

## DEVELOPMENT OF INTELLECTUAL CAPABILITY\*\*

Dr. Elliott Jaques

Brunel University

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### Summary of the Argument

This paper is concerned with the subject of the ability of individuals to engage in goal-directed behavior in problem-solving and in everyday work. It concentrates upon one aspect only of this ability; namely, that of intellectual capability - or what tends currently to be referred to as cognitive processes. It addresses a number of connected issues: first, what is the nature of cognitive processes, defined here as the processes by which individuals form or pattern the world which they construct and work with?; second, how is it possible to measure the scale or degree of complexity of cognitive processes - defined here as cognitive power - and by the same token, to measure the size of the world which a person can construct and live in?; and third, what is the pattern of development of the cognitive power of an individual - how does it mature and grow?

Cognitive power is of course not the only component of the competencies required in work. A person must also possess the psychological tools and outlook - the knowledge, experience, skill, temperament, character and values required by particular types of work. But cognitive power is of special importance when it comes to assessing the level of work, or responsibility, that a person might be capable of carrying in the present or at some future point.

A multi-attribute approach to the question of cognitive functioning and its assessment will be pursued. This approach is based upon an emerging theory, which I am calling Stratified Systems Theory, which uses a temporal scale to measure cognitive processes and cognitive power, and which posits that human cognitive functions are discontinuously or multi-modally rather than continuously or uni-modally distributed.

It has of course, been well established, since the work of Piaget, that intellectual or cognitive development occurs in discontinuous stages - in a series of steps. These steps have been seen, however, as occurring at particular ages, with maturation occurring along one single track.

While stratified systems theory supports this concept of discontinuity in cognitive development, it departs from the current views of this discontinuity in two crucial respects. First, the stages in cognitive development are not seen as associated with any particular ages. They are seen rather as associated with maturation to particular levels of cognitive power regardless of the age (e.g., 5, 10, 20, 50 or 70 years) at which the level of cognitive power is reached. Second, development theory tends to regard individuals as maturing in cognitive function along the same path or band, with some individuals progressing faster and further along that band than others. By contrast, Stratified Systems Theory sees each individual as maturing in level of cognitive function not along the same band but rather along one or other of a number of maturation bands; that is to say, it adopts a multiple-track rather than a single-track system. These multiple tracks range from maturation bands characterized by rather slow rates of growth towards low levels of cognitive power, to maturation bands characterized by much more rapid rates of development towards very much higher levels of cognitive power.

In order to present the findings upon which these conclusions about cognitive development are based, the paper first presents the results of research concerned with measuring the level of work achievable by individuals with given levels of cognitive capability. In contrast to most research on cognitive capability, which focuses upon children and young adults, we shall proceed in the opposite direction: we shall start with extensive work with adults of all ages, and then extrapolate back to children.

Level of work is measured in terms of time - time the maximum targeted completion time of the objectives or goals which a person is committed to achieve. The longer forward are these targeted completion times that the individual is able to achieve, the higher is that person's level of capability. This measure of level of work is called the time-span of discretion of the work; and the measure of the level of capability of individuals in terms of the maximum time-spans they can achieve is called the time frame of the individual.

It is then demonstrated, by the use of time-span measurement, that a systematic hierarchy of levels of organization emerges at particular time-spans in large-scale bureaucratic systems. There are clear-cut steps at 3-months, 1-year, 2-years, 5-years, 10-years and 20-years time-spans. These precise discontinuities are explained in terms of discontinuities in the nature of cognitive functioning. Each successively higher level of organization is seen as the expression of the emergence of a higher and qualitatively different level of abstraction which characterizes the particular quality of cognitive functioning which makes possible work at each high level.<sup>(1)</sup>

The discovery of a series of maturation bands of cognitive capability as reflected in growth of cognitive power as measured in individual time-frames is then presented. Each person's time-frame, and hence cognitive power, has been observed to continue to mature in a regular fashion from childhood throughout

life. Individuals moving along the higher fast-tracking bands may mature to time-frames of 10 and 20-years and above; individuals moving along the lower slower-tracking bands may mature to time-frames of days to months.

Evidence is given to show that discontinuous stages in cognitive development occur as individuals mature across the 1-day, 3-month, 1-year, 2-year, 5-year, 10-year and 20-year time-frame boundaries in adulthood. An hypothesis is suggested about the shorter time-frame boundaries at which equivalent steps occur in childhood.

It is suggested that there is a hierarchy of four fundamental cognitive states which underlie the discontinuities in cognitive development. These cognitive states are seen as recurring in group of four, but at increasingly complex levels of function. Individuals mature through one group of four states, then they mature to function in the next higher group of four states, but in a more complex world. These successive major jumps in groups of four cognitive states are used to construct what is referred to as a quintave theory of cognitive power and its development.

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(1) The conception of discontinuities in cognitive function was formulated by Harvey, Hunt and Schroder in 1961 in Conceptual Systems and Personality Organization. Streuffert has pursued this conception of discontinuities in cognitive complexity, as described, for example, in S. Streuffert and S.C. Streuffert, (1987) Behavior in the Complex Environment.

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Finally, it is suggested that maturation in cognitive power, as measured in time-frame, is strongly constitutionally-based. That is to say, given reasonable opportunity for encountering everyday social problems, a person's cognitive power as measured in time-frame will mature at a predictable rate, regardless of the particular content of social, educational or occupational opportunities. The development, however, of a person's psychological tools and orientation (knowledge, experience,

skills, temperament, values) will, to varying degree, be dependent upon cultural background and upon social opportunities. So, therefore, will a person's effective level of work and achievement, which are a combination of cognitive power and psychological tools and orientation, be dependent upon particular social and cultural circumstances.

The social and political implications of these conclusions are considerable. If it is possible to assess individuals' cognitive power, then it becomes possible to assess the level of work they would be capable of carrying if they had the necessary psychological tools and orientation for particular situations. Social deprivation may inhibit the acquisition of the necessary tools and orientation, and hence inhibit achievement; but fortunately it does not hold back the maturation of cognitive power. Steps have to be taken, therefore, to provide remedial opportunities for individuals to develop those psychological tools and orientation which fall short of cognitive power, if there is to be equal opportunity regardless of race, color, sex, religion, or ethnic or social background.

#### Some Definitions

Let us first establish certain concepts each with an unequivocal term with which to express it. A key concept, and the foundation of my argument, is the concept of work itself, since I shall be considering the development of cognitive competence in relation to work. I shall define work as the exercise of judgement within prescribed limits (real rules and regulations) in order to achieve a goal (objective). In short, work encompasses all goal-directed behavior, in contrast to musing, reverie, fantasy, dreaming, which are not goal-directed. Thus we may speak not only of employment work but of recreational work, housework, artistic work, learning work - indeed all purpose behavior.

Because work is goal-directed it exists in time. Any goal, if it is to exist in reality, must have a maximum time by which it is to be completed - its maximum target completion time. Without a targeted completion time - whether explicit or implicit - a goal is not a goal: it is a vague wish or desire which may be realized some time or other but towards which no work can be organized unless a target is set.

Capability is that complex of competencies which enables an individual to do work and to achieve goals. It comprises a person's cognitive power and psychological tools and orientation. Cognitive power is the mental force a person can exercise in processing and organizing information and in creating a complex world: it is measurable in what shall be termed "time-frame". Psychological tools and orientation include knowledge, experience, skill, emotional makeup, character, values, and type of approach to constructing the world.

Effective Level of Work is the maximum level of work which a person is able to carry out in a particular function under particular circumstances, depending upon his/her cognitive power and psychological tools and orientation. It is situation specific. Of these various components of a person's capability, only one will interest us on this occasion: namely, cognitive power and its development and growth. It is the purpose of the paper to unfold a rigorous boundary definition for cognitive functioning and an operational definition for the measurement of cognitive power in terms of time-frame.

To begin the process, let me locate cognitive functions in the general domain of our construction and patterning of the world in which we live. By amount of cognitive power I shall refer to the size or scale of the world which we are able to construct and pattern, and successfully to live and to work in. It is the domain which is sometimes described under the headings of intellectual activity and intellectual ability (but not

intellectual in terms of academic, or theoretical, or artistic pursuits - the currency of the "intellectual"). These functions do not refer to whatever might be rated by IQ: that rating is relevant to school performance and the learning of articulated examinable knowledge; but it is only distantly relevant to the doing of work: and, whatever it might be that IQ rates, it matures only to the age of eighteen or so, whereas - as I shall show - cognitive power matures in quality and grows in amount throughout a person's lifetime through adulthood into old age.

One last definition - discontinuity and multi-attribute theory. It is taken for granted in the natural sciences that qualitative changes of state - quantum changes - will occur at predictable points with changes in quantity;  $H_2O$  will change in state from ice to water to vapor at critical temperatures: discontinuity between very different states is assumed. This same assumption has been made in developmental psychology since Piaget with respect to the cognitive development of the child; but Piaget saw each change in state as occurring in conjunction with a particular change in age. I shall present evidence to show not only that there are different states of cognitive function - that it is a multi- rather than a single-attribute phenomenon - but that the change to each different state occurs as the individual reaches a specific and predictable amount of cognitive power (as measured in time-frame) rather than in conjunction with some particular age. This is to say, each change in state will occur as the individual matures to certain time-frames (to be described) regardless of whether those critical levels are reached at, say, 10, 20, 30, 50 or 70 years of age. In order to substantiate this view I shall have to establish a continuous time-frame scale for the measurement of amount of cognitive power so that critical change points (equivalent, say to  $0^{\circ}C$  and  $100^{\circ}C$ ) may be identified. Let us confront that task by turning first to the measurement of level of work.

### Time-Span and the Measurement of Level of Work

Because all work is associated with maximum target completion times for achieving particular goals, it is possible to measure objectively the longest targeted time-span at which an individual is working. This measure I have termed the time-span of discretion at which the person is working at the time the measurement was made.

What, then, is time-span measurement? Let me illustrate from employment systems. Simply ask manager A of a subordinate B for examples of assignments to B with long target completion times. It is the longest of these assignment that gives the time-span for the role.<sup>1</sup>

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<sup>1</sup>. The measurement or time-span has been described in detail in a number of publications, among them: Elliott Jaques, (1964) Time-Span Handbook, (1976) A General Theory of Bureaucracy, and (1982) Free Enterprise, Fair Employment.

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Let me emphasise that I am here referring to targeted completion times to which a person is committed, and not the actually achieved completion times. The targets can always be changed as assignments are proceeded with: and when they are changed, so the time-span may be changed. I will deal with achieved time-spans when considering the level of cognitive power of the individual as against the level of work in the role.

The significance of time-span measurement is that it appears to relate uniquely with the felt level of work or of responsibility at which a person is being expected to work: the longer the time-span the greater the weight of responsibility. (And, as I propose to show, the longer the time-span a person can achieve, the higher is that person's level of capability.)



One piece of evidence for this close relationship between time-span and level of work is an extraordinarily strong correlation that has been found to exist between time-span and felt-fair pay. People who are working at the same time-span, regardless of occupation and regardless of actual pay, name the same pay levels when asked, "what do you think would be a fair total compensation for the work you are being given to do?" The correlations between measured time-span in a role and a person's felt-fair pay range from .86 to .92.<sup>1</sup>

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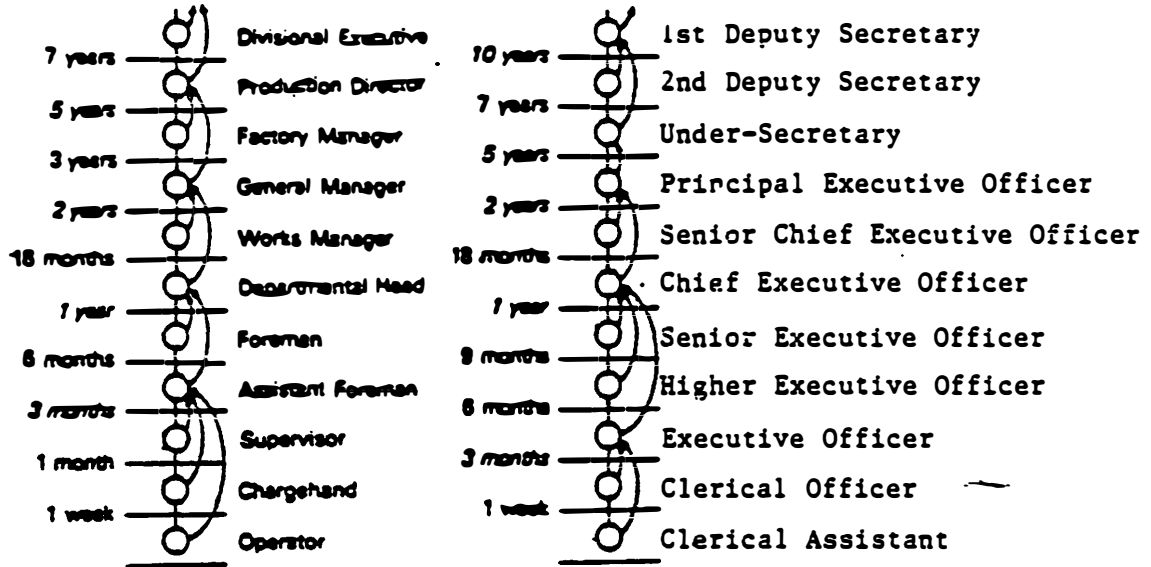
<sup>1</sup> These findings are reported in the references in the preceding footnote and in Roy Richardson, Fair Pay and Work.

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#### Stratification of Organization in Hierarchical Employment Systems

A second piece of evidence for the relationship between time-span and level of work takes us directly to our central theme. If you define a managerial role as one in which you are held accountable not only for your own performance but also for the performance of others, and in which you have the minimal authority to allow you to be really accountable in that way, the following phenomena may be observed.

In studies in over fifteen different countries it has consistently been found, as shown in the following table:



that everyone in a role below 3-month time-span feels the occupant of the first role above 3-month time-span to be his real manager; between 3-month and 1-year time-span the occupant of the first role above 1-year time-span is felt to be the real manager; between 1- and 2-year time-span, the occupant of the first role above the 2-year time-span is felt to be the real manager; between 2- and 5-year time-span, the occupant of the first role above the 5-year time-span is felt to be the real manager; between 5- and 10-year time-span, the occupant of the first role above the 10-year time-span is felt to be the real manager.

<u>Time-Span</u>	<u>Stratum</u>	<u>Industry</u>	<u>Army</u>
50 yrs			
20 yrs	Str-VII	Corporation	4-Star
10 yrs	Str-VI	Group	3-Star
5 yrs	Str-V	Subsidiary	2-Star
2 yrs	Str-IV	General Mgt	Brigade
1 yr	Str-III	Unit	Battalion
3 mo	Str-II	Section	Company
	Str-I	Shop Floor	Troops

This regularity - and it has so far appeared constantly in over 100 studies - points to the existence of a structure underlying bureaucratic organization, a sub-structure or a structure in depth, composed of managerial strata with consistent boundaries measured in time-span as illustrated, and inherently recognizable by employees within these strata.

The gravamen of these findings is that there are precisely definable critical points, specifiable in terms of time-span, at which discontinuities or quantum changes in the state of work organization occur. It is these discontinuities which can take us directly to the identification of discontinuities in cognitive state, and to a further understanding of the nature of cognitive functioning and of its development.

#### Time-Frame and Cognitive Power

Why should it be that as we move to greater felt weight of responsibility, and to higher and higher levels in executive systems, time-span increases? And why should it be that there is a regular series of steps in organization level at particular time-span levels? The only hypothesis I have been able to construct that seems to make some sense of the findings is that the maximum time-span at which a person is capable of working - that person's maximum achieved time-span - gives a measure of the person's level of cognitive power. It is this measure that I am calling the person's time-frame.

It has become apparent that there are very different cognitive states associated with each of the bands of time-frame which fall within the different organizational strata: that is to say, the strata with time-frame bands running from 1-day to 3-months, 3-months to 1-year, etc. The following patterns of cognitive function emerge, which I now believe explain the occurrence of the underlying structure of organization levels.

Stratum-I: (Concrete Shaping): Time-Frames 1-Day to 3-Months: Work within this stratum takes place in relation to goals set in concretely specified terms: it may be called concrete shaping of things. Tasks are carried out one at a time. The work is characterized by direct shaping of material things. As Stamp puts it, the person is anchored within concrete rules which are seen as inflexible. <sup>(1)</sup> We are here dealing with the kind of work carried

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1. G. Stamp, (1981), 'Levels and Types of Managerial Capability'.

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out by shop-floor manual workers and office-floor clerical staff. They operate by losing themselves in the activity. Improvement occurs with accumulated practice and experience. These experiences may be articulated as new ways of going about things as you do them. But these articulated experiences cannot themselves be detached and related to one another away from the concrete work setting. Development and improvement require the direct interaction between thought and concrete on-going experience.

Stratum-II: (Reflective Articulation): Time-frames 3-Months to 1-Year: Work within this stratum starts out with the ability to reflect upon our own work as we carry it out, and the ability to articulate what is going on. But then, in addition, we can collect these articulated experiences, so as to accumulate knowledge about aggregates of tasks. It thus becomes possible to work with these ideas in themselves, away from the actual work situation, and to develop and formulate new ideas and methods for overcoming problems and improving one's work.

As a result, individuals who are able to work in Str-II are able to deal with goal-ambiguity; for as they deal with an ambiguous goal they can work upon the further clarification of the goal by detached reflection, while at the same time working towards it.

Thus Stamp has described the phenomenon of a person using judgment and action within rules in such a way as to be able to handle ambiguity by separating situations one from another and articulating the differences. It is this facility for reflective articulation that makes it possible for the first-line manager who functions at this stratum to delegate to subordinates new ways of solving problems.

The scale of organization is that of the mutual-knowledge group. The circumstances must allow the manager to sustain direct contact with his immediate subordinates, and they with him, in order for him to accumulate the necessary build-up of experience of their problems to be able to exercise his ability in reflective articulation.

Or to take a non-manager, a social worker doing a family case work-up will have certain things in mind in talking with members of the family, but at the same time will reflectively determine what further kinds of information and interpretation are needed. This work would be very different, for example, from that carried out by a social work aide, operating at Str-I, sent out to see a family, with a specified set of questions to which the answers must be obtained.

Stratum-III: (Linear Extrapolation): Time-Fram 1-Year to 2-Years: Here the observed circumstance is that of an individual faced by two things at the same time: first, by a known work-load stretching, say, 3 to 6 months forward; and second, by the problem of preparing for an as yet unknown but probable work-load for up to an additional year, a probable load which has to be predicted. The person must therefore make trade-offs in planning and in work between the requirements of carrying out the known work-load and preparing for changes in the nature of the work-load which he must predict over the course of the following 12 to 18 months, extrapolating from current trends. Stamp describes it as work which calls for the ability to extrapolate from given rules.

This stratum is that of the departmental or unit manager, with a staff of up to 200 or 300 people. The scale is that of the mutual-recognition group; that is to say, everyone in the unit can recognize everyone else as working in the same place: it is the largest scale of institution without anonymity. In military terms it is the level of the Army battalion of 600 or the Navy destroyer of 400, the larger numbers being possible because mutual recognition can be sustained through the 168-hours-a-week working and living contact among the members of the unit.

For individual specialists in non-managerial positions at this level, such as for example scientists or independent professionals, the cognitive mode of operation is the same as for the unit managers. Independent professionals - lawyers, say, or physiotherapists - at this level are not only able to handle a case load extending over some months, as for the Str-II case-worker, but are also capable of developing their practices in the sense of extending their network of clients for a year or more beyond their present load.

Or to take the scientists at this level, they are able to carry out research tasks specified for them for periods of some months (as would be required for a level-2 scientist.) But they are able to do more. They can follow the trends in the research literature, and work out a sequence for studies for a year or more forward which follow from those trends. They can envisage new studies by extrapolation from the trend.

Because the individual's work extends from a solid known work-base to an emerging load, the probable load can be planned for and coped with by linear (or serial) extrapolation. The capability to work by linear extrapolation is the sine qua non of the cognitive state of individuals who are able to work in the 1-year to 2-year zone.

Stratum-IV: (Alternative Systems): Time-Frames 2-Years to 5-Years: The complexity of cognitive work jumps one full step from the fine-tuning of a given linear extrapolative system, to the consideration of whether there are known alternative linear systems which might get the work done better. This level requires the ability to compare known systems with one another, usually comparing them one with another in pairs. It does not call for the development of as yet unknown systems. As Stamp describes, there is the maintenance of a pattern rule structure within which hypotheses are explicitly stated and tested. Let me illustrate.

The general manager of a particular factory had to keep continually under review whether to sustain his existing foundry, rough-machine shop, and finish machining shop by replacing worn-out tools and equipment, or whether he should take the opportunity to restructure or transform any or all of those shops into a different kind of producing entity based upon paired comparison with other existing systems which he had studied and know about.

Or a research professor will unfold alternatives sets of hypotheses, conclusions or consequences from a given theoretical context within which he works, but without disturbing the theory, or indeed while striving to conserve it, for he may become anxious at the prospect of losing the support of the theory he understands.

Or an army brigade commander will need to be capable of modifying his battalion task forces in action to meet a new or unexpected situation, while expecting his task force commanders to operate their battalions as effectively as possible in their original form and then in their new form.

Competence in the development of alternative systems by means of paired comparison of known systems, then, is the substance of the quality of cognitive functioning at Str-IV in the 2-year to 5-year time-frame.

Stratum-V: (Shaping Whole Systems): Time-Frames 5- to 10-Years:  
At the fifth level a key boundary zone is reached - it is the zone which is at the upper limit of human capability to function by predicting or forecasting what the future might hold and how it should be planned for. Above this stratum there must be a transformation to constructing the future rather than forecasting it.

At Str-V there is a return to the hands-on shaping that characterized Str-I, but the entities being shaped are now complex social institutions or general theories shaped from inside, rather than material things. The individual can not only operate a complex system, but can modify the boundaries of that system and can cope with the 2nd- and 3rd-order consequences which inevitably arise. In Stamp's terms, things are explicitly seen as interdependent - to change one part is to change the whole; individuals begin to define situations for themselves and make the necessary rules.

An example would be the Chief Executive Officer of a subsidiary of a large corporation, whose role it is to shape and reshape from within the business he controls. He may push out its boundaries in one place into, say, new market opportunities or by developments of its product range; but he will then have to make the necessary consequential adjustments, by, say, pulling in its market boundaries elsewhere, or modifying certain production resources.

The same shaping-from-within approach will inform scientific research in this zone of cognitive competence. Theories are not held to be sacrosanct, but rather as contexts to be used for giving form or shape to the development of studies. These contexts may themselves be reshaped and modified in the light of experience and research results.

It is striking that human activity gets organized in such a



manner, that the largest of projects fall within the 5- to 10-year limits, usually around 6 to 7 years; to take but a few examples, the building of dams or battleships or power stations. If specific projects with budgetable outcomes are established with target completion times beyond 10 years, they turn out to be difficult to control: they tend to be broken down and planned in phases of less than 10 years - as, for example, in the building of cathedrals. Thus, the construction of nuclear power stations has become extremely difficult to control because although it is physically possible to build them in 5 to 7 years it is no longer possible to do so in under 12 to 15 years because of the complexity of the regulatory requirements.

Stratum-VI: (Reflective Articulation Between Whole Systems and the Wide World): The move in work across the 10-year boundary is accompanied by a dramatic change. You move from working inside complex institutions or general theories, which themselves exist in a whole-world environment, to working out in that environment and overseeing and changing institutions or theories from the outside. This world is no longer one in which the 'future' is merely to be forecast by predicting likely trends in events and in the behavior of other people. It is now becoming a world which might be fashioned and modified, despite what is going on, because the resources and the individual capabilities necessary for doing so have come into the situation.

The work requirement is again that of the reflective articulation which characterized Str-II. But the situation now requires the operation of reflectively articulating the relationship between complex unified institutions and the fibrillating infinity of political, economic, social, technological and intellectual, restlessly-changing variables within which they exist and function. The acronym PESTI might be used.

This living and working in the world-wide environment calls for an ability to impose upon one's world a cognitive ordering within

which what is deemed most relevant can be sorted out from the rest, priorities kept in a continual state of good repair, and as friendly an environment as possible sustained. Competence in networking with key individuals in many fields in one's own and other countries is an essential quality of capability at this level.

For example, a Strategic Business Unit Executive Vice-President of a large corporation oversees 14 subsidiary trading Business Units each directed by a BU VP. Each Business Unit is a Str-V whole-system unified command. The role of the EVP is to network within the PESTI world, to screen his BU VPs from the continual shifting of the PESTI world, to hold off the irrelevant and to let through the important, to sustain a living context for his BU CECs, and to take an active part in the modification and development of corporate strategy.

To operate at this level of reflective articulation calls for what is often referred to as a "conceptual approach". The particular meaning associated with that phrase at this level is expressed in the idea that in the over-10-year term you will find that you do not have all the pieces necessary for the complete putting together of a project or an acquisition. How to get or to negotiate the missing pieces is known (that is to say, the basic analysis, or R&D, or investigation has been done) but there is still work to be done on how to put the pieces together, how to form or pattern the pieces, so as to get a solution. The combinatorial conception has yet to be found and articulated. As, for example, in carrying responsibility for getting and putting into operation a new fleet of aircraft for 1997, when negotiations with governmental authorities over regulations have not been completed and therefore detailed specifications cannot be established.

Stratum-VII: (Linear Extrapolative Development of Whole Systems):  
Time-Frame 20-years-plus: Here we move into the full corporate

arena. It is the level concerned with managing a system which can carry out the development, formation and construction of complex Str-V institutions; or with the transformation of existing institutions; or with the divestment of such institutions. The scientific equivalent would be the construction of theories as a specific objective in its own right.

The work of Str-VII, therefore, is the work of constructing institutions and theories, and of placing those institutions and theories into society at large. The mode is extrapolative, as in level-3. But it is highly discretionary extrapolation, in that it is concerned at this level with constructing the future rather than extrapolative forecasting. You work with a number of existing institutions (say BUs) or theories. But the art is to understand which new ones might be needed to develop and oversee the extension from the present so as to fill the gaps, and to provide society with new concepts, new research and development programs, and new ideas. Thus an over-arching vision is set out which provides a 20- to 25-year working orientation within which subordinates or next-level-down scientific colleagues can work.

It might appear that these very long time-frames would introduce great feelings of uncertainty into people who work at those levels. The opposite is the case. At Str-VII and above, we are dealing with the people who are literally engaged in constructing the future within which we will live. They are putting in train now, those things and ideas which will become part of the world 20 years forward and beyond. Far from feeling uncertainty about the world, they feel a sense of familiarity with what they are creating.

#### A Quintave Theory of Cognitive Development

So much, then, for the qualitative changes in the nature of the work at each stratum. It may have become apparent that in describing the work I have at the same time described the nature

of the cognitive capability that goes with that work. Thus, for example, the work with linear probabilistic systems at Str-III (1-year to 2-year time-span bracket) is matched by the linear extrapolative organization of the cognitive approach of individuals in the 1-year to 2-year time-frame zone; it expresses the qualitative form of cognitive complexity of mental activity within that range of time-frames.

There are two phenomena embedded in the foregoing descriptions which I shall now extract and examine. The first phenomenon is a hierarchy of four cognitive states (shaping, reflective articulation, linear extrapolation, alternative systems), each state characterizing the work of a particular work-stratum (for example, Str-IV: alternative systems, 2- to 5-year time-span). The second phenomenon is that each of these four different cognitive states may reappear in a higher stratum in a more complex or higher-level setting.

These two features are illustrated in the following table:

	50Y	
Str-VII	<u>LINEAR EXTRAPOLATIVE</u>	DEVELOPMENT OF WHOLE SYSTEMS
	20Y	
Str-VI	<u>REFLECTIVE ARTICULATION</u>	OF WHOLE SYSTEMS IN WORLD ENVIRONMENT
	10Y	
Str-V	<u>SHAPING</u>	OF WHOLE SYSTEMS FROM WITHIN
	5Y	
Str-IV	<u>ALTERNATIVE</u>	CONCRETE SYSTEMS
	2Y	
Str-III	<u>LINEAR EXTRAPOLATION</u>	IN CONCRETE SYSTEMS
	1Y	
Str-II	<u>REFLECTIVE ARTICULATION</u>	ABOUT CONCRETE PROCESSES
	3M	
Str-I	<u>SHAPING</u>	CONCRETE THINGS
	1D	

The scheme can be further extended from data obtained by work on the assessment of mental handicap <sup>(1)</sup>, carried out by MacDonalld and Couchman.

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<sup>1</sup> This work has been carried out by Ian MacDonald and Terry Couchman and has been reported in: Ian MacDonald, (1978) "Five Levels of Mental Hanicap".

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They found that mentally handicapped individuals manifest cognitive approaches to work which are strikingly similar to the above cognitive modes, but in relation to a much more limited and concrete world and requiring the continual assistance of an aide. Thus, in their schema the level-1 cognitive state is one in which the individual will sit and rock and do nothing unless prompted by an aide. The prompting requires to be carried out with respect both to setting goals and to deciding how to achieve them. For example, if the individual is hungry he will not be sure what to do about it. But if an aide should suggest a sandwich and show how to get it, he will, with help, be able to feed himself. Given both a goal and a path, he will be able to shape an action.

At level-2 the individual will be able to reflect and to form a path if he is aided to construct a goal. Thus, if the aide suggests a sandwich, the individual will himself be able to reach for it without having to be shown how to do it.

At level-3 the individual will be able to choose both a goal and a path to it, but one committed to his goal and path he is on a rigid and inflexible linear action from which he cannot be shifted, slowed or stopped: he cannot entertain any alternatives. This level is that of the handicapped who are prone to temper outbursts if attempts are made to dissuade them from doing what they have determined to do.

At level-4 a more flexible pattern of behavior emerges. The possibility exists that there might be alternatives to a desired

or chosen course of action. As a result the individual who can function at this level is more flexible, more malleable, and more socialable. He can understand that other people may have alternative points of view or desires.

At level-5 we find the individuals who are able to function at the concrete shaping level as unskilled or semi-skilled operators or clerks. They in fact are capable of living on their own. If they are considered mentally handicapped it will be because they were put in that stream in early childhood and have been rendered dependent by institutional care. They can, without much difficulty, be aided to assume an independent role in life.

We have, then an apparent recurrence of our four modes of cognitive functioning (shaping, reflective articulation, linear behavior, and alternative possibilities). But they occur in a more restricted form in which individuals are depending upon aids in order to be able to function at all and the world in which they operate is made up of very concrete items completely bounded within the physically present situation.

If we put these findings and hypotheses together, we get the following pattern. The fifth level of the mental handicap overlaps and coincides with the first level of cognitive function (Str-I) in ordinary work systems. Then when we move up to Str-V we find that it is both the top of the five strata making up the organization levels of whole systems, and at the same time at the bottom or the beginning of a yet higher series of shaping, reflective articulation, and linear programming of the corporate or general-theory construction levels of organization.

This pattern is very much like the octave of the western musical scale. An octave is in fact a 7-note scale and not an 8-note scale; for example, in the scale of C-major the first note, C, reappears as the eighth, and that same eighth note C is then the first note of the next higher octave (see Diagram 1). The note C

is always both the first note (1) and the eighth (8) in the scale.

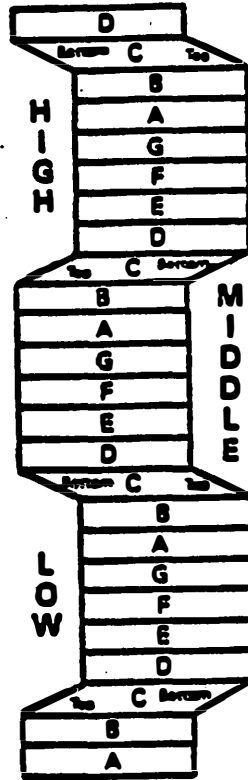


Diagram 1: Scale of C Major

That is to say, the first note in the octave is a dual: it is both the bottom of the scale and the top of the scale below.

Using this analogue we derive a quintave pattern of cognitive states with the four states recurring in groups of five but operating in increasingly complex worlds. The first cognitive state - that of shaping - acts as the dual bottom and top of each quintave, as shown in Diagram 2.

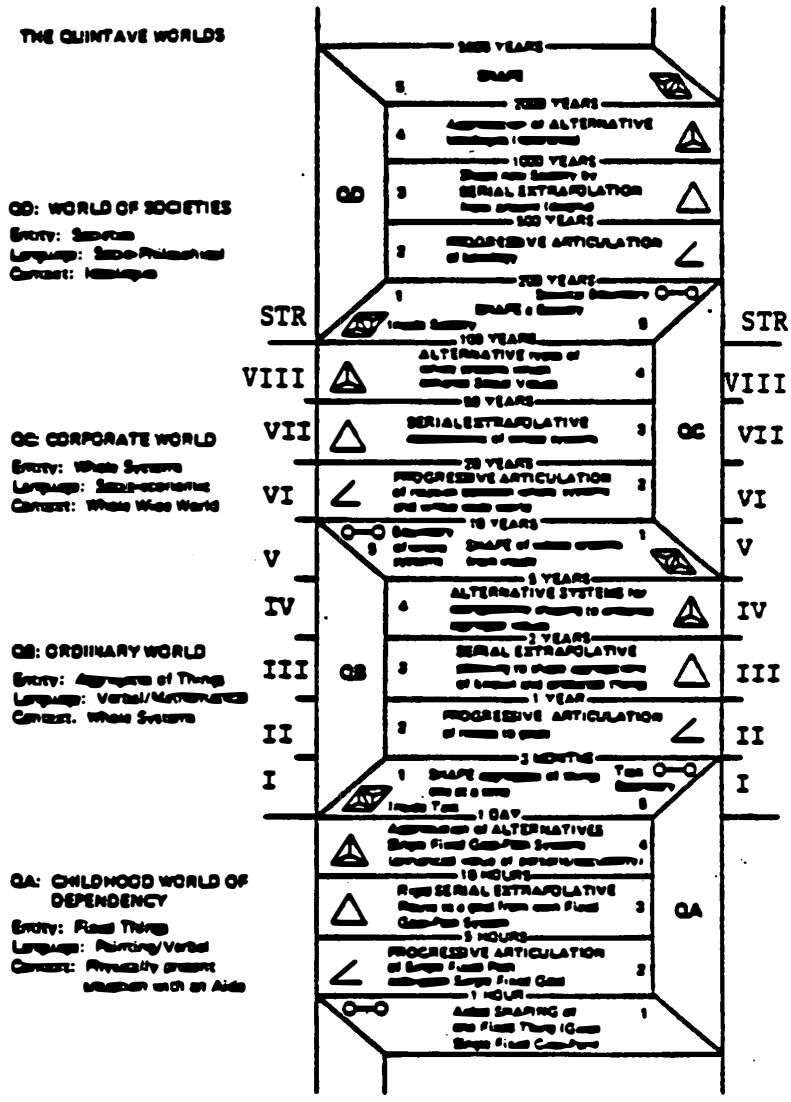


Diagram 2: The cognitive Quintaves

But what, then, might occur below QA-1 and above QC-3? I would think there would be no possibility of an individual remaining alive at levels below QA-1. The newborn would hardly survive through infancy.

At the other end of the scale, however, above QC-3, there is plenty of room for growth. QC-4 would be the level of cognitive function for Str-VIII in a corporate organization. There are some few super-corporations which have been built up and led by recognized outstanding individuals, such as, for example, Vail of



AT&T, Sloan of General Motors, and Matsushita of Matsushita Electric. An interesting thing about such individuals is that they are not only capable of developing alternative systems for the establishment of large corporations, but they are almost uniformly both concerned about and interested in the relation between their corporations and the society in which they live - their mutual interaction and impact.

This concern about societies gives a possible clue to the nature of Quintave D. If we refer back to QB-4 (alternative systems of production) we will see that it looks upwards towards the Str-V work of QB-5 in that it is concerned with volume of output and its cost, and therefore is involved in notional profitability which becomes actual profitability at Str-V. By the same token, if Str-VIII (QC-4) is looking up to Str-IX (QC-5/QD-1) in its social orientation, then QD-1 might be concerned with the shaping of societies.

This last conclusion in fact leads to speculation on a possible hypothesis about Quintave D. I think we are encountering at these levels those few rare individuals who actually create societies: the QD-1 individual is capable of shaping societies; QD-2 is capable not only of shaping a society but of reflectively articulating how a society is shaped and what kind of society he is trying to shape; QD-3 is a linear societal-system creator, but sees no alternatives - he is the creator of dogma - far-reaching in social impact but dogma nevertheless; QD-4 is able to value and to teach toleration, and to value systems and dogma which might be alternatives to his own creation. I leave it to the reader to try to fit individuals into these categories, and to speculate on the nature of a possible Quintave E.

#### Some General Features of Cognitive Complexity

In summary, then, I have outlined an hypothesis about the existence of four cognitive modes of functioning - shaping of

entities, reflective articulation of aggregates of entities, linear extrapolation from known to probable entities, and paired comparison of alternative systems of entities - and about the hierarchical grouping of those cognitive modes into an ascending series of quintaves, each quintave beginning and ending in the shaping mode.

There are thus two stepwise movements in the extension of cognitive complexity:

First, each step in cognitive mode represents a qualitative step in extension of cognitive complexity, in that there is a jump in both the number and the range of entities which can be handled by being encompassed within the context of successively more extensive categories; i.e., in the move from entry to aggregates of entities, to linear series of probable entities, to alternative systems of entities.

And Second, there is a stepwise movement in quintaves of entities, each quintave representing the movement into successively more complex and more extended worlds; i.e., from the dependent world of children, of closed categories of concrete things; to the ordinary world of open categories of things and people; to the world where people and things exist as patterns of complex systems and general theories; to the world that is constructed in the form of whole societies as entity with everything else as sub-sets within societies.

The shaping mode occurs as a dual: It operates in part in the world of the quintave of which it is the top mode; and at the same time it picks up the quality of the world of the quintave of which it is the bottom mode. This duality helps to explain a number of commonly occurring phenomena; as in the following examples.

People at the lower levels of mode QA-5/QB-1 (i.e., shaping at the top of Quintave A and at the bottom of Quintave B) may be rated

either as high-grade mentally handicapped or as unskilled workers, depending on whether they happen to have grown up and been socialized in special schools and mental handicap homes - and hence to have been reinforced in dependence on others and in the QA-5 outlook - or whether they grew up in their own homes with other children of their own level or higher levels of capability and had opportunities for developing their maximum independence in the QB-1 mode. By the same token, those individuals who are functioning at levels of abstraction at the lower half of the QA-5/QB-1 mode may require an organization at work in which their first-line manager is assisted by supervisory assistants who can be continuously present at the workplace to keep an eye on things and to be immediately available to give them help when needed.

Another example is the one cited earlier in this paper (p.15); namely, that VPs of Stratum-V subsidiary Business Units in large corporations are operating in the dual mode QB-5/QC-1. The common experience is that of reoccurring reorganizations which shift from so-called centralization, in which the VP is constrained within narrow limiting policies from above which are too constricting for him to be able to work effectively, to decentralization, in which he is suddenly given such great freedom as to be able to act against the interests of the corporation. The solution to this damaging oscillation is to recognize the duality of the QB-5/QC-1 cognitive state; first, the VP is accountable for shaping his unified system; while second, and simultaneously, he is accountable for upward inputs into the corporate strategic policy within which he must work. When the dual nature of the Str-V QB-5/QC-1 role is understood, the concepts of centralization and decentralization can be recognized as a false dichotomy and the need for such a dichotomy disappears.

Another example is what may occur at QC-4 and the movement towards QC-5/QD-1. The QC-4 mode operates at Str-VIII which is the very top of the very large corporations. The chairmen and CEOs at this level are generally well-known in their own countries and are

often known throughout the world. They build up the large corporations with which we are all familiar and then stop, although it would be my hypothesis that collegial groups of such individuals could, if they so wished, construct massively larger corporations. What they do instead, however, is to express their potential capability in the development of the relationship between their corporations and the society around them. They have a profound impact upon their societies - for better or for worse. On the one hand, they may strive to develop international cartels, with their impact upon international political relationships. Or at the other extreme, they may, like Matsushita for example, strive to orient their corporations towards "the peace, health and prosperity" of their own nation and of the world. Either way, there is a foretaste of the Quintave D orientation of which such individuals are inevitably potentially capable - an orientation which drives them towards an interest in shaping societies themselves, and pulls them away from what they feel as the boredom of occupying themselves solely with the mere construction of ever-larger institutions within societies. It is likely that it is because this interest in the shaping of society itself becomes dominant at QC-5/QD-1, that Str-IX enterprises do not emerge.

Maturation of Cognitive Power: The Growth of Time-Frame in Individuals

Let me now turn to the question of how cognitive power matures and develops in people.

In order that there shall be no confusion, let me recall my context. Cognitive power is but one component of the attributes which form a person's ability to work. The other attributes include knowledge, experience, skill, temperament, character and values, and type or quality of articulation. I am concerned in this article only with cognitive functioning. It is not that cognitive equipment (knowledge, experience and skill) is not important: but how such equipment is acquired is very different

from the regular patterns of maturation of cognitive functioning. And the question of how temperament and values change with time is yet another question - and one which will also be left aside at this time. Let me turn, then, to the question of the development of cognitive functioning in its own right.

It is a self-evident fact that human beings are not born fully matured in cognitive power. How then does the process of maturation occur? The theory of discontinuity of cognitive state and of quaternaries suggests that there are a number of different questions here which need to be teased out from one another.

One question is whether people who eventually mature, say, to be able to operate in mode QC-2 at Stratum-VI show signs of not-yet matured QC-2 potential earlier in life. If they do, when do signs of QC-2 potential first show? some time in childhood? in early adulthood? throughout life? at different times in different individuals? at the same time in all potential QC-2 individuals?

Another question is whether an individual's potential to function at a particular cognitive level or in a particular cognitive mode is inborn - constitutionally given - or whether the potential per se can be modified by education, or occupational opportunity, or social opportunity. And if it can be modified, then by how much? Is everyone capable of developing to any cognitive level? or is there a constitutional base which sets the maximum limit of growth and development? These questions are of course among the politically-loaded issues of developmental theory, and need to be addressed with great care. In order to proceed systematically, let me develop further the concept of the time-frame of the individual.

Any particular point in people's careers there is a maximum time-span at which any given person can work. If people are employed at levels of work below that maximum time-span they feel

their capabilities are being under-utilized. And they experience boredom and frustration. If people are employed at levels of work above that maximum time-span, they become disorganized and anxious and are unable to cope. If people are fortunate enough to be employed at levels of work that coincide with the maximum time-spans which they are capable of achieving, then they feel comfortably employed, and so long as their work is of interest and they have the appropriate knowledge, skill and temperament, they will derive satisfaction from that work.<sup>1</sup>

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<sup>1</sup> There is very substantial evidence for these views, set out in Elliott Jaques, (1976) A General Theory of Bureaucracy (op cit), and (1968) Progression Handbook, and John Evans, (1979) The Management of Human Capacity.

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It is this maximum time-span at which a person is able to work at a given point in time that I referred to above as that person's time-frame. This time-frame gives a measure of the extent of a person's temporal horizon at that time. (1) The Temporal horizon

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<sup>1</sup> Elliott Jaques, (1982) The Form of Time.

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sets the limits of the world of purpose and intention within which people live and construct patterns and organize their active lives and aspirations. In connection with the foregoing questions about intellectual development, let me present some evidence of regular and predictable tracks of growth and maturation of time-frame.

The curves shown in the accompanying Diagram 3 set out my hypothesis about the rate of maturation of time-frame.

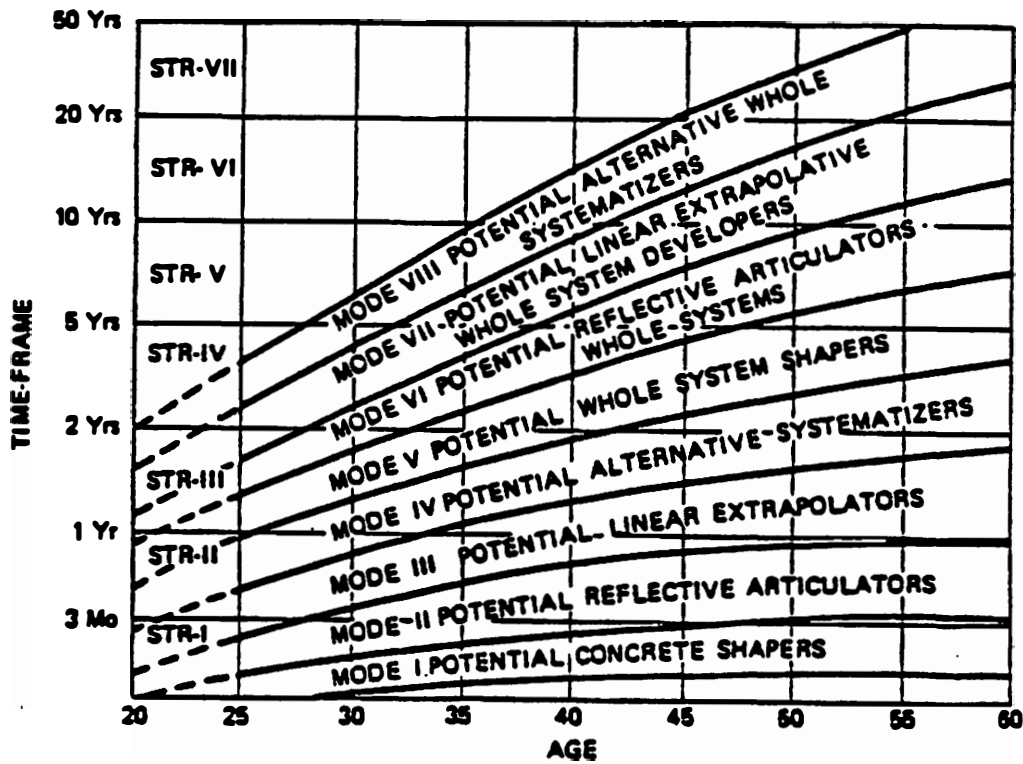


Diagram 3: Cognitive Power Maturation Curves

The hypothesis set out in these curves expresses the rates of maturation and growth of the cognitive power of individuals. This hypothesis was originally derived from a regularity noted in the real earning progressions of individuals (that is to say their earnings corrected to a common base for movements in the earnings index) in over a dozen different countries. There is an underlying trend in these progressions which is expressed in the array of curves shown here. <sup>2</sup>

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<sup>2</sup> Elliott Jaques, (1901), Equitable Payment, and Time-Span Handbook (op cit).

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My hypothesis was that the regularity in the trend of the earnings progressions reflected a regular trend in the growth of level of cognitive function in the individuals in the samples; or as I would now express it, the growth in earnings reflected a drive in the

individuals towards achieving a growth in level of work, and this drive in turn was the expression of their growth in time-frame.

That there is in fact a growth in time-frame that corresponds to these curves has been demonstrated in a number of studies described in the references cited above. One key study has been the tracking of the career of almost 200 individuals whom I have had the opportunity to follow for periods of between 18 and 25 years. At various times during those periods I was able to obtain: measures of the time-spans at which they were working; their actual pay and their felt-fair pay; their sense of the degree of comfort of fit between their level of capability and their level of work; and, if there was a felt mis-match, then we were able to get measures of the level of work in positions which they felt would be just right for them.

These data have been analyzed by Dr. Tom Kohler of UCLA. He has found a strong regularity in the "comfort curves", as he has called them, of individuals. These comfort curves conform very tightly to the progression curves of my hypothesis - some 95 per cent of the actual curves staying within the bands designated Mode I, II, etc. on my chart. The general trend of these comfort curves is shown in Diagram 4 and Kohler is now publishing the results of his study.

Let us examine these curves more closely, starting with the significance of the Mode-I, Mode-II, etc., bands just mentioned. It may be noted that there are lines running horizontally across the charts a 1-day, 3-month, 1-year, 2-years, 5-years, 10-years and 20-years time-span. These horizontals set out the boundaries of Str-I, II, III, IV, V, VI and VII. The bands have been picked out in such a way that each one encompasses all the time-frame maturation curves which reach the relevant stratum at full maturity. Thus the band designated Mode-III encompasses all the maturation curves which eventually reach Str-III.



In the case of the higher modes (V, VI, VII, VIII) it will be noted that they do not reach full maturity by the maximum age of 55 years allowed for on the chart in Diagram 4. The data suggest that people of these very high potential levels of capability do not reach full maturity in cognitive level by normal retirement age. And indeed, at the very highest levels it would appear that individuals are afflicted by senile deterioration and death before their potential cognitive power can reach full maturity - an hypothesis that is supported by the careers of many of the very greatest composers, artists, judges, politicians, and outstanding leaders in other fields.

These hypotheses are, of course, inconsistent with the findings from IQ ratings which suggest full maturation by the age of 18 of whatever it is that IQ rates. The fact that IQ matures fully at such an early age emphasizes the gross limitations of rating as far as giving any indication of cognitive development is concerned. <sup>1</sup>

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<sup>1</sup> It has been put to me that the time-frame maturation curves represent "merely" an increase in experience beyond the age of 18. That that assumption cannot be valid is shown by the fact that the time-frame curves mature in a regular and predictable fashion. This regularity cannot be explained by experience alone, although experience is certainly one necessary condition for the maturation of time-frame. Fortunately, ordinary everyday life confronts the individual with a panoply of social, economic, familial, political, and intellectual problems which provide more than enough opportunity for full maturational development of cognitive power to occur.

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### A Multiple-Track Theory of Development

It may now be apparent that we have constructed a third group of discontinuities. The first is a discontinuous hierarchy of levels in the structure of organizations. The second comprises discontinuities in the nature of cognitive capability in individuals, reflected in a discontinuous hierarchy of four cognitive states grouped in an encompassing hierarchy of quintaves.

And the third is a discontinuous series of developmental bands within which the maturation of individual cognitive power as measured by time-frame will occur.

The consequence of this third hypothesis about discontinuities in maturation bands is of some interest. It reveals the fact that most developmental theory has been wedded to the notion that everyone matures along the same track, but some people mature further along that track than do others. I would now substitute a multi-track theory in which individuals are conceived of as maturing along any one of several possible maturation bands. It is an though we were to move from single-track railway system to a multiple-track railway system: a number of new explanatory principles become available. Let me explore some of them.

There are two very general implications of this construction. They are: that each person will mature in level of cognitive power as measured by time-frame, within one particular maturation band; and that is so doing each person will cross a number of work-strata, each stratum being characterized by a particular cognitive state. The greater the cognitive power of the individual, the greater the number of strata to be crossed. There are complexities here which need to be carefully teased out and examined.

Let me take a specific example. Say on Diagram 3, individual A has matured to a time-frame of 3 years at the age of 31. There are two points to note: first, he will be capable of working in Stratum-IV at that age; and second, he is maturing in the Mode-VII cognitive band and will have the potential to reach Stratum-VII by somewhere between the ages of 60 and 65. It may be noted that Str-IV implies work in cognitive mode QB-4, and Str-VII implies work in cognitive mode QC-3.

We now encounter a prime question inherent in the theory of stratified systems which I am following. The question is: how

does an individual of high-level potential function at lower levels while is is maturing? For example, what would be the cognitive state of A at age 31: Mode QB-4 - alternative systems, or Mode QC-3 - linear programming? And, how would A compare in cognitive state with, say, B, who is 55 years of age and also at 3-years time-frame and who, according to our theory, would be both operating at QB-4 and fully matured in QB-4 so that there would be no inconsistency between his current cognitive state and his potential cognitive mode?

The answer to this question is an interesting one, and has been worked out in field studies carried out over the past ten years by Dr. Gillian Stamp. Building upon work done by John Isaac, Brian O'Connor and Roland Gibson,<sup>1</sup> she has developed an instrument for

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<sup>1</sup> D.J. Issac and B.M. O'Connor, (1978), A Discontinuity Theory of Psychological Development; and R.O. Gibson and D.J. Issac, (1978) Truth Tables as a Formal Device in the Analysis of Human Action.

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the assessment of cognitive power both current and potential.<sup>1</sup>

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<sup>1</sup> Gillian Stamp, (1978) Assessment of Individual Capacity.

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This instrument, which she has named Career Path Appreciation (CPA), comprises a card-sorting procedure based upon the Bruner cards,<sup>2</sup> a choice of phrase cards describing various preferred ways of working, and a brief interview to ascertain the time-span work in which the individual currently feels comfortable.

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<sup>2</sup> J. Bruner, Olver and Greenfield: (1966) Studies in Cognitive Growth.

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With this procedure, which takes about an hour to administer, Stamp has been able to ascertain both the individual's current time-frame and the dynamic strategies he uses in approaching

problem-solving. She is able to place individuals at low, middle, or high in a particular stratum, and by the same token to place them in a particular cognitive maturation band.

Thus, for A and B above, she would be able to place A in mid-Str-IV and maturation band VII, and B in mid-Str-IV and maturation band IV. Her studies show that both A and B would be currently operating in cognitive mode QB-4, but with a difference. B's performance would consistently show a QB-4 alternative systems approach set firmly in quintave B; and with little if any comprehension of how to go about working at any higher level: his temporal horizon would end abruptly at about 3-4 years. A's performance by contrast, would be expressed in a QB-4 strategic approach, but it would contain signs of QB-5 and higher, on the phrase cards, of comprehension of QC modes of working; and most striking of all, would have already taken for granted that people might be engaged in constructing worlds 10, 20 and 25 years ahead even though accurate forecasting could not produce such temporal horizons.

In short, the conclusion that Stamp arrived at is that individuals will express their currently matured time-frame in their work, but at the same time will show clear evidence of comprehension of their potential cognitive mode and temporal horizon. I have had extensive experience of this two-dimensional phenomenon. The temporal horizons of men and women in the younger age groups, for example, are of particular interest. The high-potential group readily understand the world in long time horizons, even though they are not yet mature enough to work at that scale of temporal extension. By contrast, the lower-potential individuals simply do not see the more extensive context. It is as though a four-foot tall person, one ten feet tall, and one forty feet tall, were standing side by side at the seaside on a clear day: their perceptions of the distance to the horizon would be markedly different! And each would feel confident that he was seeing the 'real' horizon.

Development of Cognitive Complexity in Childhood

How then does cognitive functioning as here defined develop in childhood? We are just getting studies of this question under way, within the following hypotheses.

I have re-plotted the time-frame progression array set out in Diagram 3 on to a double logarithmic scale so as to make it possible to do a crude extrapolation of these curves back to earliest infancy. On the assumption that the progressions would be in line with the sigmoid curves characteristic of biological development, I drew the extrapolated curves as shown in the accompanying Diagram 5. It will be noted that the higher the cognitive mode the later in life does a person's cognitive power continue to mature and increase.

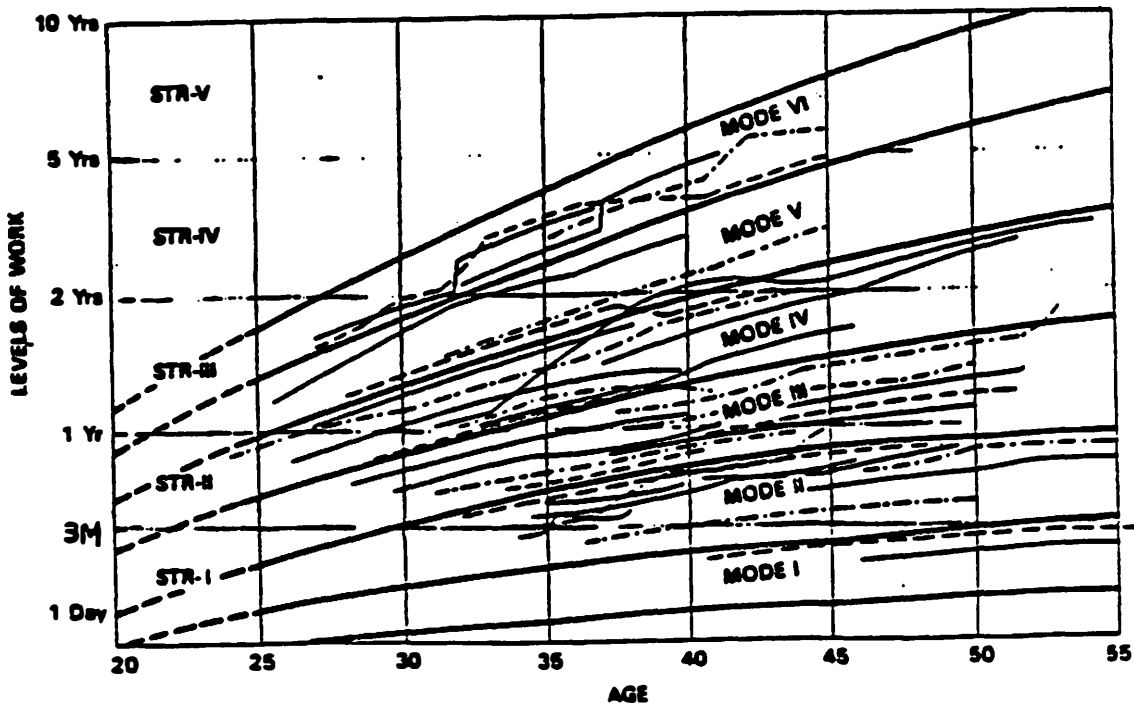


Diagram 4: Levels of Work Curves

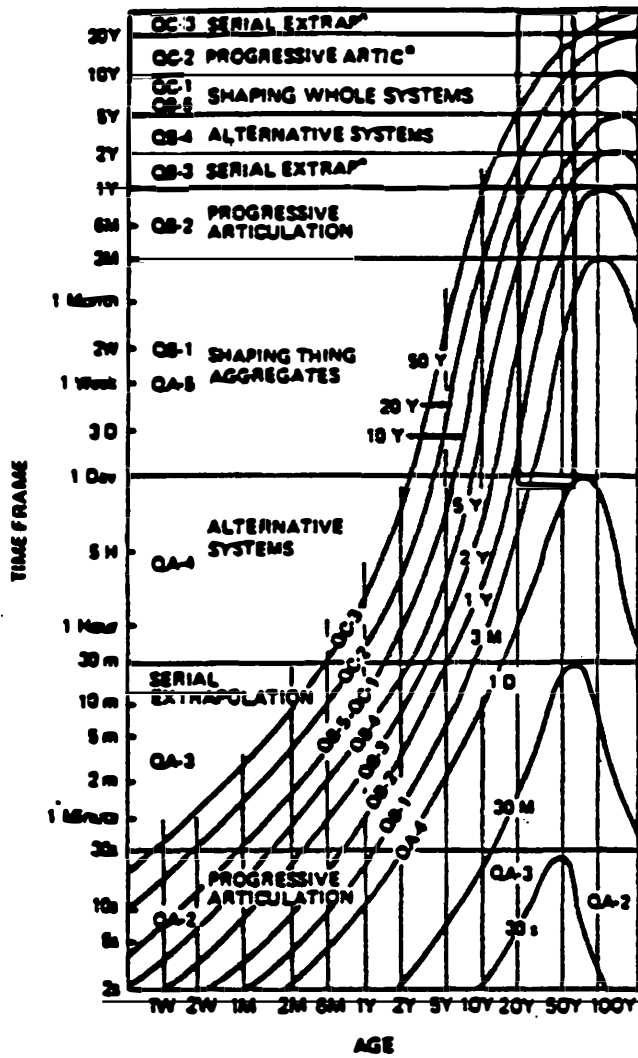


Diagram 5: Extrapolation of the Time-Frame Progression Array into Childhood.

The idea then occurred that the work of MacDonald and Couchman described earlier gave a lead into the nature of cognitive capability in children. Their findings about cognitive levels in a population of mentally handicapped adults are very suggestive of the cognitive modes found in infancy and early childhood in the type of population studied by Piaget. The following correspondence occur:

<u>QUINTAVE THEORY</u>		<u>PIAGET'S THEORY</u>
Level-5	Ability to operate in an adult world at Str-I	Period of formal operations; the ability to reason by hypothesis
Level-4	First state of concern about alternatives & about the interest of others	Period of concrete operations; combination, dissociation, ordering and correspondences which acquire the form of reversible systems
Level-3	Rigid fixation upon own goals; disregard needs of others; tantrums if stopped	Period of pre-operational thought
Level-2	Primitive reflective articulation	Sensori motor period
Level-1	Complete dependence upon an aide	

The hypothesis is suggested that the bottom quintave of the cognitive modes - Quintave A - expresses the stages of development in children. Some children may develop much more rapidly than others through the stages; and the stages extend

throughout adulthood in the so-called mentally handicapped; that is to say among those who never develop beyond the first four cognitive states.

On this further assumption that the Quintave A cognitive states will be traversed by children in the course of their development, I have hypothesized the modes within QA as shown. My rough hypothesis was that the children with the very highest potential would cross from the egocentric temper-tantrum QA-3 stage to the socialisable QA-4 capability of understanding that others may have alternatives, at perhaps 6 months to 1 year of age, and that that same stage might be reached in those with the potential to reach Str-I or II in their adult working careers at about 5 years to 7 years of age.

By the same token, the age at which a child is able to understand and to act upon the meaning of yesterday, today and tomorrow might turn out to be diagnostically of great importance. I refer here not just to an understanding of the meaning of the words but to a genuine behavioral understanding; that is to say, to the ability to start on some activity on one day with the realization that it will certainly take until the following day to complete it, and to carry the activity through without getting into a fit of rage and abandoning it when bedtime arrives with the project only half finished. My hypothesised developmental curves would predict that Mode-VII children will be able to handle the tomorrow's time-span by the age of 3; Mode-IV children by the age of 6; and Mode-I persons by the age of 21. These predictions will shortly be tested in our work.

These ideas are mere speculations at present. I put them forward to complete my account. But parents and teachers of young children seem to be familiar with the phenomena described. Our initial studies will include cohorts of 5-, 10-, and 15-year old boys and girls from different social and ethnic backgrounds. The hypotheses are at least precise enough to be falsified, reinforced, or modified.



A Note on "Predestination"

Hypotheses of the kind I have outlined about intellectual or cognitive capability and its development seem inevitably to give rise to criticism on political grounds; the hypotheses are held to be politically reactionary on racial grounds or on the grounds of being neo-feudal in the sense of putting each person into his or her own fixed slot in life. These criticisms are of substantial importance and warrent comment.

As far as racial issues are concerned, it is gratifying to be able to report that Dr. Stamp has now obtained evidence that her assessment procedure is effective regardless of cultural, social, racial or economic background. It would appear - as I would most certainly hypothesise - that individuals mature in time-frame and thus in cognitive power under the impact of the problems presented by everyday life, regardless of whether those problems have had to be faced under the exigencies of school learning or under the exigencies of survival in a setting of social and educational deprivation. Who is to say which is likely to provide the greater stimulus?

Let me emphasize that I am talking about maturation of cognitiave power only. I am not talking about the social and economic opportunity to exercise that cognitive power in education or employment and so to develop the psychological tools and orientation needed to advance in our society. If these hypotheses about development turn out to be valid, it would mean that whether or not individuals have adequate social, educational or occupational opportunities for developing particualr psychological tools and orientation, their cognitive power will develop nonetheless. If, however, they do not have the opportunity to learn and to develop the appropriate psychological tools and orientation for work with matches their capability, people will fall behind in their ability to compete in their societies, and

they will at the very least be frustrated and fed-up and feel unjustly treated.

Moreover, if the discrepancies between cognitive power on the other hand, and appropriate psychological tools and orientation, and work opportunities, on the other, are great, people will fall seriously behind in status and in achievement. Some will work zealously to overcome this disadvantage, and a few will become social reformers. But many others will become alienated, and may seek anti-social or delinquent outlets for their ability, or instigate more or less violent social changes. It is precisely, because maturation in cognitive power occurs despite social and economic opportunity, that the social alienation and resentment can occur - led by those with the highest levels of under-utilized cognitive power. Any society, to be a decent society, must provide the opportunity for individuals to gain the tools and orientation necessary for them to be able to use their cognitive powers to the full, and must ensure the provision of full employment opportunities for all. <sup>1</sup>

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<sup>1</sup> I have argued this case in detail in (1982) Free Enterprise, Fair Employment.

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Indeed, it is the viewpoint which states that educational and social opportunity are necessary for the maturation of a person's level of cognitive power which I find difficult to understand. For that view contains the implicit assumption that under generations of subjugation with social, educational and economic deprivation, subject peoples would have produced populations of intellectual morons. Human nature and the maturation of cognitive power would appear, fortunately, to be more resilient than that.

Finally, I would note that the assessments of cognitive power that I have described are a very far cry from the world of IQ ratings. My whole orientation is towards the performance of individuals in planning and carrying out goal-directed activities - and in

constructing their own worlds in doing so. This orientation has little relationship to IQ ratings with their failure adequately to separate individual cognitive power from culturally-dominated cognitive equipment. Such ratings lean too heavily upon culturally learned answers and language and upon ability to learn what is taught in schools whether or not you have been to school or even like that kind of learning.

### Conclusions

I said at the beginning that I would return to the question of defining intellectual capability and cognitive capability and complexity. Let me do so.

I have been using the terms intellectual and cognitive capability interchangeably. That has been intentional. I would now define them in terms of cognitive power, as the ability of individuals to form and pattern the world in which they live, in such a manner as to construct the goals they will seek to achieve and to order their approach to the achievement of those goals. They will use their knowledge, experience and skills in doing so, and will seek goals in line with their interests - but the over-all form and pattern of their construction, and the scale or extension of context of that construction, will represent the expression of their cognitive power.

Cognitive complexity will be expressed in the number and range of variables which individuals can use in constructing their worlds. This cognitive complexity is, I believe, the expression of cognitive power, and is measurable in time-frame.

ADDENDUM

Some Practical Applications for Educational Planning

But now let us examine some potential practical consequences of this approach to intellectual development. I shall consider three such applications: a problem-solving approach to education; assessment and grouping of students; and the transition from school to work.

The use of problem-solving exercises, or projects, has a history of regularly coming into fashion and just as regularly going out of fashion again. It should have a solidly established place. One of the implications, however, of stratified systems theory is that problem-solving projects should be tailored to the time-frame of the pupils. It is having to complete goals which require substantial periods of time to achieve, which puts individuals on their true mettle.

The time-scale would extend from 5 to 10 minutes in younger children and in less capable children, and on up to 2 to 3 months for some of the older more highly capable children. The significance of such projects is that they allow pupils to experience their cognitive power to the full. And with such experiences they will find their ability to cope with uncertainty being pulled out to full stretch. The art is to design appropriate projects to the time-scale involved.<sup>1</sup>

The difficulty with such projects is that they do not readily fit in with standardized and 'objective' grading. The substitute for such grading could, however, be that of a teacher's recording of the maximum time-span over which students could be targeted to pursue and to achieve given goals. The time-spans thus identified would provide as useful a piece of information about a student's potential in work career as any amount of so-called objective examination results.

Problem-solving project work might be facilitated by having students of roughly congruent time-frames in the same class. Before describing such groupings, let me make one thing clear. I am not arguing either in favor of comprehensive schooling or against it. To the extent, however, that some opportunity for grouping on the basis of cognitive power is deemed to be desirable, then our work would point to the following principles.

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<sup>1</sup> See Jaques, Elliott, "Learning for Uncertainty", (1971) in Working Creatively and Social Justice.

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On the assumption that it is possible to assess level of cognitive ability in time-frame, in children as in adults, then grouping in terms of cognitive mode should follow the pattern shown in Diagram 6.

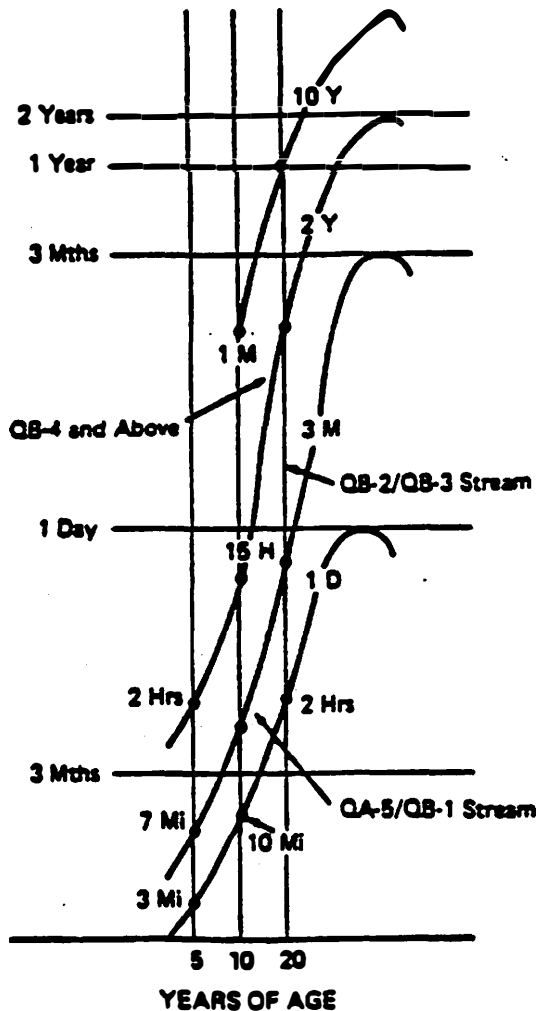


Diagram 6: Cognitive Maturation at School Age:  
Three Educational Groups

The following groups have been separated out; namely, those children maturing in Mode-I, those in Modes-II and III, and those in Modes-IV and higher. Roughly 45 per cent of school children would fall into each of the first two groups and the remaining 10 per cent in the third group.

The rationale for such a grouping is that the Mode-I group work in the same way, and at any given age, in roughly the same time-scale. They are most comfortable in concretely specified situations, with a penchant for physical doing. The Mode-II and Mode-III groups operate in longer time-scales, and require opportunity for expressing their capabilities for reflective formulation of what they are doing, as well as for formulating what might be, as illustrated above.

The third group should be composed of the students in Mode-IV and above. The reason for keeping this group together is that they are all operating in a frame of reference in which it is comfortable to handle generalizations. This ease with general categories is in contrast to the Mode-II and Mode-III groups, who, while they can formulate what they are doing, nevertheless require to be solidly and concretely in direct physiological-perceptual contact with the object of their doing.

It might be that by, say, fifteen years ago, those students who are operating in maturation Modes-VI and VII and who will eventually be capable of operating at strategic levels of work, should be given the opportunity to work together. There are, however, so few (less than 1 per cent) that special classes might be impracticable. They should, however, be recognized and identified, and given special educational opportunities consistent with their extended time-frames and capabilities.

There might, of course, be many reasons why children with the capability to work at these cognitive levels may not exercise their capability in work and study. Effective performance can be

hindered or disrupted by emotional disturbance, lack of motivation, social alienation, family economic distress or lack of support. But there is no sense, where grouping of children is being carried out, in compounding these difficulties by grouping children of high cognitive power (long time-frames) but low achievement, with students of equivalent achievement but significantly shorter time-frames. To be required to work below one's time-frame is frustrating, demotivating, soul-destroying. It would be much better to keep students together with those of their peers who are their equals in cognitive power, and to remediate whatever shortcomings in psychological tools and orientation are impairing their achievement.

Finally, on the transition from school to work, I would want to gear this transition in accord with the groupings described. The longer the time-frame of the student, the longer there should be the opportunity to continue with "purely academic" study. Vocationally-oriented education might start at 14 to 16 years of age for the Mode-I students. This age could be extended up to, say, 21 or 22 for the Mode-II and Mode-III students. The students at Mode-IV and above should have their educations left as open as possible throughout undergraduate University education; they should have their vocational tapering-off after finishing first degree level - in professional schools such as law, medicine, engineering, or perhaps by going straight into work without a vocational educational transition period.

In all the above I believe there is substantial advantage to be gained by considering students in terms of their cognitive power as measured in time-frame and in cognitive modes, rather than in terms of IQ or examination grades. It gives students a chance to show their real work potential regardless of social, racial or ethnic background, and regardless of sex. And it puts the proper emphasis upon the ability to do work as found not in answering examination questions but in doing real work.

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