	I respond more to people when...	they appeal to my logical side, my intellect	when they appeal to my emotional side, my feelings	equally respond to both kinds of appeal.
19.	I prefer to learn..	the well established parts of a subject	about the unclear parts, the hidden possibilities	both ways.
20.	I prefer..	analytic reading, taking ideas apart and thinking about them separately	creative reading, putting a lot of ideas together	both kinds of reading.
21.	I prefer..	to use logic in solving problems	to use "gut feelings" in solving problems	both equally.
22.	I prefer...	to analyze problems by reading and listening to experts	to see and imagine things when I solve problems	to do both.
23.	I'm very good at..	explaining things with words	explaining things with hand movements and actions	both.
24.	I learn best from teachers who..	explain with words	explain with movement and actions	have no preference.
25.	When I remember or think about things, I do so best with	words	pictures and images	both equally well.
26.	I prefer to..	examine something that is finished and complete	organize and complete something that is unfinished	do both.
27.	I enjoy..	talking and writing	drawing and manipulating (handling) things	both equally.
28.	I am...	easily lost in finding directions	good at finding directions	not bad in finding directions, but not really good either.
29.	I am...	primarily intellectual	primarily intuitive	equally intellectual and intuitive.
30.	I prefer to learn..	details and specific facts	from a general overview, to look at the whole picture	both ways equally.
31.	I read...	for specific details and facts	for main ideas	for both equally.
32.	I learn and remember..	only those things specifically studied	details and facts in the environment not specifically studied	have noticed no difference in these areas.

190

Section II (continued)

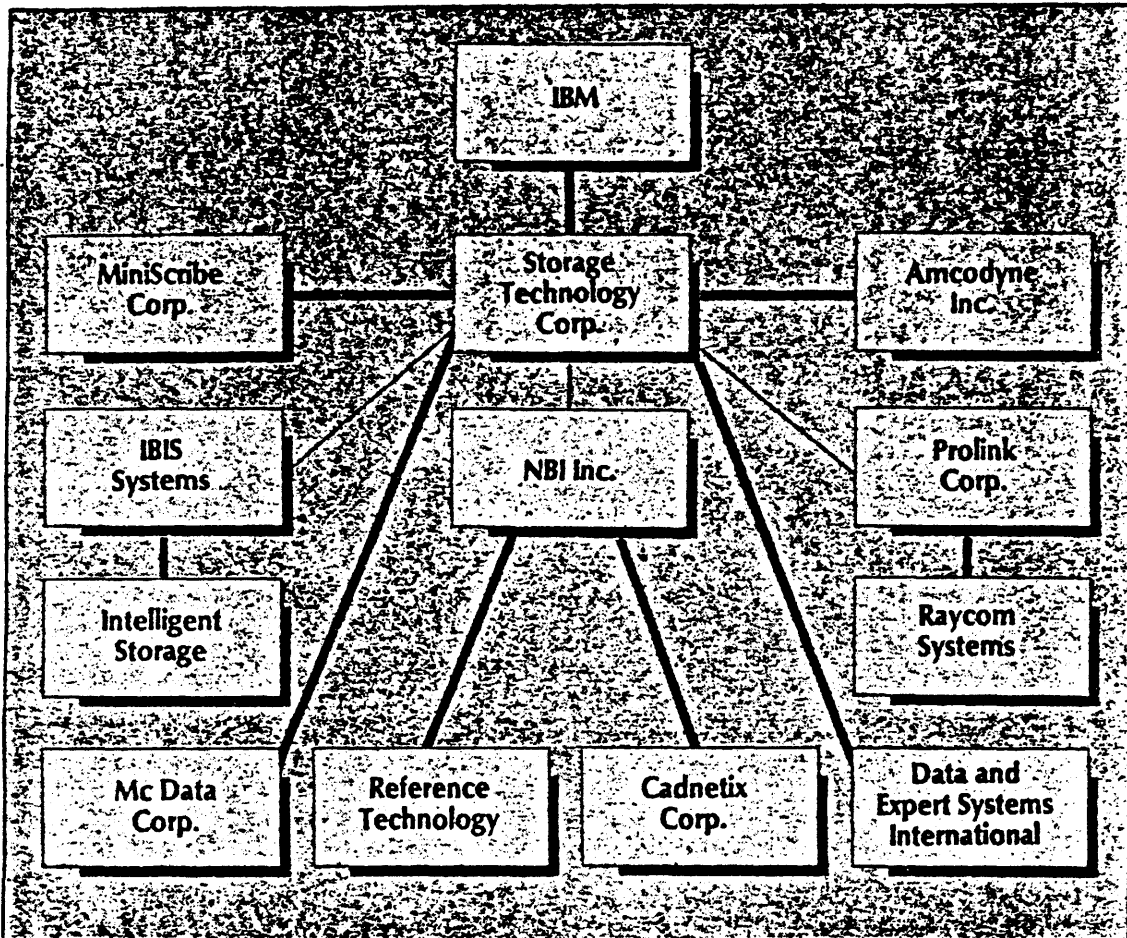|	A	B	C
33. I like to read..	realistic stories	fantasy stories	no preference.
34. I feel it is more fun to..	plan realistically	dream	both equally fun.
35. I...	prefer total quiet when reading or studying	prefer music while reading or studying	listen to music only when reading for enjoyment, not when studying.
36. I would like to write...	non-fiction books	fiction books	no preference.
37. If seeking mental health counseling, I would prefer...	the confidentiality of individual counseling	group counseling and sharing of feelings with others	no preference for group over individual counseling.
38. I enjoy...	copying and filling in details	drawing my own images and ideas	both equally.
39. It is more exciting..	to improve something	to invent something	both are exciting.
40. I prefer to learn..	by examining	by exploring	both ways equally.
41. I prefer..	algebra	geometry	both equally.
42. I am skilled in..	sequencing ideas	showing relationships among ideas	both equally.
43. I prefer..	dogs	cats	both equally.
44. I..	use time to organize myself and my personal activities	have difficulty in pacing my personal activities to time limits	pace personal activity to time limits easily.
45. I have..	almost no mood changes	frequent mood changes	few mood changes.
46. I am...	almost never absentminded	frequently somewhat absentminded	occasionally absent-minded.
47. I am strong..	in recalling verbal materials (names, dates)	in recalling spatial material	equally strong in both.
48. I am skilled in..	the statistical, scientific prediction of outcomes	the intuitive prediction of outcomes	equally skilled in both.
49. I prefer..	outlining over summarizing	summarizing over outlining	have no real preference.
50. I prefer..	verbal instructions	demonstrations	no real preference.

Adapted by Torrance and McCarthy. Copyright, Paul Torrance, 1980

APPENDIX C

SPINOFF CHART

Figure 10. Spinoff aspect of high tech emergence.

The connections

Boulder Valley's high-tech family

```
                          IBM

MiniScribe          Storage              Amcodyne
 Corp.             Technology               Inc.
                     Corp.

  IBIS                                    Prolink
 Systems              NBI Inc.             Corp.

Intelligent                               Raycom
 Storage                                  Systems

                                          Data and
 Mc Data        Reference    Cadnetix    Expert Systems
  Corp.        Technology      Corp.      International
```

Spinoffs beget more spinoffs among local high-tech firms

By SUSAN SMITH
Camera Staff Writer

In the beginning there was IBM, and in 1965 it opened a division in Boulder.

And four years later, it begat a son, and its name was Storage Technology Corp.

In 1973 came Binx Selby and NBI Inc., which in turn gave us Cadnetix Corp. and Reference Technology Inc.

lead high-tech employees to fly the coop and head out on their own. And while the Boulder Valley family remains close and mostly friendly, there have been feuds.

Breaking away can bring a good-luck handshake or even spending money. But it can also incur threats, law suits, and jealousy.

At some point during the birth process of Boulder County's new companies — it's hard to say exactly

● A division of IBIS Systems, a California company, started here two years ago that drew from the pool of engineers at STC.

● The Advanced Systems Group of Detroit-based Burroughs Corp., moved here last year.

The majority of new local high-tech companies, however, are spinoffs from other local companies.

Otrona Advanced Systems Corp., which makes a portable computer,

APPENDIX II

THE POLITICS OF QUALITY: RESTORING THE

WITHIN OF WORK

THE POLITICS OF QUALITY: RESTORING THE WITHIN OF WORK

Presented To:

Dr. David Welch
Dr. Bob Ross
Dr. Monte Clute

By: Gordon Dveirin

In fulfillment of the requirement
for a written doctoral compre-
hensive.

University of Northern Colorado
May, 1982

THE POLITICS OF QUALITY: RESTORING THE WITHIN OF WORK

> You cannot live in this world without a
> structure, for the nature of this world is form.
> The reason we have come into this particular planet
> is to transcend form with internal structure so that
> form then flows out of us rather than defines us.
>
> Shirley Luthman, Collection 1979

Sometimes it is sufficient to know what works without knowing how or why it works. An automobile, for example, can be operated by someone who has never seen an engine. But thinking that the accelerator is what makes the automobile go won't prevent it from running out of gas.

Today, in nations throughout the world, business sectors are rapidly at work "installing" Quality Circles. The results in terms of cost-saving ideas, high return on investment and improved morale are almost universally acclaimed. Quality Circles make productivity "go."

But surprisingly little attention has been given to the human dynamics at work in such Circles; and for this reason their potential for effecting a quiet revolution in the work life of mankind could be delayed or short-lived. I hope this is not so; and I believe that there are larger forces at work of an evolutionary nature which will continue to move us in the direction that Quality Circles are pointing--toward a new balance

between ourselves as creators and the world that we are creating.

This new balance will have to reconcile, or at least acknowledge, the dynamic tension that currently exists between person-centered and product-centered orientations to work. Quality Circles can be approached from either orientation. Contrast, for example, two useful and intelligent articles that appeared a few months apart in Training and Development Journal. The first enthusiastically concludes that "It is time to move Quality Circles from the auspices of the engineers to the trainers who cannot only help Circles to achieve the cost-effective goals of the program but also are better equipped to foster the personal growth of the participants."[1] The second article ends on a much more cautionary note with the reservation that " . . . heavier personnel staff involvement in QC's could cause a shift in the effort away from problem-solving for productivity and quality improvement toward a heavier emphasis on group process and relationships. 'Warm fuzzies' should clearly not replace the productivity aspect."[2]

Both of these writers are interested in results, but each would probably select different kinds of indicators for measuring results. The concern for the personal growth of Circle members points in the direction of psychological reality, whereas the more traditional

emphasis on productivity looks almost exclusively toward physical reality.

In the past it has seemed necessary to give precedence to one of these realities over the other, as when Ruskin, writing in the last century on the distinction between free and servile workmen, insisted that "You must either make either a tool of the creature or a man of him."[3] But the physicist Heisenberg, who explored both the wave-like and particle-like properties of light, has since shown that alternative realities which cannot be embraced simultaneously can be grasped sequentially to the ultimate enrichment of our total understanding. To insure that both the physical and psychological aspects of work are both accorded sufficient emphasis, modern organizations are as much in need as modern physics of a principle of complementarity.

The need to heal alienation and the need for technical advancement are twin aspects of a single problem. Quality is a complex subject precisely because it has both a subjective and an objective pole, both a within and a without. Quality is an artifact of consciousness. Insofar as it is perceptible, it is the visible fruit of an invisible tree. We are just emerging from an era that has regarded the fruit as real and the tree as unreal despite the obvious inconsistency.

The significance of Quality Circles is that they are a means of restoring reciprocity, relationship, between

the internal and external realms. "When one isn't dominated by feelings of separateness from what he's working on, then one can be said to 'care' about what he's doing. That is what caring really is, a feeling of identification with what one is doing. When one has this feeling then he also sees the inverse side of caring, Quality itself."[4]

Daniel Katz has written of a New York hospital where nurses fed babies salt instead of sugar for an entire week despite violent reactions to the formula and several deaths. He postulates that "In general, the greater the emphasis upon compliance with rules the less the motivation will be for individuals to do more than is specified by their job prescriptions."[5]

The psychological corrective to this problem has been described in linguistic terms as "denominalization," the transformation of a noun into a verb. If one has "tension," for example, in his or her body, then what can one do with "it?" But if one is "tensing" the body, is the subject of the verb, then one has recovered the freedom to reverse the situation by relaxing. Similarly, Quality Circles denominalize work by freeing their members from static job descriptions and involving them in the dynamic process of job designing.

When individuals freely choose to step off line and into a Circle, into a learning community based on scientific and democratic principles, their status is

dramatically altered. Circles are engines of human transformation that can effect a shift from subhuman <u>behavior</u> dictated by necessity to fully human <u>action</u> grounded in freedom and oriented toward an infinite deal. This lays open the possibility of an immense recovery of personal power by individuals and a consequent liberation of their creative energies. It is a paradigm shift of Copernican proportions, but in the opposite direction, centripetal rather than centrifugal.

Copernicus advanced the state of science by attaining a universal viewpoint <u>outside</u> the human condition. This has given science the leverage that Archimedes dreamed of. But in the process we have acquired the ability to operate upon ourselves from the outside as well, to behave toward ourselves as externally as though, to use Aldous Huxley's phrase, we were our own invading horde of Martians. In alienating ourselves from ourselves we have become toward ourselves our own aliens.[6]

This is the practical significance of Taylorism in the work place: it has disintegrated human beings instead of integrating them, thus reversing the process of psychological maturation that Jung and others have described. "It is not, truly speaking, the labour that is divided, but the men: --divided into mere segments of men--broken into small fragments and crumbs of life."[7] By returning to a conscious center within the human

condition, Quality Circles are restoring the possibility of human integration, thus reversing a process that has been accelerating without correction since the Renaissance. This could be the jump that the historian Henry Adams felt our survival demanded when he compared our historical path to an accelerating comet that, at its apex of imminent self-destruction suddenly reverses direction and begins to progressively slow down. We may be on the verge of such a perihelion, a new economy of the forces we have unleashed.

Through Quality Circles the organizational world may at last be discovering what biologists have known for a long time: that evolution proceeds by building progressively higher levels of organization upon levels that have already been attained. In this progression, the simpler units of organization are not destroyed. Rather they are incorporated into the new structure that emerges.

The cell, for example, remains a fully functioning unit even after it is woven with other cells into a tissue. The cells do not lose themselves in the tissue; they participate in it: " . . . union differentiates. In every organized whole, the parts perfect themselves and fulfill themselves."[8]

This balance of integration and differentiation is in striking contrast to traditional man-made organizations which have typically worked to reduce whole persons

to subhuman sequences of functions. This is why we have had problems--we have been trying to progress and regress at the same time. It is as though, in order to build a brick house, we first set about pulverizing the bricks.

The single most important fact about Quality Circles is that they originate in the free and conscious choice of their members to participate. The significance of this cannot be sufficiently appreciated. The matter of tangible rewards has yet to be settled; but from a psychological standpoint this volitional base goes a long way toward overcoming the dispossession Marx decried with a measure of real ownership.

Alienation is, to a considerable extent, a function of anonymity. Quality Circles demonstrate the healing power of recognition. Giving a group of fellow workers exposure to each other for even one hour a week can to some degree transform the remaining thirty-nine for each of them.

The Greeks of the ancient city-states understood the importance of a space in which to appear. But they made a firm distinction between the realms of freedom and necessity. The _polis_, the public realm, was reserved for those who were freed by the submerged efforts of others, including their slaves and their wives, to pursue excellence in one form or another.

In this space of appearance it was possible to act, to bring something new and unexpected into being and thus

disclose oneself as a unique "who" rather than a generic "what." "Action, as distinguished from fabrication, is never possible in isolation;" says Hannah Arendt, who inspires this and the preceding paragraph: "to be isolated is to be deprived of the capacity to act."[9] The political realm, she continues, " . . . rises directly out of acting together,the 'sharing of words and deeds.'"[10] This is consistent with the economist E. F. Schumacher's concern for smallness within bigness and his observation that "When it comes to action, we obviously need small units, because action is a highly personal affair. . . ."[11]

Quality Circles which, in the pursuit of excellence, enfranchise whole persons, constitute just such a polis, a realm of freedom; the difference is that they reside not apart from--but in the very midst of--the realm of necessity, and they transform it from within. This is a monumental achievement. I do not mean to imply that this is where we are today, but it is an indication of where, given the vision of what is possible, we can go.

While it has certainly been true, as Argyris and Schön have observed, that " . . . organizations often know less than their members;"[12] not even the members really know what they know until they see what they say. The Quality Circle is an occasion for awareness, a means of accessing what is known by individuals. With the undefined nature of quality hovering above them as a

perpetual question, each is empowered to respond by say-
ing what he or she sees. This is an incentive to _seeing_,
to monitoring with careful attention what one is doing.

Furthermore, to be heard is to hear oneself, and
this is a step toward greater personal integration.
Meanwhile, through the sharing of individual points of
view, the limitations of these points of view can be
transcended even as their insights can be built upon. In
this process diversity is easily recognized as a
resource rather than a liability, a corrective to the
situation that R. D. Laing has described as being
"in formation" but "off course."

The ascent of awareness gives new meaning to
the principle of hierarchy in organizations. What has
previously been merely externalized as the organiza-
tional chart can now be understood as an order of thought
to which any individual can gain entry. The Circle
carries each of its members a logical level (and a
managerial level) above their respective tasks. From
this new position, each task currently performed can be
regarded as simply one of the many options.

No longer objectified in their own minds as mere
components of a human infrastructure that transforms what
enters and leaves a particular system, Circle members are
elevated to a position from which they can effect
mutations in their own processes in an ongoing fashion.
This is not simply change in the sense of more or less of

the same: it is a change in the nature of change, or what Paul Watzlawick calls second-order change.[13] Having learned how to learn, Circle members become active change agents.

The Quality Circle is a continuous feedback loop between theory and action. No longer blinded by opaque job descriptions, as the nurses mentioned earlier were blinded, participants are empowered to look at the actual results they are achieving and to correct their actions as often as necessary in the light of new empirical data. The Circle thus provides an opportunity to awaken from the somnambulism of automaticity, the kind of absent days that don't appear on the records.

Furthermore, as quality is increasingly recognized as the product of whole persons who are consciously present and in full possession of their experience, feelings also will have to be recognized as legitimate empirical data. Full presence and full engagement require full testimony and full receptivity: "It is not a matter of intimacy at all; this appears when it must, and if it is lacking that's all there is to it. The question is rather one of openness. A real community need not consist of people who are perpetually together; but it must consist of people who . . . have mutual access to one another and are ready for one another."[14]

This new openness does not necessarily imply a threat to order, as some might fear. It is rather the

substitution of an organic order that accommodates the
need for growth and meaning for a mechanical order that
restricts itself to the maintenance of homeostasis and
hence degenerates toward entropy.

The distribution of power among individuals is not
the same thing as the individualism with which freedom
has often been confused. Personal power, to be more than
self-assertion, must be guided by an impersonal or
suprapersonal ideal. What gives harmony and order to a
forest is that each tree, from its own unique position
and in its own unique way, is aspiring toward the source
of light.

The same ordering principle applies to Quality
Circles. They are polycentric in that the motive force
which gives them energy resides within each of the
members; but it resides there as the individualized
orientation toward a value that is shared by all, the
ideal of quality.

It is their common concern for the quality of what
they do that unites Circle members in what the scientist
and philosopher Michael Polanyi has described as " . . .
a decentralized and free procedure of mutual adjustment
through self-coordination. . . ."[15] As means of lateral
communication improve, this could also describe inter-
action among different Circles in the same organization.

Quality cannot be legislated because people cannot
be compelled to inquire, to care or to create. Quality

can only assume concrete and specific forms when a community of free persons is enfranchised to work out among themselves, using whatever resources are necessary, what those specific forms will be. Polanyi, who describes these kinds of associations as "enclaves of freedom" and "little republics of their own," offers a picture of the free society that has special relevance to what could be the organizational consequence of Quality Circles: " . . . many of the affairs of the society would be managed through the development of various spontaneous orders--ordered wholes that develop freely by means of mutual adjustments, rather than corporate orders. . . . It is our contention that a system that develops from the bottom up, through free interaction of its parts upon one another (subject only to a free, common dedication of its participants to the value of certain standards, principles, and ideal ends), is the only social system that can meaningfully be called free."[16]

Such freedom, as should by now be evident, is not contrary to discipline. It is only, in fact, when the demands of the instrument have been fully mastered that it serves, in the hands of the virtuoso, his free expression. The problem we are facing today is that our instruments so often seem separate from us that we appear to be serving them or, at any rate, to be dissociated from them. Marshall McLuhan referred to this

dissociation as Narcissism; for Narcissus, in McLuhan's version of the myth, drowned in his own reflection because he did not recognize it as himself. Quality Circles could be a means for us to recover a sense of connectedness with our own extensions and thus to express ourselves more faithfully in what we do.

The great periods in the past have been those in which man has come closest to recovering his own projections. The human scale and proportion of gods depicted on Greek tombs and temples, for example, are a striking contrast to the more remote and massive deities of earlier cultures. The human and merciful virgin of Chartres cathedral in twelfth-century France, to cite one more example, is for the first time given a stature equal to the God who sits in judgment; and at last, on behalf of the humanity she represents, she is permitted to be seated at his side. We, in contrast, have seemed utterly dwarfed by the great god we have projected, the cold technology which--in our imaginative representations--is sometimes richly responsive but at other times eats its own children.

If Quality Circles are to assist in restoring the balance in favor of humanity, then more than engineering, more than the admittedly crucial skill and precision of applied science will be necessary. The role of imagination will have to be recognized as equally central; and those with the skills and sensitivity

to nurture creative expression will be indispensable. For the pursuit of quality in the fullest extent of its meaning is what the philosopher Neitzsche called the "humanization of the realm of contingency;" and that is a matter of art.

I realize that I have been treating what many would consider a mundane topic in terms that might appear somewhat lofty. But this is precisely what interests me about Quality Circles; they represent an opportunity to bring together those high and low extremities of human experience which have hitherto been considered irreconcilable.

This new infusion of the material realm by conscious presence is, in metaphysical language, nothing less than the miracle of incarnation through which the material realm is redeemed. It was the goal of alchemy for nearly two thousand years of man's history, in China, in Babylon, in Egypt, and even among such modern men of stature as Paracelsus and Sir Isaac Newton.

When the psychologist C. J. Jung studied this phenomenon he discovered that the alchemists' avowed purpose of turning base matter into gold was, despite the existence of actual laboratories, principally an external symbolizing of an internal quest. The intransigent world of matter was a perfect objective correlative to man's equally intransigent unconscious. By attempting to crystallize out of this inward chaos the pure light of

consciousness, the alchemists were actually making not gold, but themselves.

While earlier scholars had recognized in the often crude and superstitious machinations of the alchemists the primitive beginnings of the modern science of chemistry, Jung recognized at the core of their strivings a much more fully developed science of the unconscious, the precursor of modern psychology.

We might similarly discover, when the history of the age of technology is written, that our own colossal manipulations of the world of matter in pursuit of gold have been, for all their outward magic, principally a means of bringing us to a great collective discovery-- which is nothing less than how to be with each other. Quality is not simply what we are making: it is also who we are becoming; for that which we are truly working to perfect is also serving to perfect us.

Quality Circles, in conclusion, are more than a matter of nuts and bolts. Like our own hands, they can be used as instruments, as means; and this is entirely appropriate. But also like our hands they can be lived in and felt through; and this kind of sensitivity, which is what really defines the quality of work life, is an end in itself. The present, the here-and-now, is a radical notion in most organizations; but it is the remedy for the alienation that comes from residing too much in the future. This is why the increased

productivity that comes from Quality Circles, as the
Japanese have well understood, is not the goal but rather
the indicator of a higher commitment on the part of
management, which is to foster the fullest possible
development of working human beings.

NOTES

1. Rendall, Elaine, "Quality Circles: A Third Wave Intervention." Training and Development Journal, March, 1981, p. 31.

2. Metz, Edmund L. "Caution: Quality Circles Ahead." Training and Development Journal, August, 1981, p. 76.

3. Ruskin, John, in Craig, Hardin and Thomas, J. M. (Eds.) English Prose of the Nineteenth Century. New York: Appleton-Century-Crofts, Inc., 1957, p. 512.

4. Pirsig, Robert M. Zen and the Art of Motorcycle Maintenance. New York: Bantam Books, 1974, p. 290.

5. Katz, Daniel, "Motivational Basis of Organizational Behavior." Scott, W. E. and Cummings, L. L. (Eds.) Readings in Organizational Behavior and Human Performance. Homewood, Ill.: Richard D. Irwin, Inc., 1973, p. 342.

6. For my understanding of the Archimedean point I am indebted to Arendt, Hannah, The Human Condition. Chicago: University of Chicago Press, 1958.

7. Ruskin, John, op. cit.

8. Teilhard DeChardin, Pierre. The Phenomenon of Man. London: Fontana Books, 1969, p. 288.

9. Arendt, Hannah, op. cit., p. 188.

10. Ibid., p. 198.

11. Schumacher, E. F. Small Is Beautiful: Economics As If People Mattered. New York: Harper and Row, 1975, p. 65.

12. Argyris, Chris and Schon, Donald A. Organizational Learning: A Theory of Action Perspective. Reading, Mass.: Addison-Wesley, 1978, p. 9.

13. Watzlawick, Paul; Weakland, John; and Fisch,
     Richard. Change: Principles of Problem Formation and
     Problem Resolution. New York: W. W. Norton, 1974.

14. Buber, Martin. Paths in Utopia. Boston: Beacon,
     1958, pp. 144-145.

15. Polanyi, Michel and Prosch, Harry. Meaning.
     Chicago: University of Chicago Press, 1975, p. 190.

16. Ibid., p. 204.

BIBLIOGRAPHY

Adler, M. J. (1982). The paideia proposal: An educational manifesto. New York: Macmillan Publishing Co., Inc.

Arendt, H. (1958). The human condition. Chicago: University of Chicago Press.

Argyris, C. and Schon, D. A. (1978). Organizational learning: A theory of action perspective. Reading, Mass.: Addison-Wesley.

Aristotle (1979). The politics. (T. A. Sinclair, Trans.). New York: Penguin Classics.

Assagioli, R. (1976). The act of will. New York: Penguin Books.

Bateson, G. (1978). Steps to an ecology of mind. New York: Bantam Books.

Benne, K. D. (1979). The learning community. In G. M. Healy and W. L. Ziegler (Eds.), The learning stance: Essays in celebration of human learning (pp. 1-48). Washington, D.C.: National Institute of Education.

v. Bertalanffy, L. (1952). Problems of life: An evaluation of modern biological thought. New York: John Wiley and Sons.

Best, F. (Ed.). (1973). The future of work. Englewood Cliffs, N.J.: Prentice-Hall, Inc.

Blank, W. E. (1982). Handbook for developing competency-based training programs. Englewood Cliffs, N.J.: Prentice-Hall.

Bloom, B. S. (1981). All our children learning: A primer for parents, teachers, and other educators. New York: McGraw-Hill Book Co.

Bluestone, B., and Harrison B. (1982). The deindustrialization of America: Plant closings, community abandonment, and the dismantling of basic industry. New York: Basic Books.

Boulding, K. (1966). The image: Knowledge in life and society. Ann Arbor: University of Michigan Press.

Brown, N. O. (1966). Love's Body. New York: Random House.

Bruner, J. (1965). The growth of mind. American Psychologist, 20, 1007-1017.

Bruner, J. and Postman, L. (1949). On the perception of incongruity: A paradigm. Journal of Personality, 18, 206-223.

Burns, T. and Stalker, G. M. (1961). The management of innovation. Tavistock Publications.

Butler, S. (1955). Erewhon and Erewhon Revisited. New York: Random House.

Campbell, J. (1977). The masks of god: Creative mythology. New York: Penguin.

Campbell, J. (1979). Schizophrenia: The inward journey. In Goleman, D. and Davidson, R. J. (Eds.), Consciousness: Brain, states of awareness and mysticism (pp. 194-203). New York: Harper and Row.

Cetron, M. (1985). Schools of the future: How American business and education can cooperate to save our schools. New York: McGraw-Hill.

Committee for Economic Development, Research and Policy Committee (1985). Investing in our children: Business and the public schools. Available from Committee for Economic Development, 477 Madison Ave., New York, New York 10022.

Cooley, R. S. and Seeman, J. (1979, June). Personality integration and social schemata. Journal of Personality, 47 (2), 288-304.

Cordes, C. (1985, July). Military waste: the human factor. APA Monitor, p. 1.

Cox, H. (1966). The secular city. New York: Macmillan.

Dewey, J. (1926). Democracy and education: An introduction to the philosophy of education. New York: The Macmillan Co.

Draper, R. (1985, October 24). The golden arm Review of Robotics; Work transformed: Automation and labor in the computer age; The robotics revolution: The complete guide for managers and engineers; Robots: Machines in man's image; and Smart robots: A handbook of intelligent robotic systems . The New York Review of Books, 32 (16), 46-52.

Drucker, P. F. (1974). Management: Tasks, responsibilities, practices. New York: Harper and Row.

Einstein, A. and Infeld, L. (1938). The evolution of physics. New York: Simon and Schuster.

Eliot, G. (1968). Middlemarch (G. S. Haight, Ed.). Boston: Houghton Mifflin. (Original work published in 1871-1872).

Eliot, T. S. (1969). The dry salvages. In The complete poems and plays. London: Faber and Faber.

Ellul, J. (1964). The technological society. New York: Knopf.

Erikson, E. (1963). Childhood and society. New York: W. W. Norton.

Feldenkrais, M. (1972). Awareness through movement. New York: Harper and Row.

Ferguson, M. (1980). The aquarian conspiracy: Personal and social transformation in the 1980s. Los Angeles: J. P. Tarcher.

Foucault, M. (1965). Madness and civilization: A history of insanity in the age of reason. New York: Pantheon Books.

Friere, P. (1983). Pedagogy of the oppressed (M. B. Ramos, Trans.). New York: Continuum. (Original work published 1968.)

Fromm, E. (1962). Beyond the chains of illusion: My encounter with Marx and Freud. New York: Simon and Schuster.

Fromm, E. (1968). The revolution of hope: Toward a humanized technology. New York: Bantam Books.

Fromm, E. (1969). Escape from freedom. New York: Avon Books.

Giedion, S. (1969). Mechanization takes command: A contribution to anonymous history. New York: W. W. Norton.

Gombrich, E. H. (1969). Art and illusion: A study in the psychology of pictorial representation. Princeton, N.J.: Princeton University Press.

Goodlad, J. I. (1984). A place called school: Prospects for the future. New York: McGraw-Hill.

Graves, R. (1973). The Greek myths: Vol. 1. New York: Penguin.

Harmon, W. W. (1979). An incomplete guide to the future. New York: W. W. Norton.

Heidegger, M. (1977). The question concerning technology and other essays. (W. Lovitt, Trans.). New York: Harper and Row.

Heisenberg, W. (1958). Physics and philosophy. New York: Harper and Row.

Hirschhorn, L. (1984). Beyond mechanization: Work and technology in a post industrial age. Cambridge, Mass.: The MIT Press.

Holt, J. (1964). How children fail. New York: Dell Publishing Co., Inc.

Huxley, Sir J. (1969). Introduction to P. T. de Chardin, The phenomenon of man (pp. 11-30). London: Fontana.

Jelinek, M. (1979). Institutionalizing innovation: A study of organizational learning systems. New York: Praeger Publishers.

Jung, C. G. (1968). The archetypes and the collective unconscious. In H. Read, M. Fordam, and G. Adler (Eds.) and R.F.C. Hull (Trans.), The collected works of C. G. Jung (Vol. 9, 1). Princeton, N.J.: Princeton University Press.

Jung, C. G. (1968). Psychological commentary. In W. Y. Evans-Wentz (Ed.), The Tibetan book of the great liberation (pp. xxix-lxiv). New York: Oxford University Press.

Jung, C. G. (1970). Myterium coniunctionis: An inquiry into the separation and synthesis of psychic opposites in alchemy. In Sir H. Read, M. Fordam, G. Adler (Eds.) and R.F.C. Hull (Trans.), The collected works of C. G. Jung (Vol. 14). Princeton: Princeton University Press. (Original work published 1956-1957.)

Kanter, R. M. (1983). The change masters: Innovation and entrepreneurship in the American corporation. New York: Simon and Schuster.

Kanter, R. M. and Stein, B. A. (1980). Building the parallel organization: Creating mechanisms for permanent quality of work life. The Journal of Applied Behavioral Science, 1 (3), 371-384.

Knowles, M. (1978). The adult learner: A neglected species (2nd ed.). Houston: Gulf Publishing Co.

Koestler, A. (1976). The ghost in the machine. New York: Random House.

Korzybski, A. (1933). Science and sanity. Lakeville, CT.: The International Non-Aristotelian Library Publishing Co.

Kuhn, T. S. (1962). The structure of scientific revolutions. Chicago: University of Chicago Press.

Lewin, K. (1952). Group decision and social change. In G. E. Swanson, T. N. Newcomb, and E. L. Hartley (Eds.), Readings in social psychology. New York: Holt, Rinehart and Winston.

Lowen, A. (1975). Bioenergetics. New York: Penguin Books.

Lowen, A. (1983). Narcissism: Denial of the true self. New York: Macmillan Publishing Co.

Marx, K. (1906). Capital: Vol. 1. Chicago: Charles H. Kerr Co.

Maslow, A. H. (1975). The farther reaches of human nature. New York: Viking Press.

Maslow, A. (1968). Toward a psychology of being (2nd ed.). Princeton, N.J.: Van Nostrand.

McCage, R. D. (1982, December). Research and development agenda for the 1980s: Productivity and economic advancement through human resource development. Presidential address to the American Vocational Education Research Association.

McCarthy, B. (1980). The 4Mat system: Teaching to learning styles with right/left mode techniques. Oak Brook, Illinois: Excel, Inc.

Mead, M. (1970). Culture and commitment;. New York: Natural History Press.

McLuhan, M. (1964). Understanding media: The extensions of man. New York: Signet Books.

National Commission on Excellence in Education (1983). A nation at risk: The imperative for educational reform (#065-000-0177-2). Washington, D.C.: U.S. Government Printing Office.

Ouchi, W. G. (1982). Theory z: How American business can meet the Japanese challenge. New York: Avon Books.

Ornstein, R. E. (1980). The Psychology of consciousness. New York: Penguin Books.

Ouspensky, P. D. (1977). In search of the miraculous: Fragments of an unknown teaching. New York: Harcourt Brace Jovanovich.

Peters, T. J. and Waterman, R. H., Jr. (1982). In search of excellence: Lessons from America's best-run companies. New York: Harper and Row.

Polanyi, M. (1964). Personal knowledge: Towards a post-critical philosophy. New York: Harper and Row.

Polanyi, M. and Prosch, H. (1975). Meaning. Chicago: University of Chicago Press.

Porter, M. E. (1985). Competitive advantage: Creating and sustaining superior performance. New York: Free Press.

Reich, W. (1972). Character analysis. New York: Simon and Schuster.

Ruskin, J. (1957). Servile and free workmen. In H. Craig and J. M. Thomas (Eds.), English prose of the nineteenth century (pp. 511-514). New York: Appleton-Century-Crofts.

Sapir, E. (1963). The selected writing of Edward Sapir. (D. Mandelbaum, Ed.). Berkeley: University of California Press.

Sarason, S. (1971). The culture of the school and the problem of change. Boston: Allyn and Bacon.

Satir, V. (1980, March). Family therapy workshop conducted at Peaceful Valley Resort near Lyons, Colorado.

Schein, E. H. (1985). Organizational culture and leadership: A dynamic view. San Francisco: Jossey-Bass.

Schmuck, R. A. and Miles, M. B. (Eds.) (1971). Organization development in schools. Palo Alto: National Press Books.

Schumacher, E. F. (1975). Small is beautiful: Economics as if people mattered. New York: Perennial Library.

Schwartz, G. G. and Neikirk, W. (1983). The work revolution. New York: Rawson.

Seeman, J. (1983). Personality integration: Studies and reflections. New York: Human Sciences Press.

Shah, I. (1972). The exploits of the incomparable mulla Nasrudin. New York: E. P. Dutton.

Shah, I. (1981). Learning how to learn: Psychology and spirituality in the Sufi way. New York: Harper and Row.

Simmons, J. and Mares, W. (1983). Working together. New York: Knopf.

"Special Issue: A new science of life. (1981, August 3). Brain Mind Bulletin, 16 (3), 1.

Stake, R. E. (1978). Case studies in science education: Vol. 2. Design, overview and general findings (Contract No. NSF-C-7621134). Washington, D.C.: National Science Foundation.

Tillich, P. (1952). The courage to be. New Haven: Yale University Press.

Stevens,. W. (1959). Poems. New York: Vintage Books.

Toffler, A. (1981). The third wave. New York: Bantam Books.

Watzlawick, P., Weakland, J. H., and Fisch, R. (1974). Change: Principles of problem formation and problem resolution. New York: W. W. Norton.

Weitzman, M. L. (1984). The share economy. Cambridge, Mass.: Harvard University Press.

Whitehead, A. N. (1953). Science and the modern world. New York: The Free Press.

Whitehead, A. N. and Russell, B. (1910-1913). Principia mathematica (vols. 1-3). Cambridge: Cambridge University Press.

Wilber, K. (1981). No boundary: Eastern and Western approaches to personal growth. Boulder and London: Shambala.

Wilber, K. (1982). Reflections on the new-age paradigm: A conversation with Ken Wilber. In K. Wilber (Ed.), The holographic paradigm and other paradoxes: Exploring the leading edge of science. Boulder and London: Shambala.

Wilhelm, H. (1973). Change: Eight lectures on the I Ching (C. F. Baynes, Trans.). Princeton, N.J.: Princeton University Press.

Wilms, W. W. (1980). The unfilled promise of post-secondary vocational education: graduates and dropouts in the labor market. Unpublished (mimeo) report to the National Institute of Education.

Whorf, B. L. (1956). Language, thought, and reality. In J. B. Carroll (Ed.), Language, thought and reality: Selected writings of Benjamin Lee Whorf (pp. 246-270). New York: John Wiley and Sons.

Wolfe, T. (1980). The Right Stuff. New York: Bantam Books.

Woodard, S. (1985). Issue paper: Vocational education and training to the year 2000. Unpublished report to the Colorado Governor's High Technology Cabinet Council.

Young, J. Z. (1960). Doubt and certainty in science: A biologist's reflections on the brain. New York: Oxford University Press.

Zand, D. E. (1978). Collateral organization: A new change strategy. In W. L. French, C. H. Bell, Jr., and R. A. Zawacki (Eds.), Organization development: Theory, practice, and research (pp. 293-307). Dallas: Business Publications.

Ziegler, W. L. (1979). The concept of the learning
    stance. In G. M. Healy and W. L. Ziegler (Eds.),
    The learning stance: Essays in celebration of human
    learning (pp. 1-39). Contract No. 400-78-0029.
    Washington, D.C.: National Institute of Education.

VITA

GORDON F. DVEIRIN
P.O. Box 830, Boulder, CO 80306; (303) 444-0587

SUMMARY OF PROFESSIONAL WORK AND EXPERIENCE

Present

Consultant, The Futures-Intervention Associates,
Denver, CO (1985). Current projects include U.S.
West, Adult Learning Futures, and the Illinois State
Department of Education

Recent Past

Program Director of Regis College-Sterling, Instruc-
tor of Organizational Behavior, Consultant to Regis
College (1984-86)

Project Director and Principal Investigator of The
Storage Tek-State Education Project (funded by the
Colorado Governor's Job Training Office) (1983-84)

Teacher, Colorado Institute of Transpersonal Psych-
ology (1982)

Consultant to: City of Boulder Personnel Dept.,
Jefferson County School District, Mountain Bell
Training Center and Corporate Human Resources
(1979-82)

EDUCATION

Ed.D. 1987, School of Educational Change and De-
velopment, University of Northern Colorado,
Greeley, Colorado.
ORGANIZATIONAL DEVELOPMENT AND TRANSPERSONAL
PSYCHOLOGY.
Doctoral Dissertation: From Manpower to
Mindfulness: The High Tech Culture of Emer-
gence and its Implications for Education.
Post-Graduate 1969-1973, University of Toronto,
Toronto, Ontario
ENGLISH: Graduate Teaching Fellow, Ontario
Provincial Fellow
M.A. 1968, University of Colorado, Boulder, Colorado
ENGLISH: Minor in History
B.A. 1967, University of Colorado, Boulder, Colorado
ENGLISH: Minors in History and Philosophy