A DEVELOPMENTAL STUDY OF CONTENT, STRUCTURE AND CHANGE
IN CHILDREN'S CONSTRUCT SYSTEMS

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Personal Construct Theory, in its original form, says little about the development of construing from infancy to adulthood. The theory accounts for change taking place, and for the general direction of change towards greater validity of construing, but does not deal with the nature of construct systems at different stages of development or the parameters of development from infancy to adulthood.

In exploring a theoretical framework for accounting for the development of construing, the relationship between Personal Construct Theory and Piagetian theory is considered. Fundamental similarities are pointed out, and hypotheses are generated concerning the likely course of development in construing. It is hypothesised that construct systems show developmental changes in content, structure and dynamic properties. These hypotheses are examined in two empirical studies of construing in children between 7 and 14 years of age.

The first study considers content and structure. There is a developmental trend towards the increased use of psychological constructs and increasing complexity of structure, as manifested by increasing discrimination, differentiation, organisation, balance and openness. Commonality, in terms of relationships between constructs, also increases with age.

The second study considers the stability of construct systems
and the response to invalidatory feedback. The stability of construct relationships and overall structural characteristics increases with age.

It is suggested that there is a curvilinear relationship between the discrepancy of invalidatory feedback and the extent of response. A distinction is made between the degree of discrepancy and the level of invalidation experienced. The amount of invalidation experienced at a particular degree of discrepancy varies with the age and structural characteristics of the individual.

Two modes of response to invalidation are identified; change and rigidification. The nature of the response varies with the level of invalidation.

The direction of structural change in response to invalidation varies with the structural characteristics of the individual.
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PART ONE

THE DEVELOPMENT OF PERSONAL CONSTRUCT SYSTEMS:

THEORY AND RESEARCH
CHAPTER I

INTRODUCTION

One of the most distinctive features of George Kelly's Personal Construct Theory (PCT) is the emphasis it places upon notions of evolution and change. Inherent in the philosophical position of constructive alternativism and Kelly's model of 'Man-as-Scientist', is the assumption that Man is ever seeking to improve his understanding, prediction and control of the world and the course of events in which he is involved. He does this by creating theories or systems of constructs which he attempts to fit over the world as he experiences it. He then tests the validity of this theory against the data of experience and, in the light of the outcome, revises his theory by modifying his system of constructs.

In adopting this position, Kelly avoids a problem which faces psychologists working in other theoretical frameworks, that of explaining the impetus of psychological change. Rather than being seen as an inert,passive object being driven to action by extrinsic motivating forces; being pushed by stimuli or pulled by needs, Kelly's Man is dynamic by his very nature. He is construed as a process, engaged in structuring and understanding his world in terms of the alternative constructions he places on it. He is a form of perpetual motion in which change, from birth onwards, is implicit.

The central importance of change is reflected in the formal statement of the theory. According to the Fundamental Postulate:
'A person's processes are psychologically channelised by the ways in which he anticipates events.'

Kelly's choice of the term 'process' is intended to emphasise the kinetic nature of Man.

The dynamic implications of this are defined and expanded in the Experience Corollary which states:

'A person's construction system varies as he successively construes the replication of events.'

Man subjects his constructions of the world to continual test. The assumption that he continually strives to predict and understand his world implies that his system of understanding should vary as a consequence of his experiences. Events precipitate change when a person's experience of them does not match the prediction and anticipation generated by his existing system of constructs, i.e. when his construction of the world is invalidated. As an individual's construction of the world is successively revised in the light of varying validational experiences his construct system undergoes a progressive evolution towards greater predictive validity.

The notion of development, as well as that of change, is central to PCT. Development can be seen as change in the direction of a better understanding of the world. However, in the original exposition of the theory, the concern is very much with 'development', in the sense of evolutionary change, as it occurs in the relatively established construct system of the adult. Kelly has very little to say about longer term developmental changes in construct systems from infancy, through childhood and adolescence, to adulthood. He does not deal
with the nature of construct systems in childhood or the parameters of development from infancy to adulthood.

Some construct theorists (e.g. Bannister and Fransella, 1971) have argued that if Man is seen as a form of motion, continually developing from the moment he is born, it becomes less meaningful to divide life up into arbitrary stages of development such as childhood, adolescence, adulthood and old age. The same process of interaction between construction and experience can be called upon to explain change and development towards the increased validity of construct systems at all ages.

There are, however, important distinctions that must be made between children and adults and between two aspects of development. To a great extent the adult is relatively mature. Psychological development, in the sense of progression towards a better understanding of the world, takes place on a base of reasonably stable expectations. The years of childhood, on the other hand, represent a period during which this stable base is being developed.

The treatment of development within PCT is at the same level of explanation as Piaget's notions of functional invariants. These are processes that are underlying principles governing cognitive behaviour and which operate in an invariant manner irrespective of the level of development of the individual. It is the operation of these functions which gives rise to the cognitive structures which characterise each stage of development.
In the same way, the level of analysis in PCT tells us something about the processes which give rise to psychological change and development and these are assumed to operate at all stages in the life cycle. However, PCT tells us little about the nature of the construct systems that are generated by these processes at different stages. PCT provides a theoretical framework that can account for change taking place at all, and for the general direction of developmental change towards the increased validity of construct systems for the understanding of the world. However, in its original form, it does not consider how the child construes the world as an infant, as a young child, or as an adolescent, or, perhaps more importantly, what the parameters of change might be as the child grows up.

It is the intention in this thesis to explore the relationship between PCT and Piaget's theory of cognitive development and the implications of Piagetian theory for the development of personal construct systems for understanding other people. The empirical studies will examine the major parameters of developmental change in the nature of constructs and the process of construing.

The term 'process' is chosen deliberately. As well as considering developmental changes in the static features of construct systems such as content and structure, we will examine long term developmental changes in the dynamic properties of construct systems; stability and the process of short term changes in response to varying validational experiences.

Despite the emphasis of PCT on motion and change, few studies have examined the process of change while it is actually underway.
None of the studies of construct systems in children have considered the way in which their construct systems respond to varying validational experiences. Given the emphasis of PCT on construing as a process this is a serious inadequacy which the present study will attempt to remedy.

The thesis is divided into four parts. Part One discusses the theoretical issues involved and reviews previous related research. In Chapter II the relationship between PCT and Piaget's theory of cognitive development is discussed. Fundamental similarities in the underlying bases of the two theories are pointed out and the implications of Piagetian theory for the likely course of developmental changes in construing are discussed.

It is suggested that one likely parameter of developmental change is the structural characteristics of construct systems. The subject of cognitive structure is discussed further in Chapters III and IV. Chapter III considers previous concepts of structure employed in relation to PCT and certain inadequacies are pointed out. The multidimensional approach to structure proposed by O. J. Harvey and his associates is also discussed and offered as a more fruitful alternative. The operationalisation and measurement of structural characteristics is discussed in Chapter IV.

Chapter V discusses previous research into the development of children's interpersonal perception. Studies of content and structure are considered and comparisons are made between the results of studies carried out within the context of PCT and other theoretical frameworks. The limitations of particular methodological approaches are also
discussed.

The discussions in Chapters IV and V conclude that some form of repertory grid technique offers advantages over other techniques for eliciting the content and structure of interpersonal construct systems. In Chapter VI the most appropriate form of grid technique for use with children is considered.

Part Two presents an empirical study of developmental changes in the content and structure of children's construct systems between the ages of 7 and 14 years. Chapter VII introduces the study and describes the methodology. Chapter VIII presents results and discussion of developmental changes in the content of interpersonal construct systems. Developmental changes in the structural characteristics of construct systems are considered in Chapters IX to XI. In Chapter XII comparisons are made between the structural characteristics of personal and supplied constructs.

Part Three presents an empirical study of developmental changes in the dynamic properties of construct systems between the ages of 7 and 14 years. The properties examined include stability and the nature and extent of response to varying types and amounts of invalidatory feedback.

Chapter XIII introduces the study and presents a more detailed discussion of the role of change in PCT. Previous research into the stability of construct systems and the effects of invalidation is reviewed. Certain issues arising from this research are discussed. They include the nature of invalidation and the role of individual differences in the response to invalidation. The implications of
Piagetian theory for the development of the dynamic properties of construct systems are discussed and hypotheses are offered for the course of developmental changes in stability and the response to invalidation. The methodology for the study is described in Chapter XIV.

Chapter XV presents results and discussion of developmental changes in the stability of construct systems. Chapter XVI considers the relationship between stability and the structural characteristics of the individual's construct system.

Chapter XVII presents results for the effects of invalidatory feedback on the pattern of construct relationships and how they vary with age and structural characteristics. Chapter XVIII presents similar results for the effects of invalidatory feedback on the structural characteristics of the individual's construct system. Discussion of these results follows in Chapters XIX and XX.

Part Four presents a concluding discussion of the theoretical and empirical issues raised by the studies.
In Chapter I it was pointed out that Personal Construct Theory emphasises the changing and evolutionary nature of construing. Man changes or develops to improve and extend his understanding of the world. However, the major concern of Personal Construct Theory, as originally stated by Kelly (1955), was with change and development as it occurs in the relatively established and stable construct systems of adults. The theory has little to say about the development
of construing from infancy to adulthood.

Some people have argued (Bannister and Fransella, 1971) that, within Personal Construct Theory, it makes little sense to divide life up into arbitrary stages; infancy, childhood, adolescence, etc. Man is a form of motion, developing from the moment he is born. At all ages change is generated by the same process of anticipation, experience and reconstruction.

Nevertheless, Personal Construct Theory does not offer a framework which can describe or account for the differences in construing which might arise from the operation of this process at different ages.

How can Personal Construct Theory be extended or developed to deal with the construct systems of children, with the nature of construing at different ages, and with the parameters of change as the child grows up?

PIAGETIAN THEORY AND PERSONAL CONSTRUCT THEORY

A number of people have suggested similarities between Personal Construct Theory and Jean Piaget's theory of cognitive development (Adams-Webber, 1970; 1979; Salmon, 1970). In the remainder of this chapter we shall consider the relationship between Piaget's theory and Personal Construct Theory and explore the possible relevance of Piagetian theory to the development of personal construct systems.

Models of Man

Firstly, there are basic similarities between Piaget's and
Kelly's models of Man. Both theories attribute an active nature to Man. This is clear, firstly, in the way they deal with the notion of motivation. According to Kelly, Man is a form of motion and, thus, the necessity to postulate an energy or needs and drives, that impels Man to action, disappears. For Kelly the process is the point of departure for the formulation of a psychological theory.

Piaget too has little sympathy for the notion of motivation, as commonly conceived of in terms of needs and drives. His position is that it is of their nature that cognitive structures, once generated by functioning, perpetuate themselves by more functioning. Motion is implicit in cognitive structures and the need to function cannot be separated from functioning itself (Piaget, 1952).

According to Piaget (1960) the need to function arises from a temporary instability of schematic organisation following an attempt to assimilate a novel element into a schema prior to a fully adequate accommodation of that schema to the nature of the element. According to Personal Construct Theory changes in construing arise from a similar process. In Construct Theory terms it is the recognition of inconsistency between anticipation and experience that provides the impetus for change.

Both theories also stress the active nature of the relationship between Man and his environment. Neither regard Man as a passive object at the mercy of a randomly varying environment:

'Just as Kelly's model man lives by reaching out to reality in his behavioural ventures, so Piaget's
child grows through his active experimentation with ever wider and deeper aspects of his environment.'

(Salmon, 1970, p.214)

The Constructive Nature of Cognition

Related to an active conception of Man is the emphasis that both theories place on the constructive nature of cognition. The individual is seen to deal with the world by structuring it, using pre-existing cognitive schemas or systems of constructs. Flavell (1963) comments on the close similarity between Piaget and Kelly on this point:

'Every act of intelligence, however rudimentary and concrete, presupposes an interpretation of something in external reality, that is, an assimilation of that something to some kind of meaning system in the subject's cognitive organisation. To use a happy phrase of Kelly's (1955), to adapt intellectually to reality is to construe that reality, and to construe it in terms of some enduring construct within oneself. Piaget's epistemological position is essentially the same on this point requiring only the substitution of 'assimilate' for 'construe' and 'structure' or 'organisation' for 'construct'.' (Flavell, 1963, p.48)

According to Kelly the world is interpreted in terms of the individual's system of constructs, a view explicitly stated in the philosophical principle of Constructive Alternativism:

'Man looks at his world through transparent patterns or templates which he creates and then attempts to fit over the realities of which the world is created.'

(Kelly, 1955, p.9)
Piaget expresses similar notions in his concept of assimilation. Piagetian assimilation refers to the process by which every cognitive encounter with the environment necessarily involves some kind of cognitive structuring or restructuring in accord with the individual's existing intellectual organisation.

**Adaptation and Anticipation**

Salmon (1970) has pointed out that both Piagetian theory and Personal Construct Theory have an overall governing theme, an overriding principle which forms the basis for their systems. For Kelly the anticipation of events is the basis of human behaviour, while for Piaget cognitive action is guided by the underlying principle of adaptation. In both theoretical systems the whole framework grows from these general principles.

The concepts of adaptation and anticipation are themselves closely related to one another. While Piaget's idea of adaptation is derived from biological concepts, adaptation in the general sense can be said to occur whenever a given organism-environment interaction has the effect of modifying the organism in such a way that further interchanges, favourable to its preservation, are enhanced (Piaget, 1952).

Piaget has described two aspects of the process of adaptation. The first, assimilation, refers to the adjustment of reality to the pre-existing cognitive system. The second, accommodation, refers to the adjustment of the system to reality.
According to Piaget, development proceeds through an equilibration process of bringing assimilation and accommodation into balanced coordination (Piaget, 1957). The different equilibrium states which result from this process are the various forms which this coordination takes during ontogenesis. An equilibrium state in Piaget's system always refers an equilibrated system of relations between subject and object.

These concepts can be interpreted in terms of the validity of anticipations, the governing theme in Personal Construct Theory. Adaptation can be seen as the process of change in the direction of an increased ability to understand and anticipate the world. A state of equilibrium can be seen as a state in which the cognitive system of the individual has a high degree of validity for the construction and anticipation of a certain range of experiences.

In considering the concept of 'validity' the relationship between adaptation and anticipation becomes clearer. Development, for Piaget, progresses through the organism adapting itself by generating cognitive structures of increasing validity for understanding the world, by:

'...materially constructing new forms to fit them into those of the universe, intelligence extends this creation by constructing mentally, structures which can be applied to those of the environment.' (Piaget, 1952, p.4)

For Kelly also, development progresses through successive anticipations, experiences and reconstructions generating change in the direction of creating a construct system of greater validity.
For both theorists, therefore, development proceeds in the
direction of a better fit between construction of the world and
experienced reality. Adaptive change can only occur as a result of
the testing out of constructions through anticipation and experience
and the psychological consequence of adaptive change is the ability
to better anticipate events.

**System and Organisation**

Yet another point of similarity between Piagetian theory and
Personal Construct Theory, also discussed by Salmon (1970), is that
both lay great stress on the ideas of system and organisation. For
Piaget, organisation has the same status in cognitive behaviour as
adaptation, that of a functional invariant. Every act of intelligence
presupposes some kind of intellectual structure, some sort of organ-
isation within which it operates. Assimilatory and accommodatory
functioning demand some sort of existing structural system in the
organism. Experience must be assimilated to something:

'The apprehension of reality always involves multiple
interrelationships among cognitive actions and among
the concepts and meanings which these actions express.'
(Flavell, 1963, p.46)

Piaget argues that, from the biological point of view, organis-
ation is inseparable from adaptation. They are complementary processes
of the same basic mechanism, the first being the internal aspect of
the cycle of which the second is the external aspect. To quote
Piaget, they are:

'...the accord of thought with things and the accord of
thought with itself...these two aspects of thought are indissoluble, it is by adapting to things that thought organises itself and it is by organising itself that it structures things.' (Piaget, 1952, p.8)

The concept of organisation is also central in Personal Construct Theory. Kelly discusses understanding in terms of construct systems, emphasising the relationships between constructs as well as the content of the constructs themselves. This emphasis is formally stated in the Organisation Corollary:

'Each person characteristically evolves for his own convenience in anticipating events, a construction system embracing ordinal relationships between constructs.'

No construct stands alone. A necessary condition for organised thought and action is some degree of overlap between constructs in terms of their ranges of convenience. For any event to be anticipated or interpreted it must fall within the range of convenience of at least two constructs. The more constructs that can be brought to bear on an element, the more clear and distinct its meaning within the system. Kelly points out:

'An event seen only in terms of its placement on one dimension is scarcely more than a mere datum and about all you can do with a datum is just let it sit on its continuum. But as the event finds its place in terms of many dimensions of consideration it develops psychological character and uniqueness.' (Kelly, 1965, p.4)

The role of structure in cognitive functioning will be considered in more detail in Chapter III, together with alternative ways
of conceptualising structure.

The Nature of Reality

Piagetian theory and Personal Construct Theory share a number of significant features. There are striking similarities in their conception of Man and his relationship to the world and of the general principles that underly behaviour and development.

It has been argued, however, (Salmon, 1970) that a crucial difference argues against Personal Construct Theory being an extension of Piagetian theory into the field of personality development. Salmon sees this difference in their basic philosophical positions as to the nature of truth. She suggests that Piaget has an absolutist view of truth as, underlying the notion of accommodation, is the assumption that a person can directly experience pure reality. Salmon contrasts this with the philosophical basis of Personal Construct Theory whereby reality can never be known directly but only through our construction of it.

It can be argued, however, that Piaget and Kelly are much closer on this point than Salmon allows. The first point to be emphasised is that both theories assume the existence of external reality; an objective world independent of the individual's cognition. To quote Kelly:

'...a real world...not a world composed solely of the flitting shadows of people's thoughts.' (Kelly, 1955, p.5)

Secondly, while taking a constructivist view of cognition, both
theories recognise that a cognitive system is subject to the constraints of that external reality. Piaget deals with this explicitly in the process of accommodation. Kelly also recognises the relationship between the construed world and the external, objective world.

Having made predictions about events, the individual tests these predictions on the world and revises his constructions on the basis of the results as he construes them. While the intervening constructing of outcomes separates the individual from pure reality, his constructions are subject to the constraints of an objective reality which is not infinitely malleable. Were constructing not subject to the pressures of the external world, development, in the sense of a progression towards greater validity of understanding, would not be possible. To quote Kelly once more:

'Constructs cannot be tossed about willy-nilly without a person getting into difficulty. While there are always alternative constructions available some of them are definitely poor implements. The yardstick to use is the specific predictive efficiency of each alternate construct and the overall predictive efficiency of the system of which, if adopted, they become a part.'

(Kelly, 1955, p.15)

Salmon seems to be interpreting the process of accommodation as implying that the individual has direct contact with reality without intervening constructions of that reality. This is clearly at odds with Piaget's view of the constructive nature of cognition and seems to be a consequence of regarding assimilation and accommodation as separable mechanisms.
Piaget points out that, while assimilation and accommodation are separated conceptually, they are abstractions from the unitary process of adaptation and are indissoluble in the concrete reality of any adaptational act. Every assimilation of experience simultaneously involves an accommodation of the individual to reality and, conversely, every accommodation is at the same time an assimilatory modification of the experience accommodated.

So Piaget's position is basically the same as Kelly's. While the individual's cognition is subject to the pressures of objective, external reality, the experience of that reality is mediated by the individual's own cognitive system.

Part of the confusion over this point may arise from a major difference between Piagetian theory and Personal Construct Theory with respect to the domain of experience with which they are primarily concerned. Piaget's main interest has been in the cognition of the physical world; how the child develops his understanding of concepts such as volume, number, etc. Personal Construct Theory, on the other hand, has as its focus the understanding of social phenomena such as interpersonal relationships.

It is clear that the 'laws' governing these two areas of experience are somewhat different. Coming to an understanding of the physical world involves the individual interacting with relatively stable phenomena. The feedback he receives remains fairly constant over space and time. This consistency of feedback means that the individual can evolve a highly efficient and valid system for understanding such phenomena and predicting their behaviour. Similarly,
the constancy of feedback experiences among different individual's should lead to wide consensus about how such events should be construed, that is about the nature of these events. Under such conditions the notion of 'truth' or 'reality' clearly has more meaning than in the domain of experience with which Personal Construct Theory is concerned. In the perception and construction of the psychological world the experience of feedback may be inconsistent both within and between individuals. The range and validity of alternative constructions is therefore much greater and it makes more sense to talk of 'interpretation' rather than 'truth' or 'reality' and of 'construing' rather than 'knowing'.

Bannister and Fransella (1971) suggest another significant difference between Piaget and Kelly which is explicitly related to their conceptions of development. They see differences in the way 'change' is construed in the two theories. They suggest that a construct theorist would construe stages of development as related to experience rather than age and would seek to measure changes in structural terms rather than in culture-content terms as Piaget would.

This seems to reflect a misinterpretation of Piagetian theory. While Piaget does specify age ranges within which particular stages of development are likely to be attained, these are intended as rough guidelines and Piaget certainly emphasises the role of experience and interaction with the environment in development.

Piaget also describes changes in terms of the cognitive structures that a child possesses at a certain stage which transcend the culture-content explanation suggested by Bannister and Fransella.
Piaget claims that his theory is directed particularly towards the:
'...structure of developing construction as opposed to its function and content.' (Piaget, 1952)

PIAGETIAN THEORY AND THE DEVELOPMENT OF CONSTRUING

In the preceding section we have pointed out some of the underlying similarities between Piagetian theory and Personal Construct Theory. They share a common emphasis on the changing nature of the individual, the constructive nature of cognition, notions of system and organisation and development towards a more valid understanding of the world.

Given this common basis let us consider the implications of Piagetian theory for the development of construct systems.

Piaget views development as an inherent process characterised by invariant functions; adaptation and organisation. Within this developmental process he locates distinct stages and substages. A stage has been defined as a 'homogeneous patterning of an individual's life style for the duration of that period.' Although the notion of stage is often cited as if it referred to a definite entity, Piaget emphasises that they are no more than points of reference to understand the sequence of development. They serve only to demonstrate the course of development and do not represent development itself.

If a developmental sequence is to be amenable to a stage description, the stages abstracted must possess certain properties. Firstly, they must emerge in an unchanging and constant order, otherwise it
is erroneous to talk of them as stages. Although the sequence is invariant, the age at which a given stage might appear varies considerably.

Underlying this requirement of invariant sequence is another essential characteristic of true stages. Later stages are built upon the properties of earlier stages. For example, the stage of formal operations involves cognitive operations which are performed upon the concrete structures elaborated in the preceding stage.

What implications does this have for the development of construct systems? It suggests that construing passes through a series of recognisable stages which can be defined in terms of the qualitatively different nature of the cognitive processes that characterise them. Secondly, these stages will appear in an invariant sequence and the development of construing will follow a constant pattern.

Support for this hypothesis would depend on the level of analysis but it should be pointed out that Piaget's theory is concerned with development towards an optimal state. The progression of stages from sensori-motor to formal operational is the theoretically ideal course of development. In reality, although the attainment of an earlier stage must precede the attainment of a later stage, there is no reason to assume that the full sequence always occurs or that individuals do not regress to an earlier level of functioning. Piaget has pointed out that it is possible for adults to function in some circumstances at a level below that of formal operations, but has not discussed the possibility of individuals regressing to function habitually at a lower level. Piaget has also conceded that not all
'normal' adults, even within one culture, necessarily achieve a common level of functioning. Adults will only show 'adult' thought in those content areas in which they have been socialised.

The same point can be made with respect to Personal Construct Theory. Kelly (1955) talks about the 'progressive evolution' of construct systems. This implies that change is automatically towards a more valid system for understanding the world. This must be regarded as the ideal course of development. Individuals may not necessarily change in this direction.

The degree of variation in level of functioning is likely to be even greater in the domain of social and psychological experience with which Personal Construct Theory is primarily concerned, due to the greater potential for alternative constructions discussed earlier.

Piaget has postulated the equilibration process as the mechanism of transition from stage to stage. He sees the whole of ontogenetic development as:

'...a series of differing equilibrium states or perhaps as a succession of phases or nodes in a grand equilibration process.' (Piaget, 1957)

The continuous process of equilibration gives rise to successive, essentially discontinuous, equilibrium states which are organised systems of cognition.

The concept of equilibration is linked very closely to the concepts of assimilation and accommodation. It is the process of bringing these two aspects of adaptation into balanced coordination. The
different equilibrium states are the various forms which this co-
ordination takes during ontogenesis. Piaget has defined a number
of dimensions along which these states of equilibrium vary.

1. Field of Application.

As psychological systems are comprised of cognitions applied
to the world, they can be distinguished in terms of the size of
the domain of elements to which they can be applied.

2. Mobility.

This property refers to the spatio-temporal distances which the
actions of the system traverse in the course of their operations.

3. Permanence.

A system is said to be in permanent equilibrium if the elements,
on which the subject's cognitions bear, do not change their subject-
ive value when new elements are centred. A system which is not in
permanent equilibrium is one in which the elements change their
values with each change of input.


As far as Piaget is concerned, this is the most important dim-
ension of equilibrium. It refers primarily to the system's capacity
to compensate for or cancel perturbations which tend to alter the
existing state of equilibrium.

These four dimensions conjointly describe and hierarchically
order the major developmental structures. With respect to the impli-
cations of these notions for the development of construct systems,
Piaget's definition of these dimensions suggest that major differences
between construct systems at different stages of development will be reflected in the structural characteristics of systems and in their dynamic properties. Mobility', as defined by Piaget, implies the extent to which the individual's cognitive processes are independent of the immediate situation or alternatively are controlled by external stimulus conditions. 'Stability' and 'permanence' reflect the capacity of the system to maintain its stability and structural integrity in the face of a changing environment. These aspects of construct systems will be discussed in greater detail in Chapters III and XIII. It will be argued that the adaptability and flexibility of construct system, as reflected by these concepts, are closely related to the structural complexity of the system. The notion of structure will also be discussed in more detail in the following chapter but stated simply we would predict that personal construct systems develop in the direction of increasing complexity of structure.

Having considered the general course of developmental change in construct systems, let us consider the implications of Piagetian theory for the characteristics of construing at different stages of development.

Pre-operational Stage

Piaget emphasises that, at the pre-operational stage, the child's cognitive behaviour is strikingly egocentric. He is unable to differentiate an egocentric viewpoint from many others or to see his own viewpoint as one of many alternatives and to coordinate it with
others. We might expect this egocentrism to be manifested in highly idiosyncratic systems of constructs implying a low degree of sociality and commonality.

Piaget suggests that, causally related to the high degree of egocentrism at this stage, the child finds it exceedingly difficult to treat his own thought processes as an object of thought. This has implications in terms of Kelly's organisation corollary in that it suggests that the child finds it difficult to build ordinal relationships between constructs. The child cannot construe his own constructs, one construct cannot subsume another.

Another pronounced feature of pre-operational thought is the tendency to 'centre' or to take into account only one attribute of an object in making judgements and predictions. The child is unable to 'decentre' and take into account other attributes of the stimulus. Similarly, at this stage the child is still incapable of thinking in terms of the whole and remains pre-occupied with parts. If he attempted to think in terms of the whole, he would lose sight of the parts and the relationships between them.

This suggests a relatively simple cognitive structure on the part of the pre-operational child. He is unable to differentiate different aspect of a situation and then reorganise or integrate them in order to arrive at an overall, multidimensional view of the situation.

Piaget also argues that the child tends to see each attribute of the world in absolute terms. His thinking is categorical, he thinks in terms of black and white rather than shades of grey.
The child is, therefore, likely to apply his constructs in an all or none fashion rather than to use them discriminately.

At the pre-operational stage there is a relative absence of a stable equilibrium between assimilation and accommodation. The child's cognitive organisation tends to rupture and dislocate itself in the process of accommodating to new experiences. This suggests that the child at this stage does not possess stable construct systems but is subject to rapid and extensive change.

Finally, with regard to the content of the constructs of the pre-operational child, Piaget suggests that thought, at this stage, is predominantly concrete rather than abstract. Presumably this will be reflected in the nature of the constructs that the child uses in understanding other people.

**Concrete Operational Stage**

When the child progresses to the concrete operational stage a number of changes in cognitive functioning occur. The most general change is that the cognitive processes of this stage are based on systems in equilibrium. Thus, the child is less at the mercy of changes in his environment. With assimilation and accommodation in a state of relative balance the cognitive system is able to adapt to a wider degree of environmental change and unpredictability while maintaining a relative degree of stability and structural integrity.

Secondly, while the pre-operational child tends to operate solely in terms of the phenomenal 'before-the-eye' reality, the
child in the concrete operational stage is beginning to 'extend his thought', as Piaget phrases it, from the actual to the potential.
The child is able to interpret the world from a number of alternative perspectives which suggests a higher degree of organisation than the pre-operational child. This is also evident in the child's capacity to relate a thought or event to a total system of interrelated parts. This is in contrast to the pre-operational child's concentration on isolated parts. The child at this level should be better able to organise the differentiated parts of his cognitive system into integrated wholes and to construe the relationships between parts.

Due to the concrete operational child's social experience, his cognition is likely to be less egocentric than that of the pre-operational child. This is reflected in the child's ability to generate alternative perspectives to his own and recognise the validity of such perspectives. In Personal Construct Theory terms, the child should have a more developed 'role' construing system in which the notion of 'self' is differentiated from that of 'other'. In addition, the growth of social interaction and communication should be reflected in greater commonality or shared construing.

However, the cognition of the child at this level is limited. Concrete operations are essentially concrete. The structuring, organising and equilibration is oriented primarily towards concrete things and events in the immediate present. While there is some movement towards the abstract and potential, the starting point for concrete operations is always the concrete. Piaget stresses that widening awareness of physical factors always precedes an awareness
of abstract and social factors. The child must first organise his new perspectives of physical phenomena before he can extend these schemas to the less tangible sphere of experience.

During the concrete operational stage, organisation is only at a limited level. Various subsystems are organised internally but there is little organisation at a higher level so that subsystems cannot be integrated to form larger, superordinate structures and the child finds it very difficult to shift readily from one subsystem to another.

In comparison with the pre-operational child, the construing of the concrete operational child should show a greater complexity of structure. The degree of complexity, however, will depend on the domain of experience with which a particular system is concerned. The cognition of the concrete, physical world should be more organised than the cognition of more abstract areas such as social phenomena.

The construct systems of the concrete operational child should also show greater stability and changes, when they occur, should be less disruptive, with change in one area of a construct system not necessarily causing dislocation of the rest of the system.

The child also has a more differentiated construction of 'self' and in his construing should show a higher degree of commonality and shared meanings.

Finally, the concrete operational child should be better able to use constructs as dimensions of judgement rather than as absolute
categories and so be able to use them more discriminately.

**Formal Operational Stage**

The final stage in Piaget's theoretical account of cognitive development is the phase of formal operations. He considers that the most important general property of this stage is its concern with the 'possible' as against the 'real'. While the concrete operational child's cognition is relatively context dependent, the formal operational child can spontaneously generate alternative interpretations and predictions reflecting possibilities and hypotheses. This suggests that the cognitive processes of the child at this stage show even greater complexity of structure. This is also suggested by the fact that that the older child or adolescent is able to cognise about his own cognitive processes. In Personal Construct Theory terms the child should be able to construe subordinate constructs as the elements of superordinate constructs and erect hierarchical systems of constructs.

Formal operational thought for Piaget is not so much this or that specific behaviour as a generalised orientation towards the organisation of experience. In Personal Construct Theory terms, Piaget is suggesting that, at this level of development, construct systems possess a level of structure which includes superordinate constructs which serve an integrating function for constructs lower down the organisational hierarchy.

The individual functioning at the formal operational level is also able to organise his abstract experiences as well as his concrete
experiences. Therefore, we might expect construct systems dealing with such aspects of experience as social and psychological phenomena to manifest a high degree of structural complexity.

SUMMARY

At the beginning of this chapter we discussed the failure of Personal Construct Theory to deal with the construing of children and the parameters of development in construing from infancy to adulthood. The similarities between Personal Construct Theory and Piaget's theory of cognitive development were considered and the implications of Piagetian theory for the development of construing were considered.

On the basis of this it was suggested that developments in construing should be manifested in changes in the content and structure of construct systems. There should be a developmental trend towards increasing abstraction and commonality of content, and increasing complexity of structure. These hypotheses will be tested empirically in the study reported in Part Two. In the intervening chapters we will consider the conceptualisation and measurement of structure in more detail, review previous research in the area of children's interpersonal perception, and consider the most appropriate methodology for investigating children's personal construct systems.

It was also suggested that there should be developmental changes in the dynamic properties of construct systems, for example, stability and the ability to integrate new experiences. This hypothesis will
be discussed in more detail and tested empirically in Part Three.
In Chapter II it was suggested that if Piagetian theory were relevant to the development of construct systems then one of the major parameters of developmental change should be the structural characteristics of the system. It was suggested that, at the most general level, one would expect a progression with age towards more complex structures. In this chapter we will consider the role of structure in cognitive behaviour and some of the diverse approaches to conceptualising structural properties of cognitive systems and the complexity of structure. In the next chapter we will turn to examine methods of operationalising these concepts.

THE ROLE OF STRUCTURE

The structure of cognition has been distinguished from its content, a distinction which can perhaps be expressed more simply as the difference between the 'how' and 'what' of cognition. While this distinction is perhaps something of an oversimplification few people have considered the relationship between content and
structure (c.f. Stringer and Terry, 1978). However, if for the
time being this distinction is allowed to stand let us turn to
consider the role of structure in cognitive processes.

In the previous chapter we pointed out the central importance
of notions of structure and organisation in the theoretical frame-
works of both Piaget and Kelly. The importance of structure in
cognitive function is revealed if we consider its relationship to
the basic principles of behaviour that underly these two theories:
adaptation and anticipation. The close relationship between these
two concepts in the context of development towards increased validity
was discussed in Chapter II. It follows from both theoretical
models that one of the important correlates of increasing adaptation
or anticipatory ability is the capacity to generate alternative
constructions of the world and alternative means to reach ends.
Diverse and contradictory information can be assimilated into the
system in a manner which enables the integrity of the system to be
maintained together with a degree of equilibrium between construction
and experience.

Harvey and his associates (Harvey, Hunt and Shroder, 1961;
Shroder, Driver and Streufert, 1967) have considered in detail the
relationships between adaptation and structure. Harvey (1966)
argues that in simple or constant surroundings an individual or
social system equipped with more or less habitual or fixed
tendencies for construing or responding to given situations may
respond as well as, or even better than, a system with interpretive
and behavioural equipment attuned to complexity and variability.
In complex and changing environments, however, the flexibility, adaptability and creativity outlined above offer a far more effective strategy for dealing with the world. The solution of any problem and the attainment of a goal depends on the ability of the cognitive system to analyse the situation into the necessary elements and to organise them into appropriate relationships, clearly a structural facility. Additionally, in a changing world, failure of the system to be sensitised to changing events and to be modified or to adapt in appropriate ways leads to maladaptiveness.

Harvey (1966) defines the total adaptability of a system as the largest number of goals it can move towards simultaneously without conflict between the goals or means of achievement. The emphasis in this definition is slightly different to the approaches of Piaget and Kelly, in that it emphasises response rather than cognition or understanding. The similarities are revealed, however, by Harvey's description of 'adaptation' as the process by which the system removes environmental asynchrony through some form of accommodation to it. Incidentally Harvey does not use 'accommodation' in the Piagetian sense, but implies both Piagetian accommodation and assimilation.

Also, in contrast to Piaget, Harvey is not just concerned with the theoretical ideal of increasing adaptation as a consequence of the mismatch between the constructed world and the demands of reality. Like Kelly he considers a number of alternative strategies that an individual might adopt for dealing with experiences which are deviant in the sense of being asynchronous with the construction of that environment, an inevitable situation in a changing world.
Firstly, the individual could effectively alter the experienced environment to match the existing construction by selecting those elements that support that construction and ignoring those elements which do not. Such a response would be maladaptive in that, while it preserved the integrity of the system, it would not allow development in the direction of increased anticipatory effectiveness or validity.

Alternatively the system could change to take account of deviant experiences. Harvey presents two extreme variations of this form of response. At one extreme the system could capitulate completely to the demands of the new experiences with consequent disruption of the system, loss of system integrity and possibly the discarding of the entire anticipatory framework. At the other, the system could adapt to change by maintaining the basic structure of his system and by the development of new alternatives within it and the expansion of its boundaries to enable the inclusion of new elements. Harvey et al see these varying response strategies as related to the structural characteristics of the conceptual system.

These alternative response modes bear a close relationship to Piaget's concepts of assimilation and accommodation. The first response described, the effective exclusion of deviant experience, is predominantly an assimilatory response. The second, the breakdown of the system in the face of unexpected experiences, can be regarded as a predominantly accommodatory one. The third, the development of the system to encompass new experience while maintaining the essential structure of the system, can be seen as a balance or equilibrium between assimilation and accommodation. These different
response modes may represent different stages in the developmental progression towards a state of equilibrium between assimilation and accommodation.

Harvey's concepts also have their counterparts in PCT accounts of change. Deviant experience would be experience that conflicted with the hypothesised outcomes of anticipations derived by the existing construct system. An individual commits himself to predicting a particular event. If it takes place as anticipated then the prediction is validated and the system which generated the hypothesis is supported. If, however, the experienced outcome is not as predicted that particular construction of events can be said to be invalidated and a degree of incompatability exists between the expectation and experience of events. One response to invalidation might be to ignore it and continue to derive predictions from an unchanged system. This is equivalent to selecting out those elements of the environment which support the construction and ignoring those which do not fit. As suggested this would succeed in maintaining the integrity of the system but can hardly be regarded as adaptive.

Alternatively, the construct system may respond to invalidation by changing those parts of the system involved in generating the invalidated anticipation. However, depending on the characteristics of the system, one might expect variation in the size and extent of these changes and therefore varying consequences for the stability and integrity of the construct system as a whole. The nature of the invalidatory information presumably plays a part in determining the response; but it seems that characteristics of the system, particularly those characteristics which have to do with the structure and
organisation of the system, are also likely to play an important role. An understanding of exactly what these characteristics might be and of how they operate is essential for understanding the processes of adaptation or growth, and development of construct systems as they have been discussed.

The relationship between structure and the dynamic properties of construing will be considered in more detail in Chapter XIII. Here we have suggested its crucial role in cognitive functioning. Let us now turn to consider the diverse conceptualisations of structure that have been adopted and discuss them in relation to PCT and the issues we have outlined above.

CONCEPTS OF COGNITIVE STRUCTURE

PCT and Cognitive Structure

In the previous chapter we commented on the central role that notions of structure and organisation play in the theoretical frameworks of both Piaget and Kelly. In this section we will discuss in more detail 'structure' as conceived by Kelly. The Organisation Corollary states:

'Each person characteristic[ly] evolves for his convenience in anticipating events, a construction system embracing ordinal relationships between constructs.'

Kelly expands on the nature of organisation by considering in detail the implications of each of the terms used in this corollary:

'Characteristically' emphasises the personal nature of organisation. As well as the content of constructs being individual the hierarchical
systems into which constructs are arranged are also individual. Kelly suggests that it is the organisation of the system that characterises the individual even more than differences in the content of the constructs which make up the system.

'Evolves' reflects the dynamic nature of construct systems. Although the systemic characteristics are more stable than individual constructs it is nevertheless continually changing.

'System' is the basis of organisation, a structure in which, ideally, incompatabilities and inconsistencies between constructions and predictions are minimised thus maintaining the stability and integrity of the individual as much as possible in a changing world.

'Ordinal relationships between constructs' is what Kelly means by organisation. One construct may subsume another as an element. Within a construct system there may be many levels of superordinate and subordinate constructs. Constructs at one level subsume others at a lower level which in turn subsume other constructs at yet a lower level.

Kelly also points out the varying consequences for structure and organisation of invalidation:

'Now it so happens that a person must occasionally decide what to do about remodelling his system. He may find the job long overdue. How much can he tear down and still have a roof over his head? How disruptive will a new set of ideas be? Dare he jeopardise the system in order to replace some of the constituent parts? Here is the point at which he must choose between preserving the integrity of the system and replacing one of the obviously faulty parts.' (Kelly, 1955, p. 58)

Here Kelly is proposing the same alternatives of response to invalidation and the need to change as Harvey. We have suggested,
and will argue in more detail in Chapter XIII, that the individual's level of structure plays an important part in influencing the strategy that he adopts.

Cognitive Complexity

Kelly's notions of structure were further developed by Bieri (1955). Following Kelly, he argued that the basic characteristic of human behaviour is its movement towards greater predictive efficiency. Bieri took this further and argued that predictive behaviour and accuracy are a function of variables conceived of in terms of personality structure. Bieri saw these variables as related to the structure of the individual's construct system. He suggested that the predictive efficiency or the versatility of a system was largely a consequence of the degree of differentiation of the system. If constructs represent differential perceptions or discriminations of the environment, it would be expected that the greater the degree of differentiation among constructs, that is the greater the number of different constructs in the system, the greater will be the predictive power of the individual. Bieri derived the dimension of Cognitive Simplicity-Complexity which was defined in terms of the degree of differentiation of the system. He operationalised the dimension using a modification of the Role Construct Repertory Grid to discover the degree of interrelationships between constructs and thus arrived at an index of the extent to which the constructs are similar or different.

Bieri defines Cognitive Complexity as the tendency to construe social behaviour in a multidimensional way although it has
subsequently been applied to a much wider range of areas of experience than just the construction of social behaviour. Cognitive Complexity has since been related to a number of other aspects of behaviour. Bieri (1955) found that there was a significant positive relationship between Cognitive Complexity (CC) and the accuracy of the prediction of the responses of another person to a questionnaire on social behaviour. Bieri also found that CC subjects were less likely to make assimilative projections, that is to assume a high degree of similarity between themselves and other people. Replications of this study, however, have not found this significant positive relationship between complexity and accuracy (Leventhal, 1957; Sechrest and Jackson, 1961).

Several studies have also related CC to impression formation, and many of these have been reviewed by Crockett (1965). In general it seems that more complex subjects are better able to integrate potentially contradictory information from descriptions of unknown others, are more aware of the possibility of the existence of positive and negative attributes in the same individual and are less susceptible to order effects in impression formation. Crockett does point out, however, a number of inconsistencies in this research.

Inconsistencies are also present in work relating CC to behaviour change. Some have predicted more change in cognitively complex individuals (e.g. Lundy and Berkowitz, 1957), while others have predicted more change in simple subjects (Mayo, 1959).

The large number of studies in this area have generated a large number of instruments to measure the complexity of cognitive
structure. While the conceptual details of different investigators vary, it is generally postulated that some persons are prone to employ few dimensions when they perceive and interpret stimuli or are inclined to make only gross discriminations among dimensions of meaning. Others are held to employ many dimensions and/or to make fine discriminations among the dimensions they employ.

However, studies which have investigated the relationships between these various measures have found very little agreement. Little (1969) in a study of sex differences in CC compared three measures and found very low intercorrelations. Kuusinen and Nystedt (1975) correlated four measures: Bieri's index; an interaction variance measure; the number of factors from a factor analysis of a grid; the percentage of first factor variance. Again they found little agreement between some of the scores. Vannoy (1965) compared a much wider range of instruments designed to measure cognitive complexity or similar concepts. He subjected his data to a factor analysis and reasoned that if it yielded one factor that accounted for a large proportion of the variance and if the content of the factor was appropriate, it could be viewed as support for the existence of a general psychological construct of cognitive complexity. No unitary factor emerged from Vannoy's analysis and he argued that CC is not in fact a general trait as had been assumed and that it is a multidimensional characteristic of construct systems rather than a unidimensional one.

A number of suggestions have been put forward to account for the low correlations between measures of what is assumed to be the same property. Miller (1969) suggested that the somewhat tenuous
nature of the psychological status of CC might be due to situational factors that investigators had not taken into account. Possible factors include various attributes of the stimuli being judged, the kind of relationship between the perceiver and the stimuli and characteristics of the experimental task.

In investigating the effect of the amount of information presented, Miller predicted that the difference between those high and low in complexity would be greater in the high information condition. Miller's hypothesis was not supported, which suggests that such situational factors as information load are not significant determinants of complexity scores.

Adams-Webber (1973) studied the effect of the nature of the target in person perception tasks. He found that the cognitive complexity of the target, which is in some sense similar to information load, was an important factor. He suggested that failure to control for this may account for the failure of other studies to replicate Bieri's (1955) findings.

Scott (1969) suggests three factors that he feels may account for the poor convergent validities of different measures of what is held to be a single structural characteristic. Firstly he suggests that the assumption implied in most measures, that cognitive styles operate similarly over all domains, may not be justified. While there are theoretical reasons for this argument, the empirical evidence as to generality of CC across different domains is at best equivocal and this would not explain the lack of agreement of studies and measures in the same domain. Secondly, Scott suggests that instrument specific factors such as response styles may have overwhelmed
common content variance. Thirdly, he suggests that a crude conceptualisation of the property involved has led to the inclusion of irrelevant instruments.

What points to even more serious problems in conceiving of cognitive structure in terms of CC is inconsistency and contradiction arising in one theoretical framework. An example of such a contradiction is provided in a study by Warren (1966). In attempting to relate the concepts of Bernstein to those of Kelly, Warren argued that the difference between restricted and elaborated codes should be reflected in cognitive structure and therefore that middle class adolescents should be more cognitively complex than working class adolescents. Warren's measure of CC was derived from the modification of Bieri's technique developed by Bannister (1961) in his work on thought disordered schizophrenia. However, it emerged that, while both Bieri and Bannister worked within a PCT framework and used similar methods, Warren could derive opposing hypotheses from their work.

According to Bieri a more complex system, that is one with a low degree of interrelationship between constructs, is one with more dimensions of meaning. It is a more differentiated system and therefore more accurate, more versatile, adaptable and flexible. Warren therefore predicted that middle class adolescents should show a low degree of relationship between constructs.

Bannister, like Bieri, based his measure on a matching score derived from comparing every construct with every other for differences and similarities. According to Bannister, however, it is a measure
of the degree of organisation in the system, rather than the
degree of differentiation. At one extreme, corresponding to
Bieri's low complexity or simplicity, the degree of relationship
between constructs is such that they are all equivalent and merged
into one. The individual has only one dimension with which to construe
his experiences rather than being able to differentiate between them
in a number of ways. Both Bieri and Bannister regard construct
systems at this extreme of the dimension as dysfunctional; but
they disagree as to the interpretation of the other extreme of the
dimension and of the region between the extremes. Bieri regards
movement away from the simplicity end of the dimension as a
continuing improvement in the efficiency of the construct system.
At the other end of the dimension is the highly complex, highly
differentiated construct system with little or no matching between
the constructs and consequently of greater accuracy and adaptability.
Bannister however sees the dimension as having a curvilinear
relationship to the efficiency of construing. The opposite end of
the dimension to simplicity, Bannister sees as representing a complete
lack of organisation within a system. The lack of relationships
between constructs reflects the lack of implicative links, the absence
of a system of construing and confused thought processes. The most
effectively organised construct system lies somewhere between these
extremes. Thus we have the paradox of increasing organisation
being associated with cognitive simplicity and complexity being
equated with confusion.

One reason for this paradox may be the inadequate translation
of these concepts into operational measures. Both differentiation
and organisation have been operationalised in terms of the degree of relationship between constructs in a repertory grid. In the case of differentiation, relationships between constructs are assumed to reflect equivalence or lack of functional uniqueness. The higher the degree of interrelationship, the smaller the number of separate parts or dimensions in the system. In the case of organisation, however, relationships between constructs are assumed to reflect implicative or organisational links between separated or differentiated parts of the system. There seem to be no attempts at differentiating between these two possible interpretations of construct relationships. When do they cease indicating functional equivalence and start indicating organisational links between differentiated parts? One possibility may be to consider the strength of individual relationships. One might argue that very strong relationships between constructs reflect functional equivalence while less strong relationships indicate organisational links. The problem with the measures adopted by Bieri and Bannister is that as it takes an overall index of construct relationships, it is impossible to abstract what this reflects in terms of the strength of individual relationships. Therefore from their measures we do not know whether a high degree of relationship represents high complexity or differentiation, low organisation or moderate levels or both.

Contrasting these alternative interpretations of the meaning of relationships between constructs points out the inadequacy of an approach to cognitive structure which is concerned solely with the degree of differentiation of the construct system. Bieri has described the cognitively complex or highly differentiated individual
as tending to view the world in a multidimensional manner and has assumed that this tendency is a consequence of the availability of a large number of dimensions in the construct system. However, the ability to view the world in a multidimensional fashion should not depend simply on the dimensional nature of an individual's construct system. While the possession of a large number of constructs or dimensions gives greater potential for a more multidimensional view it does not guarantee it. This should depend on the extent to which these separate dimensions can be related or organised to be used simultaneously and provide an integrated perception. Bieri's notion of Cognitive Complexity concerns only the number of dimensions within the system and not how they can be organised or integrated.

Landfield (1977) has commented on the inadequacy of measuring structure solely in terms of differentiation within the theoretical context of PCT. He points out the central importance of hierarchical organisation or ordination as reflected in Kelly's Organisation and Fragmentation corollaries. Landfield distinguishes between low-ordinated 'Fragmenting Man', who is unable to relate his dimensions or constructs within the same or across different levels of abstraction and who adopts an exclusively propositional focus, and more ordinated individuals who do relate their constructs at the same and different levels of abstraction to produce organised superordinate and subordinate structures. Within this group of more highly organised individuals, Landfield distinguishes between 'Assuming Man' who is unaware of exceptions to his construct relationships and functions more at the level of assumption having a predominantly constellatory outlook, and 'Hypothesising Man' who
is aware of exceptions and attempts to test out the relationships between his constructs.

**Conceptual Systems Theory and Cognitive Structure**

Another, more sophisticated, approach to cognitive structure has been proposed by Schroder, Driver and Streufert (1967). Their ideas represent an extension of Conceptual Systems theory as proposed by Harvey and his associates (Harvey, Hunt and Schroder, 1961; Harvey, 1966).

Schroder et al. regard cognitive structure as a multidimensional characteristic and distinguish three aspects: Differentiation; Discrimination and Integration.

1. Differentiation. They define differentiation in a similar way to Bieri; as the number of elementary dimensions (stable, unique orderings of stimuli) in a complex cognitive structure.

2. Discrimination. In dealing with the dimensionality of the system, however, Schroder et al., also consider the capacity of the dimension or construct to discriminate between stimuli or elements. They suggest that discrimination has four aspects:
   i. The number of stimuli that can be judged or assimilated by a given dimension. This is very similar to the concept of range of convenience with PCT.
   ii. The fineness with which the dimension can be used. This refers to the number of judgemental categories within a dimension to which stimuli can be assigned and contrasts those with dichotomous black and white dimensions with those who employ dimensions as finely discriminating scales.
iii. The degree to which the final assignment of stimuli to categories is delayed.

iv. Flexibility of information processing. Schroder argues that the less forced the rules of admission or assignment are, the more stimuli it should be able to discriminate freely. This suggests that this aspect is related to the ability of the system to incorporate new elements into existing dimensions.

These latter two are only indirect aspects of discrimination and it may be more appropriate to regard them as consequences or manifestations of the degree of discrimination rather than aspects of discrimination itself.

3. Integration. The third aspect of structure that Schroder et al., discuss is Integration which they suggest is crucial in determining the complexity of the system. Integration has to do with the relationships between the differentiated parts of the system. It is the process by which a number of dimensions are used simultaneously or in interrelation in making a judgement and thus provides the capacity for a multidimensional as opposed to a unidimensional view of the world.

Integrative complexity refers to the complexity of the combinatorial rules or schemata organising both dimensions and other schemata. Low integrative complexity is roughly synonymous with a rigid hierarchical form of organisation in which the rules relating dimensions or constructs are fixed. Schemas for organising alternative combinations or arrangements of dimensions do not
exist and so the relationships between parts are relatively static. Structures with a high level of integration have more connections between rules. They have more schemata for forming new hierarchies which can be generated as alternative interpretations or as further criteria for comparing outcomes. Highly integrated structures contain more degrees of freedom and thus are more able to tolerate change in parts of the system without disturbing the integrity of the system as a whole. This is clearly related to the flexibility of construct relationships which marks Landfield's distinction between 'Assuming' and 'Hypothesising' Man.

Thus Shroder et al. argue that it is the level of integration of the system that determines its capacity to construe multidimensionally and to behave flexibly and adaptably, rather than the degree of differentiation as suggested by Bieri.

The relative independence of differentiation and integration has been discussed in detail by Streufert (1970). In summary, it seems that while a certain level of differentiation is necessary for a high degree of complexity of cognitive structure it is not sufficient by itself. An increase in differentiation is not a guarantee of increasing complexity in terms of multidimensional construing and flexibility. The number of dimensions is not necessarily related to the integrative complexity of the conceptual structure, although the greater the number of dimensions the greater the potential for the development of an integratively complex system. An individual possessing only a few dimensions on which to order his experience may be able to combine these in a large number of different ways enabling multidimensional interpretation of the
world. Although, given the complexity of his organisational schemata, a larger number of dimensions would enrich his perception of the world, such an individual still, in many ways, has the advantage over the individual who has a large number of dimensions in his system but is only able to use them independently and in isolation and therefore cannot generate such multidimensional perspectives.

Harvey et al. (1961) and Schroder et al. (1967) see the processes of discrimination, differentiation and, most importantly, integration as giving rise to cognitive structures which vary along the dimension 'concrete-abstractness'. Harvey sees this dimension as being defined by such properties as Clarity-Ambiguity, Compartmentalisation-Interrelatedness, Centrality-Peripherality, and Openness-Closedness.

1. Clarity-Ambiguity refers to the definitiveness with which a concept or construct in the system has been differentiated. At the level of more concrete functioning the system is incapable of within or between concept distinctions and as a consequence tends to react to many situations that contain basic differences as if they were similar. This clearly refers to the degree of discrimination and differentiation in the system as we have defined them.

2. Compartmentalisation-Interrelatedness refers to the degree of connectedness between the elements of a system following their individuation, the number of organisational links or the degree of integration between parts. Harvey argues that differentiation without integration is less concrete than lack of differentiation but less abstract than differentiation with integration.

3. Centrality-Peripherality is the degree of dependence of other
concepts or parts of the system upon a given element. In a
maximally abstract system all elements must be interrelated in
such a way that each contributes to the functioning of the system
but not too heavily so. This allows for a higher substitutability
of parts.

This dimension appears to have more to do with the quality of
the interrelationships between parts. Harvey does not comment on
the relationship between interrelatedness and centrality but it might
be suggested that integration itself can be regarded as a multi-
dimensional characteristic.

4. Openness-Closedness. Harvey also suggests that the abstract
system is more receptive to deviant events and has a greater
capacity to admit into the system impingements from the outside
without disruption of the system. The more open system has a greater
tolerance of the different and novel.

Schroder et al. (1967) describe in detail the characteristics
and implications of varying levels of abstractness. Simple or
concrete structures are characterised by a relative independence
and hierarchical organisation of parts. Regardless of the number
of dimensions or the number of integrative rules or procedures
present in the system, the integrating structure is absolute. The
implications for the functioning of concrete structures are as
follows: stimuli are interpreted unidimensionally; such a system
identifies and organises stimuli in a fixed way and the rules
derived from existing schemata are explicit in defining this fixed
way; few degrees of freedom exist, the low degree of differentiation
limits the potential for generating or resolving inconsistencies and
ambiguities by means other than exclusion; dimensions are dichotomous with regard to the distribution of stimuli.

Behaviour patterns characteristic of the concrete level are: categorical thinking; minimising of conflict, stimuli either fit or are excluded from consideration and there is no apparatus capable of generating alternatives; behaviour is anchored in external conditions; there is greater generalisation of functioning within a certain range; change; when it occurs, is more abrupt.

Increasing abstractness or structural complexity involves the generation of more complex rules for the combination and comparison of dimensions allowing multidimensional judgements of the environment. Eventually, at a sufficiently high level of abstractness, combinations of the schemata or rules themselves become possible which greatly increases the potential for the generation of alternatives. The possibility of choice develops, allowing an awareness of 'self' and the possibility of the internal control of behaviour. In highly abstract functioning it is possible to generate or apply general rules that systematise or integrate a large and differentiated body of information generated by simpler schemata. A highly abstract orientation should also be highly effective in adapting to a complex and changing environment.

SUMMARY

In this chapter we have suggested the important role of structure in cognitive functioning. It was suggested that the flexibility of the system and its pattern of progress in terms of the Piagetian concept of adaptation and the closely allied Kellian notions of
anticipation and validity are a function of the structural characteristics of the system. This hypothesis will be discussed further and put to the test in Part Three.

The inadequacy of Bieri's analysis of cognitive structure in terms of Cognitive Complexity was pointed out. It deals solely with the degree of differentiation, the number of dimensions in the system, and not how these dimensions might be related. We discussed a more sophisticated, multidimensional view of cognitive structure proposed by Harvey and Schroder et al., which places more emphasis on the nature and extent of relationships between the parts of a system which seems to bear a closer relationship to the capacity for multidimensional construing and the flexibility and adaptability of the system. We shall apply this more sophisticated, multidimensional view of cognitive structure in the study of developmental changes in construct systems described in Part Two.
In the previous chapter it was argued that an adequate conceptualisation of cognitive structure should recognise that structure is not a unitary characteristic of a cognitive system but rather the combination of a number of different aspects which, to a certain extent are independent of each other.

It follows from this that any attempt to operationalise and measure cognitive structure cannot rely on one index but must take into account measures of each aspect of structure.

In the previous chapter the multidimensional model of structure proposed by Harvey, Hunt and Schroder (1961) and Schroder, Driver and Streufert (1967) was offered as having certain advantages over the more limited unidimensional model of Bieri (1955). Harvey et al. defined three
major components of structure: differentiation, discrimination and integration. We will consider each of these in turn and discuss means of operationalising and measuring them.

DIFFERENTIATION

Differentiation has been described as the number of dimensions or functionally unique arrangements of stimuli within a conceptual system. A wide variety of techniques purporting to measure differentiation have been developed, but here the discussion will be restricted to three categories of measures: those derived from Object Sorting, Repertory Grid methodology and Multidimensional Scaling techniques.

Object Sorting

The rationale behind Object Sorting techniques, as modified by Sloan (1959) and Clayton (1959) to measure differentiation, is that the number of categories into which the subject sorts objects into, on the basis of as many different relations as he can devise, is a measure of differentiation. However, this method has certain disadvantages as noted by Scott (1962). Some nominal categories may be parts of larger, more complex modes of differentiation; for example, 'good' and 'bad' categories as parts of a 'good-bad' dimension. Also subjects do not reveal differences in organisation by the use of nominal categories. Two categories may contain the same elements but be labelled differently. To ensure discrimination between functionally different and nominally different categories requires some degree of scaling within categories.
A wide variety of measures of differentiation have been developed from the Repertory Grid and many of them are reviewed by Bonarius (1965). These include:

1. The number of factors extracted in factor analysis of the grid.
2. The explanatory power of the first factor.
3. An overall matching score computed by comparing each construct with each other construct.
4. The sum of all differences between all construct patterns.
5. The total number of verbally different constructs.

To ensure that constructs are functionally as well as nominally unique requires some consideration of how they are used, as well as of the labels that are applied to them. For this reason the last measure listed, the number of verbally different constructs, is clearly inadequate on its own.

The way that constructs are used to differentiate between elements is the basis of the measure of Cognitive Complexity developed by Bieri (1955), i.e. measure 3. He determined the extent to which the verbally different constructs that a subject generated were applied differentially to other persons. A subject who applied nearly every construct to refer to the same group of people was said to be cognitively simple, while one whose constructs provided markedly different groupings among the elements was said to be cognitively complex.
This measure has a number of weaknesses. Firstly, Bieri employed a dichotomous element allotment procedure in which the subject was free to classify as few or as many constructs under each pole of the construct as he saw fit. As Bannister and Mair (1968) have pointed out, such a procedure can artificially elevate the degree of association between constructs. High matching scores which can result from a preponderance of blanks, while enforcing statistically significant relationships between constructs, do not necessarily imply psychological association.

Another fundamental criticism of Bieri's measure is that it fails to take account of inverse relationships between constructs. As described above, Bieri employed a dichotomous rating procedure of checks and voids and then compared constructs on the pattern of these ratings. Similarity between two constructs was assessed by the extent to which checks co-occurred on the set of elements. Such a procedure would not classify as similar two constructs where the explicit pole of one construct was closely related to the implicit pole of the other construct and vice versa. Checks on one construct would be associated with voids on the other. This may be an error in reporting or it may be that Bieri is treating constructs more as categories and denying them the dimensional status central to PCT.

This problem is surmounted by measures derived from factor analysis, principal components analysis, or some form of cluster analysis of the grid which consider the absolute size of the relationships between constructs, defining similarity irrespective of its sign. However, Schroder, Driver and Straufert (1967)
criticise Repertory Grid measures of differentiation in general on the basis that such techniques limit the number of dimensions that a subject can generate. If the triadic procedure is used to elicit constructs the number of constructs is limited by the number of triads presented. Schrodor et al., argue that this may have the effect of grouping together moderately and extremely differentiated subjects. Two points can be made in answer to this criticism. Firstly, many of the measures derived from the Repertory Grid do not indicate the actual number of dimensions present in the system, but give an indirect indication of the degree of differentiation by reflecting the degree of relationship or similarity between constructs. Crockett (1965) suggests that such a measure is highly correlated with the number of dimensions in the system. If this is the case, it is not particularly important to elicit all of an individual's constructs, but merely to have uncovered a representative sample in which the degree of similarity reflects the degree of similarity between constructs in the system as a whole. Secondly, research using the Repertory Grid suggests that presenting twenty or thirty triads is sufficient to elicit most important constructs for most adult subjects. This number is not unmanageable for analysis.

Disadvantages of Bieri's dichotomous rating scale have already been mentioned; but also it provides only a very crude indication of the use of constructs. It precludes the use of constructs as more sophisticated ranking or rating scales. Like Object Sorting, it provides only a very crude indication of the degree of functional similarity or difference between constructs. Within similar dichotomous groupings on two constructs elements might be ranked.
or rated very differently. This problem can be overcome by allowing
the subject to use a more sophisticated ranking or rating scale.
Grids with more sophisticated rating procedures are more amenable
to some sort of multivariate data analysis, such as factor analysis
or the specific form of principal components analysis applied to
Repertory Grids by Slater (1967, 1972). Two measures have been
derived from these analyses: the number of significant factors or
components, normally defined as those with an eigen-value greater
than one, with a large number of components indicating a more highly
differentiated system; and the size of the largest factor or component
in terms of the amount of variance accounted for, a large first
component indicating a relatively undifferentiated system.

Multidimensional Scaling

Multidimensional Scaling (MDS) provides a third technique
from which a measure of differentiation has been derived. Like
factor analysis or principal components analysis, MDS is a form of
multivariate data analysis which collapses certain aspects of data
and represents the relationships between other aspects in a
parsimonious fashion. MDS differs from factor, principal components
or regression analysis in that it does not subscribe to the metric
or variance assumptions of these techniques. It uses only the ordinal
information from a block of data, for example, from similarity judg­
ments between a set of objects. Like the other forms of analysis,
however, the psychological rationale of such a procedure is that
it uncovers the number, kind and organisation of the dimensions
employed by an individual in his perception and evaluation of a
complex world.
Initially the method was developed to deal with physical phenomena such as the amplitude, frequency and complexity of light waves and their role in the perception of similarities of colours. However, there are also a number of studies which have shown that it is a useful tool in the areas of interpersonal and social perception (Messick, 1954; Morton, 1959).

How good a measure of differentiation is MDS? On some of the criteria already discussed MDS performs relatively well. Dimensions derived by MDS are functionally unique, as each dimension orders the stimuli in a different way. Any dimensions generated by MDS necessarily have a certain degree of utility as the dimension only emerges because it underlies the complex task of making judgments of stimuli.

Schroder, Driver and Streufert (1967) discuss one disadvantage of MDS as a technique for measuring differentiation: it limits the number of dimensions derived. It seems to reflect only those dimensions that map all the stimuli on the attribute and then only those that arrange the stimuli on at least an ordered scale. Schroder et al. argue that it is possible that MDS misses dimensions which might relate to only some stimuli or which arrange the stimuli in a dichotomous or other simple order.

If the measure of differentiation is taken as the number of dimensions, MDS suffers from the same weakness as Schroder et al. point to with respect to Repertory Grid methods. The number of dimensions generated is limited to a certain extent by the number of stimuli that the subject is asked to judge.
MDS suffers from other disadvantages with respect to the interpretation of the meaning of the dimensions. This will be expanded upon later in this chapter.

All of these measures suffer from the weakness pointed out in Chapter III in the discussion of the reasons for the confusion between Biari and Bannister's concepts and measures of cognitive structure. These measures are based on an assessment of the degree of relationship between constructs. As argued in Chapter III, it is not clear to what extent such measures reflect differentiation between parts of the system, or inversely, organisation of the parts. It was suggested that a possible resolution of this problem would be to discriminate between different levels of strength of relationship. Very strong relationships should indicate that constructs are similar and therefore not differentiated from each other. Less strong relationships should indicate that two constructs are differentiated and have distinct meanings but still possess links that can be regarded as organisational or implicative. With measures that give an overall indication of the degree of relationship within the system it is impossible to discriminate between these two aspects. Such discrimination may be possible via cluster analysis. Depending on the criterion level for clustering the number of clusters may be taken as a measure of differentiation or as a measure of organisation. A large number of clusters when the criterion is very strict would suggest high differentiation.

DISCRIMINATION

Schroder et al. describe four aspects of discrimination, only
two of which can be regarded as direct indications of the structural property. The first is 'stimulus range' which is analogous to range of convenience in PCT terms. The second is 'fineness of discrimination within dimensions'. Schroder et al. discuss three types of measure of fineness: ratio estimation, direct rating in test and retest, and MDS. An alternative method using the Repertory Grid might be to consider the use of constructs as rating scales in terms of how many intervals or categories are used, or to consider the spread of constructs or elements on the higher order components of a grid (see Abercrombie, Stringer and Terry, 1971).

INTEGRATION

The third and most important aspect of structure discussed by Schroder et al. is integration. They consider it to be the most important component determining the level of abstractness of the system. While the potential upper limit may be set by the number of dimensions in the system, the actual level is due far more to the integrative complexity of the system. Integrative complexity was defined by them as the extent to which differentiated dimensions can be interrelated and recombined in different ways such that they may be used to allow multidimensional perceptions of the world and more flexibility in the system.

Projective Techniques

From this concept of integration a number of open-ended projective techniques have been developed. Harvey has developed the 'This I Believe' test which requires the subject to complete
in two or three sentences the phrase 'This I believe about...'

various relevant items. The sentences are then scored in terms

of the abstractness or concreteness of their contents. Schroder

et al. have developed a similar Paragraph Completion test together

with a refined scoring procedure.

The basic disadvantage of these projective techniques is the

complexity of the scoring procedure. Raters have to reach a certain

level of expertise to be able to apply the scales reliably and

validly. There is also the danger of rater subjectivity distorting

scores. Even if high inter-judge reliability can be attained the

problem still remains that one cannot guarantee that the subject

will produce scaleable responses.

Multidimensional Scaling

Turning to more objective methods Schroder et al. again

suggest that the use of MDS can provide several kinds of information

about a multidimensional system.

MDS indicates whether or not a set of dimensions is integrated.
The model is set up so that a dimension will not be developed unless
it contributes something to each judgement of similarity. MDS
then allows the estimation of the weighting each dimension receives
in the judging process. Schroder et al. argue that uneven weighting
of dimensions suggests that not all relevant information concerning
the dimensions was integrated in the judgement. Conversely, an
integrated structure should be reflected by relatively even
weighting of dimensions.
MDS can indicate the nature of the dimensions within a system. Their meaning can be inferred from the arrangement of stimuli on each dimension.

As a modification, Schroder et al. suggest the use of repeated MDS analyses as a means of measuring the complexity of the dimensional schemata. They suggest that such an analysis may be essential to discriminate between simple and complex subjects if complex subjects generate one super-dimension which, when further analysed, might be revealed as an integration of many dimensions.

MDS has certain advantages over projective techniques. But, as discussed earlier, it does have certain disadvantages as a measure of other aspects of structure. In addition it does not require the subject to provide individually defined dimensions of meaning. A lot of information that can be elicited from the individual is not available in MDS. This is a particularly serious disadvantage if one is interested in the content as well as the structure of the system. Although the meaning of dimensions yielded by MDS can be inferred to a certain extent from the configuration of stimuli, this inference relies on the interpretation of the experimenter and may in no way correspond to the individual's own dimensions of meaning.

What is required is a technique which combines the capacity to elicit information about the content of an individual's cognitive system, as in projective techniques, with the possibility of objective indices of structural characteristics as in MDS. It seems that the greatest potential for the combination of these
requirements lies in Repertory Grid methods. The elicitation of personal constructs provides information about the content of the system. We have already discussed measures of differentiation and discrimination that can be derived from grids.

**Repertory Grid Measures**

Let us turn to grid measures of integration. We have already suggested that the degree of organisation of parts of the system is indicated by the degree of relationship between constructs in the grid if relationships of an appropriate strength are considered. While strong relationships should indicate lack of differentiation, less strong relationships should indicate organisation.

As an alternative measure, a highly integrated system in which all dimensions are of approximately equal importance (Driver, 1962) should generate relatively high average loadings on principal components other than the first. From the same rationale, the rate of decline of the percentage of variance accounted for by successive components, should be shallower in more integrated systems. A less integrated system might produce a very large first component and small later components while a more integrated system might produce a larger number of moderately sized components.

Yet another measure has been developed by Smith and Leach (1972). The rationale for their measure is again that more integrated subjects have more evenly weighted dimensions. From a raw grid Smith and Leach computed two correlation matrices, one for constructs and one for elements. These matrices were then subjected to heirarchical cluster analysis. The degree of integration
was measured by inferring the importance of structure in the system. Hypothesising that fine details of a construct system should be more important for a highly integrated or complex individual, Smith and Leach investigated the consequences of impoverishing the construct system. This they did by taking constructs that correlated above a certain level and regarding them as equivalent. Mean ratings of these combined constructs were applied to the elements, which were subjected to a second cluster analysis. The two cluster analyses were compared and the greater the difference, the greater the degree of complexity or integration. Smith and Leach report that this measure bears some relationship to scores on the 'This I Believe' test.

A measure of Landfield's notion of ordination can also be derived from the Repertory Grid. Landfield (1977) suggests that high and low ordinated subjects can be distinguished in terms of the degree of differentiation, in a statistical rather than psychological sense, at a moderate level of strength of relationship between constructs. This is essentially the same measure as that proposed for organisation. More organised or ordinated subjects should show less differentiation or fewer construct clusters at a moderate criterion level.

Landfield also distinguishes between two groups of highly ordinated subjects. 'Assuming Man' has a more rigid perspective and is unaware of exceptions to his construct relationships. 'Hypothesising Man' is aware of exceptions and attempts to test out these relationships. Landfield suggests that these two groups can be distinguished by comparing the degree of differentiation they
show at stringent and moderate criterion levels. Assuming Man should show little differentiation at both levels, while Hypothesising Man should show low differentiation at a moderate level and high differentiation at a stringent level.

**SUMMARY**

In this chapter we have reviewed various methods of measuring the structural properties of cognitive systems.

With respect to differentiation it was suggested that Repertory Grid techniques offer the best alternative. It was pointed out that previous measures of differentiation derived from grids have confounded the measurement of differentiation and organisation. It was argued that overall measures of the degree of relationship within a grid were inadequate as measures of differentiation and that the level of individual relationships needs to be considered.

Discrimination can also be assessed from a grid in terms of the number of intervals employed in the use of a construct dimension.

The disadvantages of projective and MDS methods for measuring integration were discussed. It was suggested that indices could be derived from principal components and cluster analysis of a grid which would reflect the evenness of weightings given to dimensions in a system. Measures of organisation and Landfield’s notion of ordination were also proposed, as was the basis for distinguishing between Landfield’s Assuming and Hypothesising Man.
CHAPTER V

INTERPERSONAL PERCEPTION OF CHILDREN:
A REVIEW OF RESEARCH

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Summary 93

In Chapter II we discussed the implications of Piagetian Theory and PCT for the development of children's interpersonal construct systems. In this chapter we will review existing research in the general area of children's interpersonal perception.

Previous reviewers in this area (e.g. Livesley and Bromley, 1973) have commented on the dearth of studies into the development of interpersonal perception compared with the large body of research into the development of understanding of the physical world and such properties as volume, space, etc. Two major areas of interest can be identified in the existing research: the content of children's interpersonal perception and its structure.
For convenience we will divide research into the content of children's interpersonal perception into three categories representing different methodological approaches.

Rating Scales

A number of studies have examined children's interpersonal perception by means of rating scales provided by the experimenter (see Dubin and Dubin, 1965). In general they suggest that, with increasing age, children's judgements become more realistic and include more subtle aspects of behaviour. However a number of factors limit the extent to which these conclusions might be generalised. Firstly, many of these studies have held age constant and provide no systematic evidence of the developmental processes at work. Secondly, a large proportion of them are concerned, not with person perception in general, but with perception of 'self' or parents. Thirdly, the use of rating scales provided by the experimenter imposes severe response constraints on the child which may limit him in expressing his own characteristic ways of perceiving and understanding other people.

Free Descriptions

The second approach is an attempt to overcome this last weakness and has involved eliciting from children, in either oral or written form, free descriptions of other people.

One of the earliest studies to adopt this approach was carried
out by Watts (1944). In a general study of children's language and cognitive development, Watts concluded that up to about six years of age children usually limited their descriptions of other people to outstanding physical features. If the child's description went beyond this to give any impression of personality it usually involved dividing people into two classes, good and bad; those who were liked and those who were disliked. During the years from seven to eleven children gradually begin to differentiate between different shades of 'good' and 'bad'. Terms such as 'good', 'nice', or 'kind' become specified as 'honest', 'truthful', 'polite', 'courteous', 'agreeable', 'generous', 'helpful', etc.

Unfortunately Watts only reports very general trends. He gives no detailed information about the number of different types of description in each age group. Furthermore, he gives no information about the subjects or details about the methodology used to elicit the descriptions. The vagueness of his report makes it virtually impossible to draw any detailed conclusion as to the developmental process.

A study by Yarrow and Campbell (1963), reported in more detail, examined person perception in over 250 children aged eight to thirteen years while they were at a two week summer camp. Groups of children, strangers to each other, shared a cabin, and each child was asked for his impression of the cabin member he knew best at the beginning and end of camp. Coders divided each description into 'units' defined as 'discrete actions or single characteristics or evaluations'. The number of units per description ranged from one to twenty-seven with a mean of eleven. Yarrow and Campbell do not report any analysis of
The descriptions were then content-analysed and each unit was assigned to one of seventeen content categories. The content analysis showed that children tended to make broad evaluations. Eighty-five per cent of the descriptions included units of this type. Where any elaboration took place it most commonly involved a concern with the other child's interpersonal actions. The most frequently used interaction categories were sociability, conformity, verbal sociability, affiliation and physical play. The major developmental question that concerned Yarrow and Campbell was whether there were any age differences in the use of the different content categories. After collapsing the categories to four major dimensions of interaction: Affiliation, Aggression, Assertion, and Submission, only one age trend was found to be statistically significant. Older children referred to Aggression more often than younger children.

Yarrow and Campbell interpreted the meagre developmental differences as suggesting that cognitive systems for describing and understanding other persons emerge early in childhood, before the age of eight. It seems unlikely, however, that development will not continue after this, particularly in a period which other research suggests is characterised by significant cognitive changes. An alternative explanation for the lack of age differences is that the content categories employed by Yarrow and Campbell were not sensitive to the developmental changes that did occur.

A number of theories of cognitive development (e.g. Piaget, 1952; Werner, 1947; Bruner, Olver and Greenfield, 1966) suggest that
that it may be more appropriate to classify descriptions, not by their meaning but by their level of abstraction; that is, whether they refer to concrete characteristics such as physical appearance or specific actions or to abstract, higher order, dispositional qualities. A number of studies have investigated variations of this dimension.

Scarlett, Press and Crockett (1971), working within the framework of Werner's organismic theory of development, asked boys in the first, third and fifth grade to describe four persons in turn: a boy they liked, a boy they disliked, a girl they liked, and a girl they disliked. Scarlett et al. argued that Werner's theory predicts that there should be a developmental trend towards a greater number of constructs used to describe peers; a shift from a relatively egocentric mode of description to a non-egocentric one; and a shift from a concrete mode of construing to an abstract one.

The personality constructs from each description were assigned to one of four categories:

(a) Concrete-we constructs: Child did not distinguish between himself and another but described what they did together.

(b) Egocentric-Concrete: Described what other person does in particular context and describer is object of the sentence.

(c) Non-egocentric-Concrete: Referred to concrete behaviour but did not include describer.

(d) Abstract: Referred to abstract attributes which were not limited to a specific context.

As predicted, the results indicated significant developmental shifts from egocentric to non-egocentric constructs and from concrete
to abstract constructs. First graders used mainly egocentric-concrete followed by non-egocentric concrete constructs. Their descriptions only rarely mentioned abstract constructs. Third graders showed a similar pattern although they used proportionately more non-egocentric constructs, both of a concrete and abstract nature. Fifth graders used abstract constructs most frequently, followed by non-egocentric concrete constructs. Scarlett et al. report their results as proportions rather than as simple frequencies, which precludes an interpretation of the results as reflecting developments in verbal fluency. The results also showed a significant age trend towards an increasing number of constructs per description. Although this was interpreted by the authors as evidence of greater differentiation, it may be the result of increasing verbal fluency. Bigner (1974) in a similar study of children's perceptions of siblings from kindergarten to eighth grade, found similar results and Rosenbach, Crockett and Wapner (1973) also found similar age trends in three age groups (6-7, 12-13, 18-19). The major changes occurred between six and twelve years of age, the two older groups showing few differences.

One further point needs to be made in the interpretation of these studies. Scarlett et al report that 'personality constructs' from each description were content analysed. However, it is not clear exactly what is meant by the term 'personality' in this context. It may refer to any construct that is used to describe persons or it may only refer to those constructs which imply psychological characteristics and thus excludes those concerned with physical appearance, etc. If the latter is the case, it is not possible to
draw overall conclusions about the development of children's characteristic ways of construing other persons, but only about changes in constructs that are initially regarded as concerned with personality.

This ambiguity is not present in a study by Peavers and Secord (1973). They asked five groups, from children in kindergarten to college students, to describe three friends and one disliked person. These descriptions were divided into items each consisting of one discrete bit of information. Each item was scored on each of four dimensions:

Descriptiveness: the amount of information an item yielded about a person as a unique individual. Four levels were distinguished: Undifferentiating, Simple Differentiating, Differentiating, and Dispositional. At the lowest level the person would not be differentiated from his environment but described in terms of possessions or social setting. At the highest level the person was described in terms of psychological characteristics which had implications for his behaviour in a wide range of situations. This dimension is clearly related to notions of concrete-abstractness.

Personal Involvement: the frame of reference an individual adopted in describing others; the extent to which he involved himself in the description. Three levels were identified - egocentric, mutual and other oriented, which relate to egocentrism versus non-egocentrism.

The other two dimensions were Evaluative Consistency and Depth.
These will be considered in more detail in the discussion of structural aspects of children's interpersonal perception which follows later in this chapter.

Considering first the results for 'descriptiveness', Peaers and Secord found that the proportion of undifferentiating and simple differentiating items decreased with age, while differentiating and dispositional items increased with age. At kindergarten level twenty-three per cent of items were classified as undifferentiating and only eight per cent as dispositional. For college students, on the other hand, only eight per cent were undifferentiating and thirty per cent were classified as dispositional. There is an age trend towards increasingly differentiating and abstract ideas; but what is surprising about the results is the relatively high proportion of simple differentiating items. These form the largest proportion for all age groups. Even college students, who might be expected to judge and describe others in predominantly dispositional terms, produced items thirty-one per cent of which were simple differentiating.

A tentative suggestion for these results is that they are dependent upon how the subject construes the experimental situation and what is required by the investigator. It may be that in the free description methodology where there is little interaction with or feedback from the investigator in the course of the description the subject only produces superficial descriptions. This point will receive further consideration in Chapter VI.

Turning to the 'personal involvement' dimension: for each age
group 'other-oriented' items constituted the largest category, although the proportion of such statements increased from sixty per cent at kindergarten level to seventy-eight per cent in eleventh graders. These results confirm the hypothesis of an age trend towards decreasing egocentrism. However, the extent of non-egocentrism in the youngest age group is surprising when compared with the results of the Scarlett et al. study.

A study by Livesley and Bromley (1973) represents the most extensive study to date of person perception in childhood and adolescence to employ the free description methodology. Their sample consisted of 320 children, boys and girls, ranging in age from seven to fifteen years of age. Each child was asked to write descriptions of eight people known to them; a man, woman, boy and girl whom they liked and similar people they disliked. The instructions specifically asked for information about the sort of person they were and not for information about physical appearance.

Each written description was divided into its component statements. A statement was defined as 'one element or idea'. Initial analysis of the number of statements produced showed significant age differences. Young children tended to produce fewer statements than older children. Livesley and Bromley concluded that the age trend was slightly curvilinear and decelerating, the greatest change occurring between seven and eight years of age and the age changes decreasing thereafter.

The statements were subjected to a series of content analyses.
The first analysis divided statements into peripheral, which basically corresponded to non-psychological, and central, which were psychological concepts. This distinction relates closely to the distinction between concrete and abstract concepts made in other studies.

Livesley and Bromley predicted that the proportion of central statements should increase with age and intelligence and should be higher in girls than in boys. The hypotheses regarding age and intelligence were supported. Girls used a greater number of central statements but not a greater proportion.

Age trends showed a similar pattern to those for the number of statements. There was a considerable increase in the use of central statements between the ages of seven and eight. The rate then declined and by the age of thirteen had more or less levelled off. This pattern, together with the findings of Scarlett et al. (1971), Rosenbach et al. (1973) and Peckers and Secord (1973), suggests that there is a growth 'spurt' in the use of more abstract concepts or constructs between the ages of six and eight years.

Livesley and Bromley carried out a more detailed content analysis classifying each statement into one of thirty-three content categories. Those categories showing a decline in use with age included those referring to general information and identity, routine habits and activities, possessions and family and kinship roles. A number of categories showed an increase with age and these tended to refer to more superordinate, abstract ways
of describing others, e.g. attitudes, behavioural consistencies and general personality attributes.

Thirdly, Livesley and Bromley analysed the use of trait names. Traits were defined as those occurring in the list of trait names produced by Allport and Odbert (1936). As predicted, the use of trait names increased significantly with age and, once more, the major increase occurred between the ages of seven and eight years with only slight changes thereafter. Overall, girls used a significantly higher proportion of trait names than boys but the effect of sex interacted significantly with age. The difference between girls and boys decreased with age: in the oldest age group there was no significant difference. There was also a significant age effect on the size of the trait vocabulary (the number of different traits per description). Again, the results showed an accelerated period of growth between seven and eight years of age and only a gradual increase thereafter.

The main conclusions that can be drawn from free descriptive studies of person perception in children are as follows. There is a developmental progression towards increasingly abstract modes of describing other persons. Below the age of eight years the child adopts an essentially concrete approach to person perception. He stresses the overt characteristics of others such as physical appearance, possessions, identity, etc. In contrast, older children stress covert characteristics of others such as dispositions, values, attitudes, etc., which presumably reflect an attempt to account for the consistencies and regularities observed in overt behaviours. Accompanying this is a shift from an egocentric to a
non-egocentric perspective. With increasing age children show a greater ability to describe and judge others in terms which do not involve themselves personally.

Many of the studies also suggest that girls of a particular age are more advanced than boys of the same age, in terms of the use of more abstract description. This superiority, however, seems to decline with age and to have largely disappeared by adolescence.

While the free descriptive approach as exemplified by these studies recognises the importance of eliciting from the child those interpersonal concepts which are of significance for him and which reflect his characteristic way of viewing others, it has certain limitations. One drawback is that such methods depend on the verbal ability of the child to formulate and communicate judgements that may normally be non-verbal or implicit. Secondly, as was pointed out earlier, in situations where the child is given instructions and left to produce descriptions independently, one has no control over how they interpret the demands of the experimental situation. It may be argued that the performance of a child on such a task does not necessarily reflect his ability to make social judgements at a particular level. More valid results might be obtained from an ongoing interaction with the child in which he can be encouraged to explore the further implications of the judgements that he might make. Thirdly, if our major interest is in the development of children's personal construct systems, it is important to recognise that constructs form the basis of discrimination between people and events. It might be argued that
such discriminations are implicit in free descriptions. It can also be argued that it would be more valid to build the need for discrimination and comparison into the methodology.

Repetory Grid Studies

This brings us to the third methodological approach we shall consider and, in the context of our interest in the development of personal construct systems, the most relevant; the use of the repertory grid techniques. The details of repertory grid techniques will be discussed in the next chapter. Like free descriptions, this approach has the advantage over rating scales of eliciting from the child his own characteristic ways of understanding. However, repertory grid's derivation from PCT means that, in contrast to free description methods, it emphasises the discriminative nature of constructs by encouraging discrimination between people. It can also be argued that this is also likely to elicit less explicit and less easily available constructs than the free description method.

Brierley (1967) employed a formal triadic elicitation procedure to obtain samples of personal constructs from 270 children of seven, ten and thirteen years of age. She then classified the constructs into six categories: appearance, kinship, literal, social role, behaviour and personality, and examined age differences in the use of these categories. The seven year olds reported appearance constructs most frequently followed by social role constructs and behaviour constructs. Ten year olds shifted to the use of behavioural constructs most frequently, followed by social role and appearance
constructs. Thirteen year olds also used behavioural constructs most frequently, followed closely by personality constructs.

The general trend was for the use of personality and behavioural constructs to increase with age and for the use of other types of constructs to decrease. While this general trend fits the findings of the free description studies, there are differences in detail. For example - Brierley's results suggest that it is only between ten and thirteen years of age that personality constructs rise to any degree of prominence. Other studies using free descriptions (e.g. Livesley and Bromley, 1973; Peevers and Secord, 1973; Scarlett, Press and Crockett, 1971) have suggested that the major change occurs between seven and eight years of age.

In a similar study Little (1968) investigated the personal constructs of three age groups: eleven, thirteen and sixteen years of age. He employed a similar classification scheme and found that the frequency, but not the proportion, of psychological constructs increased with age. This suggests that the age changes are due largely to differences in verbal fluency rather than significant shifts in modes of construing. This result again differs from the findings of the free description studies which found a significant although slower increase in the use of abstract, psychological constructs during this age period. Little's results also differ from Brierley's in that they show a dramatic increase with age in the use of role constructs and, even more surprising, a peak in the use of physical constructs during adolescence.

Little found no sex differences in the proportion of
psychological constructs. Boys used a higher proportion of role constructs than girls particularly in the youngest age group, and girls tended to use a higher proportion of physical constructs again in the pre-adolescent age groups. These results also differ from those of previous studies.

One contributing factor to the somewhat discrepant results of this study may be Little's over-inclusive use of the physical construct category. It included many of those constructs which other studies would have classified as behavioural. Little's most concrete category may well contain a large proportion of constructs which other studies have regarded as relatively abstract. This classification may conceal a significant age trend towards increasingly abstract constructs and may account for the high proportion of physical constructs during adolescence.

Another reason for Little's discrepant results may lie in his experimental procedure. His subjects were required to generate as many constructs as possible from each of four triads. Evidence suggests that such an elicitation procedure encourages the generation of trivial, less important constructs (Bender, 1974).

Summary

In these studies of the content of children's interpersonal perception there seems a general consensus that person perception proceeds from being predominantly concrete in character to being predominantly abstract. This is reflected in a transition from a concern with external, immediately discernible characteristics to an emphasis on underlying psychological characteristics which have
implications for a wide range of situations. This change is accompanied by a shift away from egocentric frames of reference. The results from most studies suggest that girls tend to be more advanced than boys but that this superiority decreases with age.

Where there is disagreement in these studies it is with regard to the age and rate at which this change occurs. Some studies suggest that children's psychological vocabularies develop relatively early, particularly between the ages of six and eight years (e.g. Scarlett, Press and Crockett, 1971; Livesley and Bromley, 1973). Others suggest that it is only in adolescence that truly psychological modes of construing become prevalent (e.g. Briarley, 1967). This difference seems to be related to the methodology employed, a point which we shall return to in Chapter VI.

STRUCTURE

As well as the development of the content of children's person perception, we can consider changes in the structural and organisational characteristics of such perceptions. (See Chapter III for a discussion of the structure of cognitive systems.) Livesley and Bromley (1973) have suggested that the ability to produce an organised impression or conception of another person, depends on the ability to create links, to build implications and inferences between the items of information in an impression. There are two distinct methodological approaches in research into the development of this ability. There are those studies which have inferred organisational and structural characteristics from the content of descriptions. These have employed variations of the free description.
technique. In contrast there are those studies which have investigated structural links and characteristics by using a variety of statistical procedures. Of necessity these studies have used more structured methods, such as repertory grid techniques. We will consider each area of research in turn.

Content Measures of Structure

Many of the studies discussed in the section on content also considered structural aspects of children's person perception.

Watts (1944) presents some findings with organisational implications. The free descriptions of the youngest children tended to be univalent. That is, they were either broadly positive or broadly negative. With increasing age these broad evaluations were increasingly elaborated and children began to construe others as possessing a cluster of distinct but similarly evaluated traits. This was followed by the recognition that the stimulated person could possess positively and negatively evaluated traits simultaneously. Between the ages of thirteen and fourteen only fifty per cent of the children in Watts' study recognised this possibility. Watts concluded that up to the age of eleven organisation of children's social perception was entirely univalent and undifferentiated. The development of an organisational level which allowed the reconciliation of inconsistent information and the formation of unified, integrated impressions was a relatively late process.

In a more fully reported and more adequately controlled study, Gollin (1958) inferred organisational level from children's ability
to reconcile inconsistent information about another person. Each subject was shown a film which depicted a boy behaving in a socially desirable and a socially undesirable way. Gollin scored children's descriptions of the film for the extent to which they inferred some underlying disposition or motive to explain one of the actions and also for the extent to which they introduced conceptual material to relate and integrate the conflicting behaviours.

Half of the subjects between eight and ten years of age reported the two themes and this tendency increased to ninety per cent at sixteen years of age. While the inference of underlying causes for one set of behaviour seemed to be well established by twelve years of age, almost no children below the age of ten referred to conceptual material to integrate the inconsistency. From ten onwards the use of such material increased gradually but only sixteen year olds used it to any great extent.

Like Watts, Gollin concluded that the ability to integrate conflicting information is a relatively late development.

Yarrow and Campbell (1963) also considered organisational level in a similar way, in terms of attempted explanations of another person's behaviour. From eight to thirteen years of age they observed a significant but slight increase in the complexity of such explanations.

Scarlett, Press and Crockett (1971) argued that the increased use of abstract non-egocentric constructs was evidence of increased organisational complexity.
The study by Peevers and Secord (1973) involved the rating of descriptive items on two dimensions which have organisational implications. Firstly, 'evaluative consistency': the extent to which the subject recognised positive and negative attributes in the same person. Peevers and Secord found that consistency was lowest in kindergarten, presumably because at this age children either do not recognise inconsistency or have not yet established any need to be consistent. Disregarding this age group, consistency showed a significant drop with increasing age.

The second dimension was 'depth': the degree to which personal characteristics were recognised as conditional upon certain situational, temporal or internal states; essentially the tendency to make inferences and offer explanations. The results showed a significant increase in depth with age, although even for college students eighty-nine per cent of items were at the lowest level and only four per cent at the highest level.

The studies reviewed up to this point suggest that there is a developmental trend towards increasing differentiation of inter-personal perception and that this is accompanied by an increasing ability to reconcile and integrate contradictory information and to make inferential links between information and offer explanations. Together they suggest an increasing complexity of organisation.

Livesley and Bromley (1973) chose to assess organisation by analysing the words and phrases which children used to modify the meaning of a description or to specify relationships between behaviour, dispositions and context. Their data showed an overall
increase with age in the use of organising and qualifying terms. There were two marked periods of growth. The first was between seven and eight years, corresponding to the rapid growth in the use of central statements. This was followed by a second period of rapid growth between twelve and thirteen years of age.

With respect to qualifying terms, younger children made frequent use of a limited number of qualifiers (e.g. very, quite) as part of a general tendency to make extreme judgements. Older children used a wider variety of qualifiers and were more discerning in their use. The increased use of qualifiers also meant that the discriminative capacity of dimensional attributes was increased and they could be applied more sensitively.

Increased use of organising statements such as explanations linking different parts of the description or statements specifically denying links suggest the development of an increasingly organised system of interpersonal perception with the growth of implicative links between the parts.

The results of this study confirm those of Peevers and Secord (1973). There is a developmental trend towards greater differentiation and the use of inferential links between the differentiated parts.

These free description studies suffer from one major disadvantage. They only reveal structural and organisational characteristics of interpersonal conceptual systems indirectly. Direct measurement of structural properties such as differentiation and organisation requires more structured approaches which allow
direct access to inter-concept or inter-construct links. This approach is allowed by repertory grid methodology.

**Repertory Grid Studies of Structure**

Neither of the repertory grid studies of the content of children's social perception discussed earlier (Brierley, 1967; Little, 1968) considered structural aspects. There are, however, a few studies which have addressed this issue.

Signell (1966) employed a repertory grid technique to examine age changes in the construing of persons and nations. She focused on three kinds of structural complexity. Firstly, the complexity of single concepts; the number of intervals or gradations in the attribution of a concept, and how evenly events are distributed across the intervals. Secondly, the complexity of cognitive structure; the number of dimensions available for making judgements. Signell derived three measures of this: the number of constructs generated; the number of dimensions yielded by a cluster analysis; and the number of substantial dimensions, which took account not only of the number of dimensions but also the proportion of communality associated with each. Similar measures were derived with respect to the structure of the elements. The third aspect of structure considered was complexity of content. This, in fact, refers to diversity of content and was assessed by two measures: the number of content categories and the number of substantial content categories which took into account the number of concepts or constructs in a category.
Signell predicted that all of these aspects would increase in complexity with age and tested these hypotheses with thirty-six children ranging in age from nine to sixteen years. Half the subjects completed a grid on nations and half on persons. The results suggested substantial differences in the development of construing the two domains. The study of nation construing showed a significant positive correlation between age and measures of complexity of cognitive structure and complexity of content but not for the complexity of single concepts. The person study, however, yielded a significant correlation between age and complexity of single concepts but no other aspects of complexity. Signell interprets these results as reflecting the difference between the experiential and didactic learning processes underlying person perception and nation perception respectively.

The results regarding person perception however are surprising when compared with the conclusions of some of the free description studies. The development of the complexity of single concepts parallels the increase in the use of qualifiers found by Livesley and Bromley (1973). However, Signell's study does not show the increase in differentiation and organisation inferred in the free description studies. This is particularly surprising as, according to Piaget and other developmental theorists, the years nine to sixteen embrace a series of profound cognitive changes. It would seem reasonable to expect that such developments should be reflected in the structure of interpersonal construct systems.
Barratt (1975) commented on the theoretical embarrassment of these findings and reported a study which attempted to extend and modify Signell’s research. Grids were elicited from sixty-four children ranging in age from eight to fourteen years and submitted to a principal components analysis (Slater, 1972). Barratt derived two measures of the functional efficiency of constructs:—lopsidedness and maldistribution; and five of organisational complexity and structure:—explanatory power of salient constructs and of principal components, a parametric version of Bieri’s measure of cognitive complexity, a similar measure termed construct inter-relations, and structural articulation (Norris, Jones and Norris, 1970) by which structures were defined as monolithic, segmented or articulated.

Generally Barratt’s findings confirmed those of Signell. Measures of construct efficiency showed a significant increase with age while those of conceptual structure showed no significant change. This again contradicts the conclusions of the free description studies.

Barratt offers three explanations for the failure of his and Signell’s studies to find developmental changes in the structure of interpersonal construct systems. Firstly, he suggests that complexity and structure of peer perception do not increase systematically during middle and late childhood. As mentioned earlier, this is contrary to theoretical accounts of cognitive development during this period and to other research findings. Secondly, Barratt suggests that grid methodology is somehow
inappropriate for the developmental investigation of structural aspects. This may be true of some of the details of the techniques used. However, this point will be discussed further in Chapter VI. The third suggestion is that within-group variances are too large to reveal subtle between-group differences and that a longitudinal design is more appropriate than a cross-sectional one.

There are, however, alternative explanations. It will be remembered that Brierley (1967) and Little (1968) reported significant age changes in the content of constructs elicited in a repertory grid. Barratt reports a similar trend and while Signell does not give a detailed account of the content of the grids she elicited, it seems fairly safe to conclude that a similar trend occurred in her study. Barratt and Signell compared structural aspects of grids which differed significantly in content. The grids for younger children are likely to contain a higher proportion of concrete constructs than those of older children. Stringer and Terry (1978) found that adults with systems high in concrete content tended to show greater discrimination, differentiation and integration. If this finding can be generalised to children then any age changes in structure are concealed and confounded by changes in content. A fairer test of developmental changes in structure would be provided by controlling for the content of the grid.

A second explanation concerns the approach to the conceptualisation and measurement of structure adopted in these studies. In Chapter III it was argued that cognitive structure is not a unidimensional characteristic but embraces a variety of factors, e.g. discrimination,
differentiation and integration. The studies of Signell and Barratt are restricted almost entirely to an analysis of differentiation measured in various ways and, to a lesser extent, of discrimination. It was argued in Chapter III that this reveals little about the extent or nature of the organisation of the construct system and it is in the area of organisation that the free description studies suggest the major developmental change takes place. It may be that the studies of Signell and Barratt are simply not measuring those aspects of cognitive structure that show the greatest change during this age period.

Summary

Free description studies have concluded, on the basis of inferences of structure from content, that children's interpersonal conceptual systems become increasingly differentiated and organised. It was suggested that more structured techniques such as repertory grids have certain advantages, as direct measures of structural measures can be obtained. However, studies that have employed such techniques have failed to find any significant developmental trends. Two possible explanations for this are the confounding effect of age changes in content and the adoption of a limited approach to structure.
CHAPTER VI

REPERTORY GRID METHODOLOGY WITH CHILDREN

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INTRODUCTION

The overall aim of the present study is to examine differences in the content, structure and process of construing in children of different ages. The question arises as to what is the most appropriate methodology to achieve this aim. In Chapter IV the advantages of repertory grid methodology for the investigation of structural characteristics of conceptual systems were discussed. In Chapter V we suggested that repertory grid techniques had some advantage over other methods, such as rating scales and free descriptions, for the study of interpersonal construct systems. However, Barratt (1976), in failing to find predicted age changes in the structure of construct systems using a repertory grid technique, suggested that such methods might not be appropriate for the investigation of developmental phenomena. Therefore, before adopting repertory
grid methodology let us consider in more detail the advantages and disadvantages of the method and how it might be used most appropriately with children.

The major advantage of repertory grid methods is their emphasis on the individual's own characteristic ways of viewing the world. In contrast to rating scales where the dimensions of interest are defined by the experimenter and may be of little significance to the individual child, the use of repertory grid techniques allows the elicitation of those constructs which have meaning and importance for the individual.

Repertory grid technique shares this advantage with open ended, free description methods. However, in a study within the context of PCT, repertory grid techniques have certain advantages over free description methods.

The technique reflects some of the basic principles underlying PCT that other techniques do not. The need for the individual to make comparisons between people in grid techniques recognises the essential nature of constructs as the basis of discrimination between people. The individual is required to recognise constructs as dimensions and to define both poles. The repertory grid allows direct access to the relationships between constructs and therefore enables more objective measurement of structural and organisational characteristics emphasised in PCT.
It has also been suggested (see Chapter V) that the more demanding task set by the repertory grid may encourage individuals to uncover more implicit, less easily available constructs.

Repertory grid techniques have been criticised for a number of reasons. Schroder, Driver and Streufert (1967) argued that they cannot reflect all the constructs in an individual's system; the number elicited is limited by the number of triads presented. As pointed out in Chapter IV, it is possible that most of the important constructs in an individual's system can be elicited with a relatively small number of triads. Also, the validity of this criticism depends on the question being asked. If one requires exhaustive information on one individual's construing any limiting has serious consequences. On the other hand, if one requires an example or representative sample of an individual's construing, perhaps for comparison with other individuals, the criticism has less force.

The appropriateness of repertory grid techniques with children has also been questioned. Livesley and Bromley (1973) suggest that free description methods have an advantage over repertory grids in that they have much in common with familiar classroom exercises and are more easily understood. It can be argued that repertory grid techniques, which can be a demanding task for adults, are too difficult for young children to master. However, this is a criticism, not of repertory grid techniques in general, but of particular methods and we will now turn to consider what methods of grid administration are most appropriate for use with children.
This question has been discussed recently by Salmon (1976) and we will follow her strategy of considering each stage of grid administration in turn.

INTRODUCING THE GRID

Dealing with the initial introduction of the grid to child subjects, Salmon argues that there are certain principles which underlie all of the many different variations of grid technique and that these have certain implications for how any grid method should be introduced. It is a common strategy with many other psychological tests that the real purpose of the test remains concealed from the subject both by the investigator and by the items of the test. This is presumably to avoid the possibility of arousing anxiety in the subject or the risk of obtaining artificial responses. Grids, however, can be presented for what they are, a means of assessing how the child sees the world, not a test in the sense of there being any right or wrong answers, and with everyone giving different answers. This makes it possible for questions that the child has about the technique to be answered truthfully which may well lead to the subject feeling less anxious and make for a more honest dialogue.

ELICITATION OF ELEMENTS

Once the grid has been introduced the next stage is to elicit elements, that is those events that are to be construed. A wide range of element domains have been used even by the very small number of studies that have employed grid techniques with children. These include stories (Applebee, 1974) and nations (Signell, 1966) as well as significant persons (Harper, 1974,
Brierley, 1967; Little, 1968). The major assumption about the elements to be used in a grid is that they are representative of the subject's experience of that particular domain. That is: 'it must be assumed that the sample of elements is an adequate representation of the total population of the relevant elements in the person's world' (Bannister and Mair, 1968).

Kelly goes even further, he says:

...it is not enough to say that the sample is representative - it must be representative with regard to certain dimensions. It is only as the sample is representative along essential dimensional lines that it can be called representative of a population.

(Kelly, 1955, P.270)

Bannister and Mair (1968) point out that as yet there is no means of determining which dimensions might be described as essential within any element sample. It is clear, however, that with children as well as with adults, the elements to be used in a grid should refer to personally familiar, meaningful and significant aspects of the child's experience.

In practice this requires that, ideally, elements should be elicited from the child himself either spontaneously as they occur in conversation or in response to some role title list whether it be of people or of anything else. Salmon (1976) points out that this is not always possible, as in cases where the grid is to be administered to groups or where the interest is in the child's construing of particular persons, objects or situations. In these cases, Salmon argues that care should be taken to ensure that the elements provided are personally relevant and meaningful to individual subjects, perhaps by asking them to choose the most relevant from a list.
Beyond the assumption of representativeness and meaningfulness however, the use of grids with children is likely to introduce limitations on the types of elements that are suitable and also on how they might be represented to the child. Theories of cognitive development (e.g. Piaget, 1952; Werner, 1947; Bruner, Olver and Greenfield, 1966) argue that very young children are only capable of dealing with very concrete stimuli, operating as they do in terms of physical objects and actions. As they get older they develop the capacity to deal with more and more abstract stimuli, dealing with symbolic representation and the manipulation of possibilities.

Thus, the sort of elements that are likely to be suitable for use with young children are those that can be represented physically by real objects, models or pictures. Use of such representations can also enable children to make judgements of elements by physically manipulating them, a means of operation with which they are likely to feel more at home. With older children it is possible to use more abstract material, such as verbally represented elements. Even with older children however, it may be helpful to aid the judgmental process by making the elements physically manipulable, for example by writing the names of the elements on cards.

Another point considered by Salmon is that different elements may belong to different ranges of convenience. This problem is illustrated by a study by Ravenette (1964) which found that the constructs elicited from primary school children which were applicable to their peers were not necessarily applicable to adults and vice versa. Therefore care must be taken not to ask children to apply constructs to elements that are outside their range of convenience.
Having obtained a representative and meaningful sample of elements the next stage is to obtain the constructs to be used for the grid. The two basic assumptions discussed with regard to the selection of elements hold equally for the selection of constructs, that is, they should be representative and personally meaningful.

As the emphasis of PCT is on how the individual personally structures his world, the obvious place to obtain constructs is from the subject himself. The most common method of eliciting constructs from adults has been the triadic method which was the original technique developed by Kelly. This involves presenting the subject with groups of three elements from the sample of elements and asking him to describe an important way in which two of these elements are similar and different from the third. Encouraging the subject to verbalise the similarity and the difference provides both poles of the construct used to make the discrimination.

The triadic method has a close relationship to the definition of a construct as 'a way in which some things are construed as being alike and yet different from each other'. (Kelly, 1955, p.105). Three events are the minimum from which one can infer the basis of similarity and difference.

Some of the studies employing repertory grids with children have used the triadic method: (Brierley (1967); Little (1968); Signell (1966); Harper (1974). While these investigations
assume that the task is a meaningful one for their subjects, who range in age from seven years upwards, there has been no test of this assumption nor any systematic comparison of the constructs elicited by this method with those elicited by other methods. However, there is evidence to suggest that differences do exist (Ravenette, 1964).

Thus, while the triadic method has been successful in eliciting responses from children, this is not conclusive evidence of the psychological meaningfulness of the task. Neither can it be assumed that young children understand the formal nature of the triadic elicitation procedure sufficiently well to generate the sort of responses that are assumed by the theory or that the constructs so elicited do in fact represent those that the child actually uses in trying to understand his experience.

What then are the possible alternatives to the triadic elicitation method? A slight modification was employed by Allison (1972) who elicited constructs from children as young as four years of age by presenting dyads of elements. However, in this study also there was no test of the assumption that the task was a meaningful one for the children involved.

In contrast to these rather formal approaches to the elicitation of constructs, a few studies have employed less structured techniques. Ravenette (1964) reports a study in which, having used the orthodox triadic procedure and found that the constructs elicited had less of a personal connotation and more of a role status connotation, substituted a different procedure by asking children to write short essays about boys and girls, and men and women whom they liked and disliked.
Another study which, while not directly carried out within the context of Personal Construct Theory, is very relevant to this discussion of the elicitation of constructs, is the extensive study of person perception in childhood and adolescence undertaken by Livesley and Bromley (1973). Like Ravenette, they asked their subjects, ranging in age from seven to fifteen years, to write short descriptions of peers and adults of each sex whom they liked and disliked.

While methods such as these do avoid presenting children with a formal task such as the triadic procedure which they may find unnatural and difficult to follow, they do present problems of their own, some of which were discussed earlier. Firstly, asking a child to write an essay, a common task in school, may well evoke the sort of associations and biased responses that it was argued the repertory grid avoided. Secondly, it presupposes a certain level of literacy on the part of the child which, particularly in the case of young children, may not exist. In the same way as with the triadic method, the constructs elicited may well be an artifact of the method employed rather than reflect the child's spontaneous construing. Thirdly, the triadic method has the advantage of reflecting the discriminative and dimensional nature of constructs.

Also, the grid in its optimum form is more than just a means of assessing an individual's construct system. It allows the subject himself to explore something of his own ways of understanding and viewing the world by asking him to consider elements in juxtaposition to each other in ways that he would
not normally do. The triadic procedure might encourage this sort of exploration in ways that description writing techniques do not. It may be more likely to lead the subject to uncover constructs that he is not normally aware of but may be equally important to his construing. Asking the subject to produce a written description of another person without further guidance or encouragement may lead to the elicitation of more immediately available, superficial constructs. There has, however, been no empirical test of this hypothesis.

The limitations of the triadic procedure, that have been discussed, suggest that with young children the elicitation of constructs should take a less formal, more unstructured form. Salmon (1976) suggests that at the most basic level this simply involves engaging in conversation with the child. Such a conversation can be given some structure by being built around the elements that have been elicited and asking the child to consider each element in turn and to talk about it; to describe it; to compare it with other elements, thinking how it might be similar or different from them. In this way it should be possible to elicit a number of constructs that are significant in the child's structuring of his experience. Care must be taken to ensure that the meanings of the constructs are understood as they are used by the child and that the meanings held by the investigator are not forced upon the child. Interaction makes it possible to explore with the child the meanings and implications that a particular construct may have for the child and may be quite different from those held by the investigator. It would also be important to elicit from the child both poles of a construct
Salmon (1976) suggests a modification of this technique for children who are shy or who have difficulty in expressing themselves in words. The child can be asked to sort the elements into categories on the basis that they 'seem to go together' and then encouraging the child to put into a word or phrase the way these elements do 'go together'.

While the looseness of these techniques may present some problems compared with the use of written and other more structured methods, it can be argued that the increased relevance of the constructs elicited more than compensates for this.

**Supplied Constructs**

The foregoing discussion has been concerned with the eliciting of constructs. An alternative source of constructs is the investigator. Supplied constructs have been used in one or two grid studies with children. The constructs that Ravenette (1964) obtained from a sample of non-clinical children were content analysed and those that showed a high degree of consensus were subsequently supplied as constructs for the grids of children seen at a child guidance clinic. Applebee (1974) supplied constructs to children in a study of their construing of stories.

The use of supplied constructs does present some theoretical problems. The emphasis of Personal Construct Theory is on how the individual construes the world. The Individuality Corollary states: 'Persons differ from each other in their construction of events'.

...
One of the reasons suggested for the appropriateness of Personal Construct Theory and the repertory grid to the study of personality development was the emphasis on the individual's dimensions of meaning. The provision of constructs by the investigator would seem to deny this emphasis.

A number of studies have empirically tested the hypothesis that provided constructs are less meaningful than those elicited from the individual. Several of these studies have been based on the assumption that there is a positive relationship between the personal relevance or meaningfulness of a construct and the extent to which the individual rates elements extremely on that construct (Isaacson and Landfield, 1965; Cromwell and Caldwell, 1962; Mitsos, 1961; etc.). These studies have confirmed that personal constructs are used more extremely but there has been some discussion as to whether the extremity of rating is, in fact, an indicator of meaningfulness. Other studies using different criteria, such as the amount of variance accounted for by supplied and elicited constructs in a sorting task (Stringer, 1972), do suggest that constructs elicited from the individual are psychologically more meaningful.

These studies have all used adult subjects and there are no studies which have compared the use of supplied and elicited constructs by children. However, as argued in Chapter II, the egocentricity of young children may be manifested in highly individual constructs. The elicitation of constructs would therefore seem to be of particular importance with child subjects.
While personal constructs are of prime interest, there are some situations where the use of supplied constructs can be helpful. For example, comparison of grids, particularly with regard to structural characteristics, is much more convenient when elements and constructs are kept common. The problem that then arises is: 'What constructs should be supplied?'. If results derived from the grid are to have any psychological significance the constructs used must have a fair degree of relevance for the subject. In some cases supplied constructs have been derived from the investigator's own repertoire. One can question the relevance for a child of such constructs, and also whether the construct has the same meaning for a child as it does for the investigator.

Despite the emphasis of Personal Construct Theory on the individuality of construing, this does not mean that there is no point of contact between the construct system of one individual and another. The Commonality Corollary states:

'To the extent that one person employs a construction of experience which is similar to that employed by another, his psychological processes are similar to those of the other person.'

Communication between one person and another requires that they share at least some aspects of how they construe the world; there are certain ways of construing events that tend to be common within a group of people. Therefore an alternative method of choosing supplied constructs would be to discover those which tend to be held in common by the population under study. Initially, this requires the elicitation of constructs from a large sample popul-
vation by one of the methods already discussed. By selecting those constructs that are most commonly used, one has a set of constructs that can be supplied to any subject who is considered to be psychologically comparable to the sample population with some basis for the assumption that they are psychologically relevant and meaningful to the subject.

By both eliciting and supplying constructs the advantages of individual relevance and convenience for group comparisons can be combined.

THE SORTING PROCEDURE

Once elements and constructs, whether elicited, supplied, or both, have been decide upon the next stage is to obtain some indication of how the subject uses the constructs to understand the elements. The grid method requires the subject to consider each of the elements in terms of each of the constructs by performing some form of categorisation or sorting task. There are several forms that this procedure can take and these have been described and discussed by Bannister and Mair (1968) and Fransella and Bannister (1977). They include dichotomous categorisation, ranking and rating.

Dichotomous categorisation does not allow very sensitive use of a construct dimension as it restricts choice to two categories. The range of scores that can be attributed can be increased by asking the subject to rank order the elements on each construct. However, the ranking method does not allow the subject to indicate exactly how the elements are distributed along the construct dimen-
enation. For example, the ranking procedure would show the same scores for elements on a construct where the elements were evenly distributed along the dimension and which was being used in a finely discriminating fashion, and on a construct which was being used in an essentially dichotomous manner with a cluster of constructs at each pole. This problem can be solved by allowing the subject to use each construct as a rating scale on which to judge each element. Any size of rating scale can be used, although five or seven point scales have been most commonly used.

As well as differing in their sensitivity to show how constructs are used, the different methods of element allotment also differ in how sensitive they are to differences between constructs in terms of their matching scores. This becomes particularly important when one wishes to consider the structural characteristics of construct systems.

The dichotomous method is likely to produce artificially high matching scores when lopsided constructs present a preponderance of blanks. If a split-half form is used the range of matching scores is limited. The rank order form enables comparisons between constructs to be made by rank order correlational methods but, as already pointed out, does not take into account the distribution of elements. The rating form offers the greatest potential for the subject to express his own pattern of judgements, and therefore should be the most sensitive method for investigating the relationships between constructs.
With this wide variety of techniques for the sorting of elements the question to be asked in the present context is: 'What is the most appropriate form for use with children?'. Salmon (1976) suggests that, as young children are likely to construe in a different way from older children, a standard form of allotment across all ages is inappropriate. In view of Piaget's findings that young preoperational children have difficulty in making comparative judgements, Salmon suggests that the rank order form should be avoided with very young children. A study by Wooster (1968) used such a procedure with five year olds. Wooster obtained some anomalous findings which may have been due to difficulties his subjects had in performing the task.

With children older than seven, rank ordering should be a possible task. However, even children of this age are likely to find it difficult to grasp too many elements simultaneously for ranking. Also they may have difficulties if the method of expressing their rankings is too complex, for example requiring clerical recording. An alternative would be to present the elements in some concrete form. They could be randomly arranged in front of the child who would be asked to pick out the 'most' whatever the first pole of the construct was. This element could then be removed and the child asked to select the 'most' of those remaining. This procedure could be repeated until the child had, in effect, rank ordered all the elements.

It has been argued, however, that the rank order method is likely to do some violence to the way constructs are actually
used and that the rating method has the great advantage of allowing more subtle use of constructs. Therefore, this method would be preferable in those situations where it was possible. Salmon (1976) suggests that the rating procedure is easier for young children than the ranking procedure and that children over six years of age can perform it quite happily. This, however, depends on the number of points on the scale. Salmon talks in terms of three point scales which have little advantage in flexibility and sensitivity over the dichotomous form. Increasing the flexibility and sensitivity of the scale by increasing the number of points also increases the complexity of the task, making it less suitable for young children.

The nature of constructs, as defined by Kelly, suggests that judgements of elements are not made in absolute terms but rather in relation to each other. For the rating of one element the child must consider other elements. As with the rank order form, having to consider too many elements simultaneously is likely to present the young child with problems. On this basis therefore it is argued that, if the advantages afforded by the rating method are to be realised, the complexity of the task increases so as to make the rank order method more appropriate for young children.

**SUMMARY**

In this chapter we have discussed the use of repertory grid techniques with children. It was argued that the repertory grid has certain advantages over other techniques for the investigation of children's interpersonal construing. Grid methods have greater
individual relevance than rating scales. They have more theoretical validity, may encourage the elicitation of less superficial constructs and allow more direct measurement of structural characteristics, than free descriptions.

Each stage in the completion of a grid was considered and the most appropriate approach for children of different ages was discussed.
PART TWO

A DEVELOPMENTAL STUDY OF CONTENT AND STRUCTURE IN CHILDREN'S CONSTRUCT SYSTEMS
CHAPTER VII

INTRODUCTION AND METHOD

INTRODUCTION

In Chapter I it was pointed out that Personal Construct Theory, as originally stated by Kelly (1955), does not deal with the parameters of developmental change in construing or the characteristics of construct systems at different stages of development.

In Chapter II the relationship between Personal Construct Theory and Piaget's theory of cognitive development was discussed. It was suggested that Piagetian theory might offer a fruitful framework from which to consider developmental changes in construct systems. It was predicted that there should be developmental changes in the content, structure and dynamic properties of construct systems.

The empirical study to be described in Part Two considers the first two of these aspects; content and structure. The specific hypotheses to be tested are that there are developmental trends
towards increasing abstractness and commonality of content, and towards increasing complexity of structure.

The notion of structure was discussed in detail in Chapter III. On the basis of that discussion, in this study we will examine three aspects of structure: discrimination, differentiation and integration.

METHOD

The method adopted in this study is derived from the discussion of the use of repertory grid technique with children, presented in Chapter VI.

Subjects

The subjects in this study were eighty children ranging in age from 6 years 10 months to 14 years 6 months. They were drawn from an infants, junior and secondary school in the same area of Guildford.

The subjects were divided into three groups according to age:

Group A. Twenty eight children ranging in age from 6,10 to 7,9 with a mean age of 7,5. This group consisted of sixteen boys with a mean age of 7,6 and twelve girls with a mean age of 7,5. The group was one class from an unstreamed infant's school.

Group B. Twenty six children ranging in age from 9,9 to 10,7 with a mean age of 10,2. This group included fifteen boys with a mean age of 10,2 and eleven girls with a mean age of 10,3. They were selected at random from children of the appropriate age in two classes of
an unstreamed junior school.

Group C. Twenty six children ranging in age from 13.2 to 14.6 with a mean age of 13.8. This group included twelve boys with a mean age of 13.9 and fourteen girls with a mean age of 13.8. The group was one class from an unstreamed secondary school.

Materials

Each subject was provided with two response sheets. On the first was marked a grid with eighteen rows and ten columns. Spaces were provided at the end of each row. At the head of each column was printed a role title. The role titles were as follows and appeared in this order from left to right:

- Self
- Brother or Sister
- Mother
- Disliked Child
- Disliked Teacher
- Father
- Best Friend
- Well Known Adult
- Liked Teacher
- Well Known Child

To satisfy one of the basic assumptions of grid methodology, this set of elements was assumed to be a representative sample of people playing a significant part in the life of a child. The elements were chosen to include adults and children and both positively and negatively evaluated others.

On the second response sheet was marked a grid with nine rows and ten columns. The head of each column was marked with the same role title as on the first sheet. At the left-hand end of
each row was printed a construct label with both poles specified.

The constructs were as follows:

- Bad tempered—Good tempered
- Selfish—Unselfish
- Like me—Not like me
- Important—Unimportant
- As I would like to be—Not as I would like to be
- Friendly—Unfriendly
- Not clever—Clever
- Humorous—Not humorous
- Unkind—Kind

The constructs supplied were chosen on the basis of previous studies of person perception in children (Ravenette, 1964; Brierley, 1967; Livesley and Bromley, 1973). Those selected had been found to have a high frequency of occurrence throughout the age range, 7 to 14 years. In addition the two constructs 'Like me' and 'As I would like to be' were included to allow examination of the child's self perception.

Procedure

Before individual interviews were carried out, each group of subjects was seen by the investigator who introduced himself, explained a little about psychology and psychologists (with varying degrees of success), and told them something about the purposes of the study. It was explained that the investigator was interested in finding out how children of different ages thought about other people. The group could help if each of them would have a talk with the investigator about some of the people that they knew. It was emphasised that this had nothing to do with their schoolwork, was not a test of how clever they were, that there were no right or wrong answers,
but that everyone had different ideas. It was also emphasised that no-one else would know what they had said.

It was hoped that this introduction would make the investigator a familiar and friendly figure and remove any anxiety the children might have had about the procedure.

For the testing procedure each child was seen individually. The investigator began by trying to relax the child by engaging in incidental conversation and reiterating the points made in the introductory talk to the group. It should be noted that the level of relaxation shown by subjects varied widely. However, it did not seem to be related to age.

The investigator placed the first response sheet in front of the child and explained that he would like the child to talk about some of the people he knew well. The child was shown the list of role titles on the sheet and asked to name someone different who represented each of the role titles for them. Each of these names was written by the investigator on a small card which were laid out in front of the child. If the child did not know anyone who filled a particular role, he was asked to name the person who was most like that role.

Having elicited the elements, the elicitation of constructs began. As this procedure took the form of a relatively unstructured conversation it is impossible to give exact details. However, the general structure was as follows.

One card was selected at random and the child was asked what
sort of person the named individual was. Any constructs the child generated were noted down on the response sheet at the ends of the rows by the investigator. A second card was selected at random and the child was asked if there were any ways in which the two people were similar or different. Again any constructs were noted. A third card was selected and the child was asked if there were any ways in which two of the people were similar yet different from the third. In making comparisons, if the child did not specify both poles of a construct spontaneously, he was asked what the opposite pole was. At this point the three cards were replaced and a new one selected to begin the procedure again. This procedure was repeated ten times, with each element beginning it.

It was felt that the departure of this method from a conventional triadic elicitation procedure was justified as it might be better understood by young children (see Chapter VI). The gradual introduction of comparisons was consistent with the theoretical emphasis of PCT on constructs as dimensions of similarity and contrast between elements.

Once the elicitation of elements and constructs was complete, the child sorted the elements on each of the constructs. For reasons discussed in Chapter VI, it was decided to use a ranking procedure with the two younger age groups.

The element cards were placed randomly in front of the child. He was then asked to consider the first construct, e.g. 'nervous-confident', and to pick out the element whom he thought was the 'most nervous'. The investigator gave this element a rank of
1 on this construct which was entered in the appropriate cell of the grid. That element card was removed and the child was asked to select the 'most nervous' of those remaining. This element was given a rank of 2. The procedure was repeated until each element had been ranked on each construct.

When the procedure had been completed for all elicited constructs the child ranked the elements on the supplied constructs. Throughout the ranking procedure, in cases where the child could not decide on which of two or more elements to allot to a particular rank, they were regarded as tied and allotted the mean of the appropriate ranks.

For the oldest age group a rating scale was used for the sorting of elements rather than a ranking procedure. As discussed in Chapter VI, this was felt to be more appropriate to their level of cognitive development. It was explained to the child that he should think of each construct, e.g. 'nervous-confident', as a scale from 1 to 10. A score of 1 meant 'very nervous', a score of 10 meant 'very confident'. All subjects seemed to understand the procedure; if there were any doubts they were given an example. For each construct in turn, the child was presented with the elements, one at a time, in random order, and asked to give each a score which the investigator entered on the response form. This procedure was repeated with the supplied constructs.

Analysis

Each grid was analysed by means of the INGRID principal compon-
ents analysis program (Slater, 1972). Three separate analyses were carried out. The first included both elicited and supplied constructs, the second only elicited constructs, and the third only supplied constructs. Of the elicited constructs, only those classified as psychological, either explicitly or implicitly (see Chapter VIII), were included in the analyses. The normalisation option in INGRID was chosen.

Three comparable analyses were carried out by means of a hierarchical cluster program (Johnson, 1967). These produced element and construct cluster diagrams by the diameter method.
CHAPTER VIII

THE CONTENT OF CHILDREN'S CONSTRUCT SYSTEMS: RESULTS AND DISCUSSIONS

RESULTS

Number of Constructs

Types of Construct

Summary of Significant Results

DISCUSSION

Number of Constructs

Types of Construct

Summary

In this chapter we will present and discuss results concerning the number and type of constructs elicited from different age groups and from males and females.

RESULTS

Number of Constructs

(Results and analysis are summarised in Table 8.1)

A total of 723 personal constructs were elicited from the 80 subjects in the study, a mean per subject of 9.04. The effects of age and sex were tested by means of a two-way analysis of variance. The main effects of age and sex were not significant, neither was there any significant interaction between age and sex.
### Table 8.1

<table>
<thead>
<tr>
<th>AGE</th>
<th>MALE</th>
<th>FEMALE</th>
<th>OVERALL</th>
</tr>
</thead>
<tbody>
<tr>
<td>7</td>
<td>8.06</td>
<td>9.17</td>
<td>8.54</td>
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<tr>
<td></td>
<td>n=16</td>
<td>n=12</td>
<td></td>
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<td>10</td>
<td>10.64</td>
<td>8.82</td>
<td>9.85</td>
</tr>
<tr>
<td></td>
<td>n=15</td>
<td>n=11</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>8.83</td>
<td>8.64</td>
<td>8.73</td>
</tr>
<tr>
<td></td>
<td>n=12</td>
<td>n=14</td>
<td></td>
</tr>
<tr>
<td>OVERALL</td>
<td>9.19</td>
<td>8.87</td>
<td>9.04</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>SOURCE</th>
<th>AGE</th>
<th>SEX</th>
<th>AGE X SEX</th>
<th>ERROR</th>
</tr>
</thead>
<tbody>
<tr>
<td>D.F.</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>74</td>
</tr>
<tr>
<td>F-VALUE</td>
<td>1.61</td>
<td>0.32</td>
<td>2.52</td>
<td></td>
</tr>
</tbody>
</table>

**TABLE 8.1** Number of constructs elicited x age x sex: Means and analysis.
Types of Construct

As described in Chapter V, previous studies of the content of children's conceptual or construct systems for the understanding of other people have examined developmental differences in the use of concrete and abstract constructs (Livesley and Bromley, 1973; Brierley, 1967; Little, 1968). It was decided to focus on the same issue in this study. The construct categories used by Brierley and Little were adopted.

The categorisation procedure was as follows. Three independent judges were asked to read through the list of 723 constructs and to classify each as physical, appearance, role or psychological, having first being given examples of each category. They were also asked to indicate constructs, which although they fell most obviously into one category, could also be considered under or imply another. For example, the construct 'Fights-doesn't fight', a fairly common construct particularly for younger children, is essentially a construct describing the behaviour of other people. However, it might also imply something about the psychological characteristics of an individual. In such cases the judges were asked to indicate both the primary or explicit category which they thought applied and also any other categories they considered were implied.

The reliability of the categorisation procedure was assessed by computing agreement scores between pairs of judges. This was done by totalling the number of constructs which both judges assigned to the same category. Agreement on explicit categorisation was very high, the three agreement scores being 721, 716 and 712. There were no constructs which were assigned to a different category by each of the
three judges. Those constructs on which there was not complete agreement were assigned to the category on which there was agreement by two of the judges.

The level of agreement on the assignment to implied categories was somewhat lower. One hundred and ninety eight constructs were assigned to implied categories. Of these, there was agreement by all three judges on 105, most of which were behavioural constructs with psychological implications. There was agreement between two of the judges on the assignment of a further 66 constructs. The remaining 27 constructs were assigned to an implied category by only one of the judges; these were categorised only by their explicit assignment.

Table 8.2 shows the number of constructs and the percentage of the total explicitly assigned to each category. By far the largest category is psychological constructs which contains 63.21 per cent of the total. The second largest category, behavioural constructs contains 22.27 per cent; 11.89 per cent are appearance constructs and the smallest category, role, accounts for only 2.63 per cent of the total. A $X^2$ test shows that the frequencies in each category are significantly different ($X^2 = 618.79$, df = 3, $P < 0.001$).

1. Age Differences

Table 8.2 shows the number and percentage of constructs elicited from each age group and assigned to each category. For each age group psychological constructs form the largest category followed by behavioural, appearance and role constructs.
<table>
<thead>
<tr>
<th>AGE IN YEARS</th>
<th>CONSTRUCT CATEGORY</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>APPEARANCE</td>
</tr>
<tr>
<td>7 Males</td>
<td>29 (21.80)</td>
</tr>
<tr>
<td>Females</td>
<td>26 (22.93)</td>
</tr>
<tr>
<td>Overall</td>
<td>55 (23.01)</td>
</tr>
<tr>
<td>10 Males</td>
<td>19 (11.88)</td>
</tr>
<tr>
<td>Females</td>
<td>6 (6.19)</td>
</tr>
<tr>
<td>Overall</td>
<td>25 (9.73)</td>
</tr>
<tr>
<td>13 Males</td>
<td>4 (3.77)</td>
</tr>
<tr>
<td>Females</td>
<td>2 (1.65)</td>
</tr>
<tr>
<td>Overall</td>
<td>6 (2.64)</td>
</tr>
</tbody>
</table>

TABLE 8.2. Number of constructs assigned to each category x age x sex. (Figures in parentheses refer to percentages)
While the construct categories show the same order of size for each age group the distribution of constructs among categories differs significantly among age groups ($X^2 = 56.18$, df = 6, $P < 0.001$). The effect of age on the use of the four types of constructs was tested by means of a $X^2$ test on each category. The numbers of appearance, role and behavioural constructs decrease significantly with age ($X^2 = 42.13$, df = 1, $P < 0.001$; $X^2 = 41.01$, df = 1, $P < 0.001$; $X^2 = 25.89$, df = 1, $P < 0.001$). Only the number of psychological constructs shows a significant increase with age ($X^2 = 47.15$, df = 1, $P < 0.001$).

Table 8.2 shows the number of psychological constructs overall, and within each age group, when implicit psychological constructs are included. Overall, the number of psychological constructs is 79.25 per cent of the total. Seven and 10 year-olds show a substantial increase in the number of psychological constructs while 13 year-olds show only a slight increase.

A $X^2$ test shows that the effect of age on the number of psychological constructs is still significant ($X^2 = 17.08$, df = 1, $P < 0.001$), although the strength of the effect is diminished.

Table 8.3 shows the number and percentage of explicit and implicit psychological constructs in each age group. The percentage of explicit psychological constructs increases with age from 62.1 per cent at 7 years of age to 95.4 per cent at 13 years of age. A $X^2$ test shows that the distribution of explicit and implicit psychological constructs differs significantly with age ($X^2 = 52.7$, df = 2, $P < 0.001$).
<table>
<thead>
<tr>
<th>AGE</th>
<th>CONSTRUCT TYPE</th>
<th>SEX</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>MALE</td>
<td>FEMALE</td>
</tr>
<tr>
<td>7</td>
<td>Explicit</td>
<td>46(56.79)</td>
<td>44(68.78)</td>
</tr>
<tr>
<td></td>
<td>Implicit</td>
<td>35(43.21)</td>
<td>20(31.25)</td>
</tr>
<tr>
<td>10</td>
<td>Explicit</td>
<td>94(72.87)</td>
<td>74(85.06)</td>
</tr>
<tr>
<td></td>
<td>Implicit</td>
<td>35(27.13)</td>
<td>13(14.94)</td>
</tr>
<tr>
<td>13</td>
<td>Explicit</td>
<td>86(91.49)</td>
<td>112(94.92)</td>
</tr>
<tr>
<td></td>
<td>Implicit</td>
<td>8(8.50)</td>
<td>6(5.08)</td>
</tr>
<tr>
<td>OVERALL</td>
<td>Explicit</td>
<td>226(74.34)</td>
<td>230(85.50)</td>
</tr>
<tr>
<td></td>
<td>Implicit</td>
<td>78(25.66)</td>
<td>39(14.50)</td>
</tr>
</tbody>
</table>

**TABLE 8.3** Number of explicit and implicit psychological constructs x age x sex.

(Percentages in parentheses.)
2. **Sex Differences**

Table 8.4 shows the number and percentage of constructs assigned to each category for male and female subjects overall. Although for both sexes overall the order of construct categories is the same, there is a significant sex difference in the distribution of constructs among categories \( \chi^2 = 16.39, \text{df} = 2, P < 0.001 \). Sex differences in the use of particular categories were tested by means of the normal approximation to the binomial test. There were no significant sex differences in the use of appearance or role constructs. However, boys used relatively more behavioural constructs than girls \( Z = 3.00, P < 0.01 \). Girls used relatively more psychological constructs than boys \( Z = 2.29, P < 0.05 \). When implicit psychological constructs are included the sex difference disappears.

Table 8.3 shows the number and percentage of implicit and explicit psychological constructs for each sex. A \( \chi^2 \) test reveals that boys produce significantly more implicit and significantly fewer explicit psychological constructs than girls \( \chi^2 = 10.95, \text{df} = 1, P < 0.001 \).

Sex differences were also examined within each age group. Table 8.2 shows the number and percentage of constructs explicitly assigned to each category broken down by age and sex. Sex differences in the use of each category within each age group were tested by means of the normal approximation to the binomial test. This reveals that the greater use of behavioural constructs by male subjects, reported in the previous section, is restricted to the 10 and 13 year-old
<table>
<thead>
<tr>
<th>CONSTRUCT</th>
<th>SEX</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>MALE</td>
</tr>
<tr>
<td>APPEARANCE</td>
<td>52 (13.16)</td>
</tr>
<tr>
<td>ROLE</td>
<td>9 (2.28)</td>
</tr>
<tr>
<td>BEHAVIOURAL</td>
<td>108 (27.34)</td>
</tr>
<tr>
<td>PSYCHOLOGICAL</td>
<td>226 (57.22)</td>
</tr>
<tr>
<td>PSYCHOLOGICAL INC. IMPLICIT</td>
<td>304 (76.96)</td>
</tr>
</tbody>
</table>

**TABLE 8.4.** Number of constructs assigned to each category x sex. (Figures in parentheses refer to percentages).
groups (Z = 1.67, P< 0.05; Z = 1.82, P< 0.05). The tendency for girls to use more psychological constructs is only significant for 10 year-olds (Z = 1.61, P< 0.05).

With the inclusion of implicit constructs in the psychological category (see Table 8.2) there are no sex differences for any age group. Table 8.3 shows the number of implicit and explicit psychological constructs broken down by age and sex. $X^2$ tests reveal that at 7 and 13 years of age there are no significant sex differences in the use of implicit or explicit constructs; but that at 10 years of age boys use significantly more implicit and less explicit constructs than girls ($X^2 = 4.46, df = 1, P< 0.05$).

Summary of Significant Results

1. Psychological constructs were the most frequently used by all age groups followed by behavioural, appearance and role constructs.

2. The frequency of psychological constructs increases with age; the use of all other categories decreases with age.

3. The proportion of explicit psychological constructs increases with age.

4. At 10 and 13 years of age, boys produce more behavioural constructs than girls. At 10 years of age girls produce more psychological constructs than boys.

5. With the inclusion of implicit psychological constructs the sex difference at 10 years of age disappears: boys use a higher proportion of implicit psychological constructs than girls.
DISCUSSION

Number of Constructs

Several previous studies have reported an increase with age in the number of concepts or constructs in children's descriptions of other people (e.g. Livesley and Bromley, 1973; Scarlett, Press and Crockett, 1971). This has been interpreted as indicating a developmental increase in the degree of differentiation. The lack of significant age differences in the number of constructs shown by the present study is not consistent with these findings. But, as argued in Chapter VI, such a measure does not discriminate between nominal and functional differences between constructs and therefore is inadequate as a measure of differentiation.

Type of Construct

The results of this study reveal a decrease with age in the use of appearance, role and behavioural constructs and an increase in the use of psychological constructs. This confirms the general hypothesis, derived from Piagetian theory, of a developmental shift towards a more abstract and psychological mode of construing. This result also confirms the findings of other studies which have employed both free description and repertory grid techniques for eliciting constructs (e.g. Livesley and Bromley, 1973; Brierley, 1967; Little, 1968; Scarlett et al., 1971).

However, while the general direction of developmental change revealed by this study is in line with the findings of these earlier studies, the details reveal important differences to other repertory grid studies. In this study, by far the largest number of constructs
was in the psychological category. In contrast, Brierley (1967) found that the largest category for children within the age range 7-14 years was behavioural constructs. Furthermore the results of the present study reveal a predominance of psychological constructs for all three age groups. This also is in contrast to Brierley's findings. In her study appearance constructs were used most frequently at 7 years of age followed by role and then behavioural constructs. There was a minimal use of psychological constructs. At 10 years of age behavioural constructs were predominant followed by role and appearance constructs. It was only at 13 years of age that psychological constructs rose to any degree of prominence, although even at this age behavioural constructs still formed the largest category. Brierley concluded that a shift to a predominantly abstract, psychological mode of construing was a relatively late development, a conclusion not supported by the results of the present study which reveal a predominant use of abstract psychological constructs even at 7 years of age.

The results of this study are more in line with the findings of free description studies of children's interpersonal perception (e.g. Livesley and Bromley, 1973; Scarlett et al., 1971; Peaves and Secord, 1973) which found a considerable increase in the use of abstract, psychological constructs between the ages of 6 and 8 years. These results are also more consistent with the findings of another study of construing in childhood carried out by Bannister and Agnew (1977). They examined aspects of the child's construing of 'self' by investigating the reasons given by children for the recognition of descriptions of themselves. Bannister and Agnew found that, even
at 7 years of age, children give a relatively large proportion of psychological reasons for recognition.

What explanation can be offered for these discrepancies in findings? In Chapter VI it was suggested that the triadic construct elicitation procedure used by Brierley and Little may be a difficult task for young children to master. The difficulty of the task may encourage the elicitation of more superficial, readily available constructs. The results would therefore reflect a response limitation rather than children's characteristic ways of construing other people. In contrast, the less formal, more easily understood, more open-ended, and perhaps more searching technique employed in the present study may have provided a more representative view of children's actual mode of construing.

When implicit constructs are included in the psychological category the results suggest that, accompanying the general developmental trend towards a greater emphasis on psychological constructs, there is a change in the nature of the psychological constructs being used. With increasing age the proportion of psychological constructs which are implicit in nature decreases. When young children are making discriminations between people that are essentially psychological, they very often express them in behavioural terms. For example, when discriminating between people who are argumentative or not, young children are more likely to express this distinction via the verbal construct 'Argues a lot - does not argue'. Older children on the other hand are more likely to express it explicitly via the trait name 'argumentative'. What is not clear is whether this change represents differences in vocabulary or verbal fluency or a
more fundamental, qualitative difference in the nature of children's construing of psychological characteristics.

Turning to sex differences, previous research has found that girls tend to be more cognitively developed than boys, particularly in early and middle childhood. For example, Livesley and Bromley (1973) found that girls used a significantly higher proportion of trait names than boys. In the present study overall sex differences were in the expected direction. Boys used more behavioural constructs and girls used more psychological constructs. However, the generality of this conclusion is limited as the difference for behavioural constructs was only significant for 10 and 13 year-olds and the sex difference for psychological constructs was only significant at 10 years of age.

Summary

The results of this study support the hypothesis derived from Piagetian theory and the findings of previous studies that there is a developmental trend towards abstract and psychological modes of construing other people. The present results differ from those of previous studies of children's repertory grid responses in the predominance of psychological constructs even in the youngest, 7 year-old, age group. It is suggested that this difference is due to the methodology employed in this study to elicit constructs. There is also a developmental trend away from expressing psychological characteristics in behavioural terms which may reflect the development of vocabulary and verbal fluency or more fundamental changes in the nature of construing. Girls use fewer behavioural and more psychological constructs than boys and also use a lower proportion of implicit psychological constructs.
Harvey et al. (1961) and Schroder et al. (1967) distinguished a number of aspects of discrimination which were discussed in detail in Chapter III. The present study focuses on one particular aspect of discrimination; the fineness of the graduations of intra-category distances in terms of the number of values available for judging elements on a construct dimension. Constructs can be seen as varying along a continuum from simple dichotomous scales to complex interval scales which offer the capacity for making finer discriminations. Individuals should vary in terms of the characteristic degree of discrimination of the constructs within their construct system.

In line with the predicted developmental trend towards increasing complexity in the structure of construct systems proposed in Chapter II, we would predict that the discriminative capacity of an individual's constructs should increase with age. Therefore, older children should be able to use their constructs in a more
discriminating fashion than younger children. Also it is predicted that the advanced cognitive development of females during childhood will be reflected in a greater degree of discrimination for girls than for boys. It is further predicted that this superiority of girls will decrease with age.

MEASUREMENT OF DISCRIMINATION

Discrimination was measured in terms of the number of intervals used to judge elements on each construct. For 7 and 10 year olds the discrimination score for each individual was the mean, across constructs, of the number of ranks used to judge elements. Initially it was felt that the use of a ranking procedure for these age groups might have masked any differences in discrimination with all subjects using all ranks. However, examination of the results revealed wide individual differences ranging from the use of all 10 ranks to the inability to discriminate between the first ranked and the remainder of the elements. For 13 year-olds the discrimination score was the mean, across constructs, of the number of rating intervals used.

The different element allotment procedures used meant that it was not possible to test the effect of age across the whole age range but only between 7 and 10 years of age.

RESULTS

Differences in discrimination between 7 and 10 year-olds were tested by means of a two-way analysis of variance by age and sex (results and analysis are shown in Table 9.1). The effect of age
<table>
<thead>
<tr>
<th>AGE</th>
<th>SEX</th>
<th>OVERALL</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>MALE</td>
<td>FEMALE</td>
</tr>
<tr>
<td>7</td>
<td>6.08</td>
<td>5.64</td>
</tr>
<tr>
<td>10</td>
<td>7.18</td>
<td>7.28</td>
</tr>
<tr>
<td>OVERALL</td>
<td>6.61</td>
<td>6.42</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>SOURCE</th>
<th>AGE</th>
<th>SEX</th>
<th>AGE X SEX</th>
<th>ERROR</th>
</tr>
</thead>
<tbody>
<tr>
<td>D.F.</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>50</td>
</tr>
<tr>
<td>F-VALUE</td>
<td>5.04*</td>
<td>0.06</td>
<td>0.15</td>
<td></td>
</tr>
</tbody>
</table>

*P<0.05

**TABLE 9.1**  Mean discrimination scores broken down by age and sex: Results and analysis.
is statistically significant, the mean for 10 year-olds being higher than that for 7 year-olds. The main effect of sex and the interaction between age and sex were not significant.

For 13 year-olds the difference between males and females was tested by means of a t-test. Males have a significantly higher score ($\bar{x} = 5.86$) than females ($\bar{x} = 5.17$, $t = 2.41$; df $= 24$, $p < 0.05$).

DISCUSSION

The limited conclusions that can be drawn from this study, regarding the effect of age on discrimination, generally support the hypothesis, derived from Piagetian theory, offered in Chapter II. The increase, from 7 to 10 years of age, in the mean number of ranks used is interpreted as reflecting a change from the pre-operational child's categorical, black-and-white thinking and his tendency to apply constructs in an all or none fashion, to the concrete operational child's ability to use constructs as dimensions of judgement rather than as absolute categories.

These results also confirm the findings of previous studies. Signell (1966) employed a similar measure of discrimination based on the mean number of intervals used. She found a significant positive correlation between age and discrimination in the construing of persons although not in the construing of nations. This finding was replicated by Barratt (1975) who also found a significant sex difference with girls showing higher discrimination than boys.

Applebee (1976), in a study of children's construing of stories, measured discrimination in terms of polarity; the tendency to use
extremes rather than moderate or neutral points on a rating scale. Applebee concluded that between the ages of 6 and 17 years there is an increase in the 'psychological length' of constructs. Younger children make essentially a bipolar discrimination, while older children apply a scale with clearly recognised intermediate points.

The sex difference in the results for 13 year olds is contrary to hypothesis and also to the results of Barratt's study.

SUMMARY

Between 7 and 10 years of age there is a significant increase in the mean number of ranks used in judging elements. This is interpreted as reflecting an increase in discrimination.
In Chapter III we discussed a number of different concepts which have been used to describe the structural characteristics which we shall refer to as 'differentiation'. They include cognitive complexity, FIC and dimensionality. All of these varied concepts basically relate to the number of different dimensions or functionally independent constructs that an individual has available for making judgments about and discriminating between the elements in any particular domain of experience. An individual who has available a large number of different dimensions would be regarded as highly differentiated. From the discussion of the relationship between Piagetian theory and PCT in Chapter II we would predict that the degree of differentiation should increase with age.
MEASURES OF DIFFERENTIATION

The various concepts of differentiation have produced a large number of measures, many of which were discussed in Chapter III. Those that have been derived from the repertory grid are all based in some way on the degree of relationships between the constructs in the grid.

In the present study three common measures based on this rationale and regarded as operationalizations of differentiation were used.

Two of these measures are derived from the principal components analysis of the psychological constructs in the grid (Slater, 1977).

D1: The percentage of variance accounted for by the first principal component. The size of the first component is inversely related to the degree of differentiation. A high score signifies a high degree of interrelationship between constructs which has been interpreted as reflecting a low degree of differentiation (Jaspers, 1963; Barratt, 1976).

D2: The number of significant components derived from principal components analysis. Significant components were defined by the Kaiser-Guttman test as those having an eigen value greater than 1.0 (Kaiser, 1960). A large number of significant components indicates high differentiation (Signell, 1966; Pedersen, 1958; Kuusinen and Nystadt, 1975).

The third measure is derived from the hierarchical cluster
D3: The number of construct clusters at a certain level of significance. Following Smith and Leach (1972) the measure is the number of clusters present at a level corresponding to a correlation coefficient between constructs, significant at the 5% level for 10 elements, i.e. 0.63. A large number of clusters indicates high differentiation.

In Chapter III a number of problems in the interpretation of these measures were pointed out. Do these measures of the degree of relationship between constructs or the amount of organisation between differentiated parts? In an attempt to clarify the meaning of these measures two further possible measures of differentiation were used.

D4: is also derived from the cluster analysis of the grid, and again refers to the number of construct clusters. In this case however the criterion for relationships between constructs in a cluster is much stricter ($p < 0.001$); it refers to the number of clusters present at a correlation of 0.87.

D5: represents a slightly different approach to differentiation. The previous measures have been concerned directly with the degree of differentiation between dimensions or constructs. One can also consider the degree of differentiation between elements, the extent to which an individual can make differentiations and discriminating judgement about other people. This ability should in part be a consequence of the number of different dimensions in the system.
This aspect of differentiation was operationalised by considering the degree of discrimination between particular elements in the grid. In particular the ability for subject to differentiate between elements in terms of their similarity to or difference from the element 'self' was examined. 'Self-other' comparisons rather than 'other-other' comparisons were chosen in view of the emphasis given by Piaget's theory to the growth of the self-concept and to developmental changes in egocentrism. A more differentiated individual should be able to make more differentiated comparisons between himself and other persons. He should see some as very similar to himself and some as very different. A less differentiated individual should tend to make simple distinctions between 'self' and 'other' and fewer subtle distinctions as to degree of similarity or difference.

This ability was measured by considering the distances between 'self' and other elements in the grid as revealed by the INGRID principal components analysis programme. These distances are expressed as the ratio of the observed distance to the unit of expected distance. The variance of the distances between 'self' and the nine other elements was calculated for each subject as a measure of the degree of discrimination between the elements: high variance represents a high degree of differentiation.

RESULTS

Relationships Between Measures

Table 10.1 shows the matrix of intercorrelations between the
<table>
<thead>
<tr>
<th>N=80</th>
<th>D2</th>
<th>D3</th>
<th>D4</th>
<th>D5</th>
</tr>
</thead>
<tbody>
<tr>
<td>D1</td>
<td>-0.77***</td>
<td>-0.63***</td>
<td>0.28*</td>
<td>0.70***</td>
</tr>
<tr>
<td>D2</td>
<td>0.56***</td>
<td>-0.21</td>
<td>-0.55***</td>
<td></td>
</tr>
<tr>
<td>D3</td>
<td>-0.11</td>
<td>-0.50***</td>
<td></td>
<td></td>
</tr>
<tr>
<td>D4</td>
<td></td>
<td>0.45***</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*P<0.05  ***P<0.001

**TABLE 10.1** Correlation coefficients between five measures of differentiation.

<table>
<thead>
<tr>
<th>AGE</th>
<th>SEX</th>
<th>OVERALL</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>MALE</td>
<td>FEMALE</td>
</tr>
<tr>
<td>7</td>
<td>49.89</td>
<td>46.82</td>
</tr>
<tr>
<td></td>
<td>n=16</td>
<td>n=12</td>
</tr>
<tr>
<td>10</td>
<td>48.51</td>
<td>50.21</td>
</tr>
<tr>
<td></td>
<td>n=15</td>
<td>n=11</td>
</tr>
<tr>
<td>13</td>
<td>60.14</td>
<td>70.20</td>
</tr>
<tr>
<td></td>
<td>n=12</td>
<td>n=14</td>
</tr>
<tr>
<td>OVER-</td>
<td>52.27</td>
<td>56.67</td>
</tr>
<tr>
<td>ALL</td>
<td></td>
<td>54.31</td>
</tr>
</tbody>
</table>

**TABLE 10.2** Mean scores on D1. (% of variance of 1st. principal component) broken down by age and sex: Results and analysis.

<table>
<thead>
<tr>
<th>SOURCE</th>
<th>AGE</th>
<th>SEX</th>
<th>AGE X SEX</th>
<th>ERROR</th>
</tr>
</thead>
<tbody>
<tr>
<td>D.F.</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>F-VALUE</td>
<td>21.70***</td>
<td>1.42</td>
<td>2.73</td>
<td></td>
</tr>
</tbody>
</table>

***P<0.001
five measures of differentiation. The first three measures, D1, D2 and D3, are intercorrelated in the expected directions at a high level of statistical significance. D4, the other measure derived from the cluster analysis, correlates with D1, D2 and D3 in a direction contrary to expectations and has a significant positive correlation with D5, as would be predicted. D5 is significantly correlated with D1, D2 and D3 in the contrary direction.

Two distinct clusters of measures emerge from this pattern of intercorrelations. One cluster contains D1, D2 and D3, and the other, negatively correlated to the first, contains D4 and D5.

Age and Sex Differences in Differentiation Measures

1. D1: Percentage of variance accounted for by the first principal component.

Table 10.2 shows mean scores by age and sex and summary two-way ANOVA. Age has a significant effect on scores on D1. The mean for 13 year olds is significantly higher than the mean for 7 and 10 year olds. The difference between 7 and 10 year olds is not significant. The interaction between age and sex just fails to reach statistical significance \((P = 0.07)\). At 7 and 10 years of age there is little difference between males and females. At 13 years of age, however, the mean score for boys is significantly lower than the mean for girls. \((F = 6.33, df = 1,74, P<0.05)\).

2. D2: Number of significant components (see Table 10.3).

Age has a significant effect on scores on D2. The mean for
### TABLE 10.3
Mean scores on D2. (No. of components with eigen value ≥ 1.0) broken down by age and sex: Results and analysis.

<table>
<thead>
<tr>
<th>AGE</th>
<th>SEX</th>
<th>OVERALL</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>MALE</td>
<td>FEMALE</td>
</tr>
<tr>
<td>7</td>
<td>2.50</td>
<td>2.67</td>
</tr>
<tr>
<td>10</td>
<td>2.93</td>
<td>2.45</td>
</tr>
<tr>
<td>13</td>
<td>2.17</td>
<td>1.71</td>
</tr>
<tr>
<td>OVERALL</td>
<td>2.56</td>
<td>2.24</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>SOURCE</th>
<th>AGE</th>
<th>SEX</th>
<th>AGE X SEX</th>
<th>ERROR</th>
</tr>
</thead>
<tbody>
<tr>
<td>D.F.</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>74</td>
</tr>
<tr>
<td>F-VALUE</td>
<td>12.10***</td>
<td>3.25</td>
<td>2.46</td>
<td></td>
</tr>
</tbody>
</table>

\[ F_{7,10} = 0.05 \quad F_{7,13} = 15.65^{***} \quad F_{10,13} = 24.31^{***} \]

*** \( P < 0.001 \)

### TABLE 10.4
Mean scores on D3. (No. of clusters at 5% level) broken down by age and sex: Results and analysis.

<table>
<thead>
<tr>
<th>AGE</th>
<th>SEX</th>
<th>OVERALL</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>MALE</td>
<td>FEMALE</td>
</tr>
<tr>
<td>7</td>
<td>6.13</td>
<td>6.17</td>
</tr>
<tr>
<td>10</td>
<td>6.93</td>
<td>6.64</td>
</tr>
<tr>
<td>13</td>
<td>6.00</td>
<td>5.36</td>
</tr>
<tr>
<td>OVERALL</td>
<td>6.37</td>
<td>6.00</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>SOURCE</th>
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<th>SEX</th>
<th>AGE X SEX</th>
<th>ERROR</th>
</tr>
</thead>
<tbody>
<tr>
<td>D.F.</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>74</td>
</tr>
<tr>
<td>F-VALUE</td>
<td>3.15*</td>
<td>0.65</td>
<td>0.30</td>
<td></td>
</tr>
</tbody>
</table>

\[ F_{7,10} = 0.19 \quad F_{7,13} = 4.52^* \quad F_{10,13} = 6.90^* \]

\* \( P < 0.05 \)
13 year olds is significantly lower than the means for 7 and 10 year olds. The difference between 7 and 10 year olds is not significant. The main effect of sex just fails to reach statistical significance. Males show a higher mean score than females.

3. D3: Number of significant clusters (5% criterion) (see Table 10.4).

Age has a significant effect on scores on D3. The mean for 13 year olds is significantly lower than the mean for 7 or 10 year olds. The difference between 7 and 10 year olds is not significant.

4. D4: Number of significant clusters (0.1% criterion) (see Table 10.5).

Age has a significant effect on scores of D4. The mean for 7 year olds is significantly lower than the means for 10 and 13 year olds. Ten and 13 year olds do not differ significantly.

5. D5: Variance of self-other distances (see Table 10.6).

The main effect of age is significant. The mean for 13 year olds is significantly higher than the means for 7 and 10 year olds. The difference between 7 and 10 year olds is not significant. The interaction between age and sex is also significant. At 7 years of age the mean score for males is greater than that for females. At 10 years of age there is no difference between males and females and at 13 years of age the mean for females is higher than the mean for males. This difference just fails to reach statistical significance.
### Table 10.5
Mean scores on D4. (Number of clusters at 0.1% level) broken down by age and sex: Results and analysis.

<table>
<thead>
<tr>
<th>AGE</th>
<th>SEX</th>
<th>OVERALL</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>MALE</td>
<td>FEMALE</td>
</tr>
<tr>
<td>7</td>
<td>8.90</td>
<td>9.42</td>
</tr>
<tr>
<td>10</td>
<td>12.07</td>
<td>10.91</td>
</tr>
<tr>
<td>13</td>
<td>12.67</td>
<td>11.29</td>
</tr>
<tr>
<td>OVERALL</td>
<td>11.07</td>
<td>10.57</td>
</tr>
</tbody>
</table>

**SOURCE**

<table>
<thead>
<tr>
<th>AGE</th>
<th>SEX</th>
<th>AGE X SEX</th>
<th>ERROR</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>2 74</td>
</tr>
</tbody>
</table>

**F-VALUE**

\[ F_{7,10} = 8.51^{***} \]
\[ F_{7,13} = 13.84^{***} \]
\[ F_{10,13} = 0.65 \]

**P<0.01**

**P<0.001**

### Table 10.6
Mean scores on D5. (Variance of self-other distances) broken down by age and sex: Results and analysis.

<table>
<thead>
<tr>
<th>AGE</th>
<th>SEX</th>
<th>OVERALL</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>MALE</td>
<td>FEMALE</td>
</tr>
<tr>
<td>7</td>
<td>0.22</td>
<td>0.16</td>
</tr>
<tr>
<td>10</td>
<td>0.20</td>
<td>0.21</td>
</tr>
<tr>
<td>13</td>
<td>0.30</td>
<td>0.35</td>
</tr>
<tr>
<td>OVERALL</td>
<td>0.24</td>
<td>0.25</td>
</tr>
</tbody>
</table>

**SOURCE**

<table>
<thead>
<tr>
<th>AGE</th>
<th>SEX</th>
<th>AGE X SEX</th>
<th>ERROR</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>2 74</td>
</tr>
</tbody>
</table>

**F-VALUE**

\[ F_{7,10} = 0.04 \]
\[ F_{7,13} = 52.19^{***} \]
\[ F_{10,13} = 38.41^{***} \]

**P<0.05**

**P<0.001**
Summary of Significant Results

1. D1, D2 and D3 are significantly intercorrelated in the expected direction. D4 and D5 correlate significantly in the expected direction. These two groups of measures are significantly correlated in the contrary direction to expectation.

2. Thirteen year olds show significantly higher D1 scores than 7 or 10 year olds.

3. Thirteen year olds show significantly lower D2 scores than 7 or 10 year olds.

4. Thirteen year olds show significantly lower D3 scores than 10 year olds. Seven year olds do not differ significantly from either 10 or 13 year olds.

5. Ten and 13 year olds show significantly lower D4 scores than 7 year olds.

6. Thirteen year olds show significantly higher D5 scores than 10 or 7 year olds. At 13 years of age males show a higher mean score than females.

DISCUSSION

The first point that needs to be made in discussing the results for the five measures of differentiation employed in this study is that they do not all correlate with one another in the expected direction. Two distinct groups of measures emerge: one consists of three measures that previous studies have interpreted as indices
of differentiation, the size of the first principal component, the number of significant components, and the number of significant clusters (5% criterion). The other consists of two measures developed in this study, the number of significant clusters (0.1% criterion) and the variance in 'self-other' distances, an index of differentiation between elements. These two groups of measures, all intended to reflect the degree of differentiation are clearly not measuring the same structural characteristic of construct systems.

Not surprisingly the two groups of measure are affected differently by age and sex. The results for the first three measures, if they are taken to reflect differentiation, show a decrease in the amount of differentiation with age. The major decrease occurs between the ages of 10 and 13 years. This finding is in direct contradiction to the hypothesis derived from Piagetian theory and is at odds with the results of previous findings. Watts (1944), Scarlett, Press and Crockett (1971) and Peevers and Secord (1973) are among those who have inferred an increase in differentiation with age from the content analysis of children's description of others.

The results for the other two measures show an increase in differentiation with age. Between the ages of 7 and 10 years there is an increase in the number of construct clusters at the stringent criteria level of 0.1%. The rate of increase levels off after 10 years of age. Between 10 and 13 years of age there is a significant increase in the tendency to differentiate between others in terms of their similarity to self. If these measures do indeed reflect the degree of differentiation within the construct system these
results confirm the hypothesis and the results of earlier content analytic studies.

How can the inconsistencies between the results for these two different groups of measures be reconciled? One answer may be found by reference back to the discussions of the concept of differentiation and its measurement in Chapters III and IV. In Chapter III we discussed the inconsistency between Bieri's concept of Cognitive Complexity and Bannister's concept of Intensity. The operationalisation of these two concepts is almost identical, being based on matching scores between constructs. These measures were not used in the present study, though a pilot study revealed them to be highly correlated with D1.

Bannister and Bieri offered differing interpretation of these measures of the degree of interrelationship between constructs in a grid. Bieri interpreted a low degree of interrelationship within the grid as reflecting a high degree of differentiation among constructs, and thus a large number of different dimensions within the system. Bannister interpreted a low degree of interrelationship as reflecting a low degree of organisation among constructs, a lack of predictive or implicative links between dimension.

If the three measures in the first group are interpreted in Bannister's terms, as measures of organisation rather than differentiation, the results suggest an increase in the degree of organisation between constructs with age rather than a decrease in differentiation. This interpretation of the result confirms the predictions of Piagetian theory with respect to structural development.
and is consistent with previous findings.

Are there any reasons why these measures should be interpreted as reflecting organisation, rather than differentiation? It was argued in Chapters III and IV that one reason for the confusion between the concept of Bieri and Bannister was the failure to take into account the strength of individual construct relationships. It was suggested that a strong relationship between constructs indicates a lack of differentiation between them. The constructs are being used synonymously and reflect different verbal labels attached to the same dimension of meaning. Less strong, although still significant, relationships between constructs should indicate that they are not synonymous and represent two differentiated dimensions of meaning but have organisational, predictive or implicative links with one another. The measures used by Bieri and Bannister, in common with many other measures of differentiation and with the principal component measures in this study, are based on an aggregate of the relationships between constructs. They fail to reflect the varying strength of individual inter-construct relationships. Therefore a high score on these measures may reflect a low degree of differentiation, a high degree of organisation or moderate levels of both.

In the present study the measures derived from the cluster analysis offer some insight into this problem. These measures do take into account the strength of individual relationships. D3 is concerned with the relationships between constructs at a relatively weak level while D4 reflects the degree of relationship between constructs when the criteria is relatively stringent. In the light
of the preceding discussion, while D4 should reflect the degree of differentiation, D3 might be more appropriately regarded as a measure of organisation than of differentiation. As D1 and D2 correlates higher with D3, in this study, they too might be more appropriately interpreted as reflecting the degree of organisation among differentiated parts than the degree of differentiation between constructs.

This conclusion has implications for the measurement of differentiation. It is clear that measures which are based on the overall degree of relationships between constructs, without differentiating the varying strength of these relationships, are inadequate. They fail to distinguish between level of differentiation and level of organisation which, although both determined by relationships between constructs, are conceptually independent.

The results of the current study suggest that the five measures originally conceived of as reflecting the degree of differentiation within a construct system can be divided into two groups. Measures in the first group (i.e. D4 and D5) do indeed reflect the degree of differentiation in the system either directly, in terms of the number of functionally independent construct clusters; or indirectly, in terms of the degree of differentiation between other elements in terms of similarity or difference to 'self'. The second group of measures (i.e. D1, D2 and D3) might be more appropriately interpreted as reflecting the degree of relatedness or organisation between differentiated constructs.

Given this interpretation the results are according to
hypothesis. The significant increases in D4 and D5 with age reflect an increase in the degree of differentiation. The significant increase in D1 and decreases in D2 and D3 with age, reflect an increase in the degree to which differentiated constructs have organisational links between them. While differentiation and organisation both increase with age, the major changes in these two structural characteristics occur at different times. With respect to differentiation, most change occurs between the ages of 7 and 10, while for organisation the major change occurs between 10 and 13.

The timing of these changes is consistent with the findings of studies which have used content-based measures of structure. Watts (1944), Bigner (1974) and Livesley and Bromley (1973) all found accelerated growth between the ages of 7 and 9 years in differentiation, measured in terms of the number of statements used to describe others. After this age the rate of growth declined. As discussed in Chapter IV such measures have disadvantages and the measures used in the present study are more appropriate measures of differentiation as they take into account the use of constructs as well as the labels attached to them.

Livesley and Bromley (1973) found that there was a major period of growth in the use of organising and qualifying statements, which might be taken as a measure of the degree of relationship between differentiated dimensions, between the ages of 12 and 13. This could be seen as consistent with the finding of the present study of a major change in the degree of organisation between the 10 and 13 year old groups. Also, Watts (1944) found that up to the age of eleven children's social perception was organised at a relatively
simple level and that it was only subsequent years which saw the development of an organisational level which allowed the reconciliation of inconsistent information and the formation of unified integrated impressions embracing implicative and predictive links between traits. Similarly, Gollin (1958) found that only from the age of ten onwards did the use of conceptual material to organise and integrate inconsistency rise to prominence.

While the general direction of the results of this study, and even the age ranges within which the major developments occur, agree with the findings of free description studies of the development structure, they are at odds with the mainly non-significant findings of the repertory grid studies reviewed in Chapter V. Signell (1966) did not find a hypothesised increase with age in the number of dimensions yielded by a cluster analysis which she took as a measure of differentiation. Barratt (1976) also failed to show a hypothesised increase in differentiation with age. His measures were based on principal components analysis and matching scores similar to Bieri's (Bieri, 1955).

In the light of the results of the present study, it may be that the measures employed by Signell and Barratt reflected the degree of organisation within construct systems rather than the level of differentiation. If this was so the failure to find a significant increase in these measures with age is not surprising. However it does not explain the failure to find significant age changes in the opposite direction which we would predict if the measures reflect the level of organisation.
This failure may be due to the confounding of content and structural changes in these studies discussed in Chapter V. Signell and Barratt were comparing structural characteristics of grids which differed significantly in the amount of abstract or concrete content. Those of younger children had a greater proportion of concrete constructs which tend to be more differentiated and organised. In the present study such variation in content was reduced by including only explicit or implicit psychological constructs in the structural analysis. This avoided the confounding of content and structural changes and hopefully gives a more accurate representation of age differences in the structural characteristics of psychological modes of construing.

Grid Size and Structural Measures

As a large proportion of psychological constructs were elicited from even the youngest age group in this study, the exclusion of non-psychological constructs drastically reduce the number of constructs in the structural analysis. However, at this point we must consider the possible effect of the number of constructs in the grid on the structural measures. Data only exist on the effect of the number of constructs and elements on the size of the first principal component. Slater (1977) argued that the explanatory power of the first principal component must vary, to a large extent, depending solely on the number of constructs and elements in the grid. Comparing grids of different sizes, randomly generated by the GRANNY program, Slater found that the size of the first component decreased as the size of the grid increased. For a 6 x 10 grid the mean size of the first component was 37.77 per cent. For a
15 x 25 grid the mean size was 15.08 per cent. It is clear that this relationship between grid size and explanatory power of the first principal component cannot account for the results of this study. While the mean number of constructs included in the structural analysis increases with age, so does the size of the first component. The direction of this relationship is contrary to that found with randomly generated grids. The effect of age on the size of the first component may be greater than the results of the present study suggest.

No information is available on the expected relationship between grid size and other structural measures. However to provide a crude indication of any relationship in the present study correlations were computed within each age group between the number of constructs in the structural analysis and structural measures.

Of the other measures of organisation, only the cluster analysis measure showed a significant positive correlation with the number of constructs and only among 7 year olds. Again, this relationship is contrary to the direction of change in organisation with age and so differences in the size of grids cannot account for the effect of age on organisation.

This conclusion is supported by the results for supplied constructs only, in which the number of constructs is constant across age. These results will be reported in more detail in Chapter XII but they show the same overall effect of age on organisation.

Turning to measures of differentiation the cluster analysis measure is significantly positively correlated with the number of
constructs for 7 and 10 year olds. However, the results for this measure for supplied constructs also show a significant increase with age so it might be concluded that the age differences for the complete grid are not due entirely to differences in the number of constructs.

The other measure of differentiation, the variance of self-other distances does not correlate with the number of constructs for any age group.

To conclude this section, it does not appear that the age differences in differentiation and organisation are due to the confounding effect of variations in the number of constructs in the structural analysis.

Egocentrism

The measure of differentiation based on the variance of self-other distances has implications for the notion of egocentrism. As discussed in Chapter II, Piaget argues that the preoperational child's cognitive behaviour is strikingly egocentric. The child is unable to see his own viewpoint as one of many alternatives. Subsequently the child develops the capacity to generate alternative perspectives and realise there are viewpoints other than his own. We would therefore predict that the notion of 'self' would become more differentiated from other and that this would be reflected by an increase with age in the mean distance between self and other. Analysis of this data (see Table 10.7) shows that this prediction is not upheld. The mean distance between self and others decreases significantly between the ages of 10 and 13 years. On the other hand,
### Table 10.7

Mean 'self-other' distances broken down by age and sex: Results and analysis.

<table>
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<tr>
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<th>SEX</th>
<th>OVERALL</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>MALE</td>
<td>FEMALE</td>
</tr>
<tr>
<td>7</td>
<td>0.99</td>
<td>1.03</td>
</tr>
<tr>
<td>10</td>
<td>0.97</td>
<td>0.99</td>
</tr>
<tr>
<td>13</td>
<td>0.88</td>
<td>0.80</td>
</tr>
<tr>
<td>OVERALL</td>
<td>0.95</td>
<td>0.93</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>SOURCE</th>
<th>AGE</th>
<th>SEX</th>
<th>AGE X SEX</th>
<th>ERROR</th>
</tr>
</thead>
<tbody>
<tr>
<td>D.F.</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>74</td>
</tr>
<tr>
<td>F-VALUE</td>
<td>20.14</td>
<td>0.05</td>
<td>2.42</td>
<td></td>
</tr>
</tbody>
</table>

*** $P<0.001$
as we have seen, the variance of self-other distances increases significantly with age. One possible interpretation of these findings is that the first stage in decreasing egocentrism is a categorical, indiscriminating differentiation of self from other which is followed by a more sophisticated view of self in relation to others which recognises a dimension of similarity with 'self' ranging from the very similar to the very different.

SUMMARY

The five measures expected to reflect degree of differentiation cluster in two groups which are negatively correlated with each other. The first group includes the two measures derived from the principal component analysis and the number of clusters at the 5 per cent significance level. It was suggested that these measures might be more appropriately regarded as indices of organisation rather than of differentiation as they reflect relatively weak relationships between constructs or do not differentiate between strong and weak relationships. With this interpretation the results for these measures show an increase in organisation with age as hypothesised and as found by studies using content-derived measures of structure. The major increase in organisation occurs between the ages of 10 and 13 years.

The second group of measures includes the number of clusters at the 0.1 per cent significance level and the variance of self-other distances. The result for these measures shows an increase in differentiation with age. The major increase in differentiation
occurs between the ages of 7 and 10 years.

It was suggested that other studies using grid measures of structure have failed to find these significant age changes because they have confounded the effects of content and structural changes.

The possibility of the results being due to age differences in the number of constructs in the grid was discussed and discounted.

The implications of the results for changes in egocentrism was also discussed. While the overall separation of self and other decreases with age the subtlety of distinctions between others in terms of similarity to self increases.
In Chapter III the concept of integration, as derived from the work of Harvey et al. (1961) and Schroder et al. (1967), was defined as the process by which a number of dimensions are used simultaneously or in interrelation in making a judgement. This provides the capacity for a multi-dimensional as opposed to a unidimensional view of the world. Integrative complexity refers to the complexity of the combinatorial or organisational rules.

Harvey and Schroder argue that the degree of integration is the crucial structural characteristic which determines the overall level of abstractness of a cognitive system. From the discussion in Chapter II we would predict an increase in integration with age.
MEASURES OF INTEGRATION

Various methods of measuring integration were discussed in Chapter IV. It was suggested that the projective techniques developed by Harvey and Schroder have disadvantages due to the complexity of the scoring procedures and rater subjectivity. It was suggested that principal components and cluster analysis of the grid might provide alternative measures.

One index of integration might be the degree of organisation or interrelatedness between dimensions in a system. It was suggested in the previous chapter that measures based on construct relationships in the grid which have previously been interpreted as reflecting differentiation might be more appropriately interpreted in the context of the present study as measures of organisation. Therefore in this chapter we will present results on measures of other aspects of integration.

1.1 The standard deviation of the percentages of variance accounted for by the first three principal components. The rationale for this measure is suggested by Abercrombie, Stringer and Terry (1971). They suggest that in a highly integrated system the percentage of variance accounted for by successive components extracted from a grid should decline gently rather than abruptly. This would reflect relatively high average loadings for each construct and element on components other than the first and suggest that elements are being considered in terms of several integrated dimensions at once.

A grid in which the first three components each account for
25 per cent of the variance reflects a more integrated system than one in which they account for 50 per cent, 15 per cent and 10 per cent respectively. This difference would be reflected in the standard deviation of the sizes of the first three components. A low standard deviation would indicate a more gentle decline and a more integrated system.

1.2 Hierarchical measure of Cognitive Complexity. This measure was developed by Smith and Leach (1972) and is derived from a cluster analysis of the grid. Smith and Leach argue that the fine details of a construct system are more important for the highly complex, highly integrated individual. This again implies a more even distribution of importance throughout the system. The rationale for the measure is that the importance of the finer details of a system can be inferred by observing changes that take place if the structure is impoverished and the contribution of these fine details removed.

The method involves a number of stages. Firstly the construct intercorrelation matrix is cluster analysed (Johnson, 1967). Constructs related at the 5 per cent level of significance (see measure D3 in Chapter X) are regarded as equivalent and a composite score for each element is derived by taking the mean rating of the constructs in the cluster. Two cluster analyses of elements are carried out, the first using data from the original unimpoverished grid and the second using the impoverished, composite ratings. From each cluster analysis of elements a matrix of relationships between elements in terms of the number of common nodes can be derived. An example is provided in Fig. 11.1.
In this example elements 3 and 4 have three nodes in common, elements 1 and 8 have only one node in common. The matrices derived from the two analyses are compared by subtracting one from the other. The values in the resultant matrix are totalled, disregarding signs, to provide an integration score. The higher the score the greater the effect of impoverishing the system, the greater the importance of the finer details of the system and the higher the level of integration.

The second aspect of integration examined was the distinction that Landfield (1977) makes between 'hypothesising' and 'assuming' individuals. Assuming Man is unaware of exceptions to his construct.
relationships and has a predominantly constellatory outlook. Hypothesising man has a more propositional approach. He is aware of exception and attempts to test the relationships between constructs. The following measure was developed to reflect this aspect of integration.

1.3 Landfield's measure of integration. Landfield suggests that 'assuming' and 'hypothesising' individuals can be distinguished in terms of the degree of differentiation they show at varying levels of relationship between constructs. Hypothesisers should show a decrease in differentiation from a stringent to a minimal criterion for relationships between constructs. Assumers, on the other hand, should show a consistent level of differentiation at both a stringent and minimal criterion. A measure of this was derived from the ratio of D3, the number of clusters at a minimal criterion level (5 per cent level of significance), to D4, the number of clusters at a stringent criterion level (0.1 per cent level of significance). The lower the ratio the greater the decrease in differentiation from a stringent to a minimal criterion and the stronger the tendency towards an integrated, propositional, hypothesising mode of construing.

RESULTS

Interrelationships Between Measures

Table 11.1 shows the intercorrelations among the measures described above and their correlations with the measures of organisation and differentiation described in the previous chapter.
### TABLE 11.1
Intercorrelations between integration measures and between integration measures and differentiation measures.

<table>
<thead>
<tr>
<th></th>
<th>I1</th>
<th>I2</th>
<th>I3</th>
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<tbody>
<tr>
<td>I1</td>
<td>0.09</td>
<td></td>
<td></td>
</tr>
<tr>
<td>I2</td>
<td>-0.58***</td>
<td>-0.10</td>
<td></td>
</tr>
<tr>
<td>I3</td>
<td>0.98***</td>
<td>0.07</td>
<td>-0.55***</td>
</tr>
<tr>
<td>D1</td>
<td>-0.74***</td>
<td>0.08</td>
<td>0.39***</td>
</tr>
<tr>
<td>D2</td>
<td>-0.57***</td>
<td>-0.08</td>
<td>0.19</td>
</tr>
<tr>
<td>D3</td>
<td>0.31**</td>
<td>0.26*</td>
<td>-0.26*</td>
</tr>
<tr>
<td>D4</td>
<td>0.70***</td>
<td>0.18</td>
<td>-0.45***</td>
</tr>
<tr>
<td>D5</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*P<0.05  **P<0.01  ***P<0.001

### TABLE 11.2
Mean scores on I1 (s.d. of first three components) broken down by age and sex: Results and analysis.

<table>
<thead>
<tr>
<th>SOURCE</th>
<th>AGE</th>
<th>SEX</th>
<th>AGE X SEX</th>
<th>ERROR</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>74</td>
</tr>
<tr>
<td>D.F.</td>
<td>26.72***</td>
<td>1.63</td>
<td>2.93</td>
<td></td>
</tr>
<tr>
<td>F-VALUE</td>
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</tr>
</tbody>
</table>

F_{7,10}=0.01  F_{7,13}=35.41***  F_{10,13}=36.34***

***P<0.001
Of the integration measures described in this chapter only I.1 and I.3 are significantly correlated with one another. However, the correlation is in the opposite direction to that expected. High integration as measured by I.1 is associated with low integration as measured by I.3.

Turning to the relationships with measures of organization: integration as measured by I.1 is significantly negatively associated with organisation as measured by D1, D2 and D3, integration as measured by I.3 is significantly positively associated with organisation as measured by D1 and D2, I.2 is not significantly correlated with any measures of organisation.

Integration as measured by I.1 is significantly negatively associated with both measures of differentiation. Integration as measured by I.2 and I.3 is significantly positively correlated with differentiation as measured by D4 and I.3 is also significantly positively correlated with D5.

Age and Sex Differences in Integration

I. I.1: Standard deviation of size of first three components. (see Table 11.2 for mean scores and analysis).

Age has a significant effect on integration as measured by I.1. I.1 scores for 13 year olds are significantly higher, and therefore integration is significantly lower, than for 7 or 10 year olds. The difference between 7 and 10 year olds is not significant. The interaction between age and sex just fails to reach statistical
significance ($P = 0.058$). At 7 years of age males are slightly less integrated than females. At 10 years of age males are slightly more integrated than females and at 13 years of age they are substantially more integrated than females.

2. $I.2$: Hierarchical measure of cognitive complexity. 
(See Table 11.3)

Age has a significant effect on integration as measured by $I.2$. Comparison of age groups means reveal that the mean score for 13 year olds is significantly higher than for 7 year olds. This indicates that 13 year olds are more highly integrated. Ten year olds do not differ significantly from 7 year olds. The difference between 10 and 13 year olds just fails to reach statistical significance ($P<0.10$).

3. $I.3$: Landfield's Measure of Integration. (See Table 11.4)

Age has a significant effect on integration as measured by $I.3$. Thirteen year olds have a significantly lower mean $I.3$ score, and therefore are more highly integrated, than 7 year olds. Ten year olds are not significantly different from 7 or 13 year olds.

Summary of Significant Results

1. Integration scores as measured by $I.1$ and $I.3$ are negatively correlated.

2. Integration as measured by $I.1$ is positively correlated with organisation and negatively correlated with differentiation.
### TABLE 11.3
Mean scores on I2 (Hierarchical measure of cognitive complexity) broken down by age and sex: Results and analysis.

<table>
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<th>AGE</th>
<th>SEX</th>
<th>OVERALL</th>
</tr>
</thead>
<tbody>
<tr>
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<td>MALE</td>
<td>FEMALE</td>
</tr>
<tr>
<td>7</td>
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<tr>
<td>10</td>
<td>43.27</td>
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</tr>
<tr>
<td>13</td>
<td>54.75</td>
<td>61.57</td>
</tr>
<tr>
<td>OVERALL</td>
<td>46.05</td>
<td>47.16</td>
</tr>
</tbody>
</table>

**SOURCE**  
D.F.  2  1  2  74  
F-VALUE  3.60*  0.01  0.44

* $F_{7,10} = 0.02$  
$F_{7,13} = 4.44^*$  
$F_{10,13} = 3.88$

**P<0.05**

### TABLE 11.4
Mean scores on I3 (Landfield's measure of integration) broken down by age and sex: Results and analysis.

<table>
<thead>
<tr>
<th>AGE</th>
<th>SEX</th>
<th>OVERALL</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>MALE</td>
<td>FEMALE</td>
</tr>
<tr>
<td>7</td>
<td>0.84</td>
<td>0.79</td>
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<tr>
<td>10</td>
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<td>0.75</td>
</tr>
<tr>
<td>13</td>
<td>0.69</td>
<td>0.69</td>
</tr>
<tr>
<td>OVERALL</td>
<td>0.71</td>
<td>0.74</td>
</tr>
</tbody>
</table>

**SOURCE**  
D.F. 2  1  2  74  
F-VALUE  3.60*  1.00  1.00

$F_{7,10} = 2.39$  
$F_{7,13} = 11.25^{**}$  
$F_{10,13} = 3.27$

**P<0.05**  
**P<0.01**
3. Integration as measured by I.2 is positively correlated with integration as measured by D4.

4. Integration as measured by I.3 is negatively correlated with organisation and positively correlated with differentiation.

5. Integration as measured by I.1 decreases with age.

6. Integration as measured by I.2 and I.3 increases with age.

DISCUSSION

Integration, as defined by Harvey and Schroder and as discussed in Chapters III and IV is concerned with the relationships between the differentiated parts of a cognitive system. In a more highly integrated system dimensions can be combined and organised in order to allow multidimensional judgements to be made about the world; dimensions are more evenly weighted in their contributions to judgements; the organisation of parts is less rigid and deterministic and there is a greater potential for generating alternative relationships.

The measures described in this chapter and those of organisation described in the previous chapter reflect these characteristics of integrated systems. If integration as so defined is a unidimensional structural characteristic we would expect all these measures to be closely related. The results show that this is not the case. Only I.3 and two of the organisation measures are significantly correlated in the expected direction. I.1 is positively correlated with the organisation measures and I.3 but in the opposite direction to
expectation. I.2 is not significantly correlated with I.1, I.3 or the organisation measures and thus appears to be measuring an unrelated characteristic. The lack of correlation between I.1 and I.2 is particularly surprising. The rationale for both measures is based on the same characteristic of integrated systems, that the contribution of dimensions to making judgements is more evenly distributed in highly integrated systems than in less integrated systems.

The conclusion from these findings must be that integration as defined by Harvey et al. is not a unidimensional characteristic and that the measures employed in this study do not reflect different aspects of a single structural property. Rather, they reflect independent structural characteristics in their own right.

This conclusion has implications for the notion of concreteness-abstractness (Harvey et al., 1961). As discussed in Chapter III, Harvey et al. suggest that underlying the more generic characteristic of concreteness-abstractness are such intra-system properties as 'clarity-ambiguity', 'compartmentalisation-interrelatedness', 'centrality-peripherality', and 'openness-closedness'. The measures employed in this study relate to these different inter-system properties.

Clarity-Ambiguity is related to the extent to which concepts or constructs in a system are differentiated and is reflected by measures of differentiation; D4 and D5.

Compartmentalisation-interrelatedness refers to the degree of connectedness among the differentiated parts of a system. This
property is reflected by the measures of organisation; D1, D2 and D3.

Centrality-peripherality refers to the distribution of weightings among the parts of the system. At an optimal degree the importance of parts should be more evenly balanced. All parts or dimensions should contribute to the functioning of the system, but not too heavily so. This property should be reflected by those measures which consider the relative contribution made to overall judgements by the different parts of the system, namely I.1 and I.2. In the discussion that follows we shall use the term 'balance' in preference to 'centrality-peripherality', as the latter refers to the status of individual concepts or constructs while the former refers to a property of the overall system.

Openness-closedness refers to the receptivity of the system to external events or to varied interpretation of the system. As expressed in the degree of certainty or commitment one feels and hence in the number of alternative interpretations one is willing to pursue it is related to Landfield's distinction between constellatory 'assuming' and propositional 'hypothesising' and should therefore be reflected by I.3.

Harvey et al. (1961) and Schroder et al. (1967) imply that these last three properties are interdependent structural manifestations of the unidimensional characteristic of integration. The findings of this study suggest that these properties may vary independently. It may be more appropriate, therefore, to investigate their causes, consequences and relationships with other psychological variables, separately rather than subsuming them under the general dimension
integration. Given that these properties are independent, the question arises as to how they are related to the concrete-abstract dimension which Harvey et al. see as based on the degree of integration. For example, is a less organised system of optimal centrality more abstract than a more highly organised system of high centrality or vice versa?

We have concluded that integration as described by Harvey and his colleagues is not a unidimensional property but includes a number of relatively independent structural characteristics, organisation, balance and openness.

Let us consider the effects of age and sex on each characteristic separately. In the previous chapter we saw that the degree of organisation increases with age particularly between 10 and 13 years of age.

Turning to balance, we have already seen that the two measures which should measure this structural characteristic, I.1 and I.2, are not significantly correlated. They also differ in the way they are related to age. Balance, as measured by I.2 shows a significant increase with age particularly between 10 and 13 years. This finding confirms the general hypothesis, derived from Piagetian theory, that there is a developmental trend towards increasing complexity of structure in construct systems. It also agrees with the more specific prediction of Harvey et al. (1961) that developmentally more advanced conceptual systems are characterised by more evenly balanced centrality of concepts.

Scores for I.1, on the other hand, show a significant decrease
balance with age. Why is there this inconsistency in measures based on very similar rationales? One possible answer is suggested by the very high positive correlation between scores on I.1 and scores on D1, the percentage of variance accounted for by the first principal component. Such a high correlation between balance and organisation would not necessarily be expected theoretically but, upon reflection, seems inevitable with the present measures. The standard deviation of the first three principal components is not independent of the percentage of variance accounted for by the first component. With a very large first component the standard deviation necessarily becomes very high. While I.1 scores may differentiate between high and low balance subjects when the size of the first component is kept relatively constant, the wide range of D1 scores in this study may well mask subtle variations in I.2 at particular levels of D1.

The results show a significant decrease in scores on I.3 with age. This suggests that older children are more open or propositional in their construing. This again accords with the hypothesis derived from Piagetian theory that the complexity of structure increases with age and also with Harvey's suggestion of a developmental trend towards greater openness.

SUMMARY

The results derived from measures of different aspects of integration as defined by Harvey et al. suggest that it should not be regarded as a unidimensional structural property. It was suggested that these measures represent the intra-system properties
described by Harvey as compartmentalisation-interrelatedness, the
degree of organisation among parts of the system, represented by
D1, D2 and D3; centrality-peripherality, the degree of balance
between the different parts of the system (I.1 and I.2) and openness-
closedness, the receptivity to external events or alternative
interpretation or the tendency to adopt a hypothesising mode of
construing as defined by Landfield (I.3). Rather than being closely
associated manifestations of a single structural property, integration,
the results suggest that these three properties are relatively
independent structural characteristics in their own right and
therefore ought to be considered independently.

It was suggested that balance as measured by I.1 was highly
confounded with measures of organisation; but results from other
measures show a developmental trend towards greater organisation,
balance and openness of construed systems in line with the general
hypotheses regarding increasing structural complexity derived from
the discussion of Piagetian theory in Chapter II.
INTRODUCTION

In the previous three chapters we have discussed results derived from the analysis of the full grid completed by each subject. As described in Chapter VII the full grid comprised a set of common constructs supplied to each subject and a set of personal constructs elicited from each subject. In this chapter we will present results for the separate analyses of these two groups of constructs. The focus will be on the comparison of the structural characteristics of the two types of construct and of the effects of age and sex.

Kelly's individuality corollary states: 'Persons differ from
each other in their construction of events'. From this it has been suggested that a more valid and meaningful picture of how an individual characteristically construes the world, both in terms of content and structure, can be obtained from elicited personal constructs.

As discussed in Chapter VI, a number of studies have examined the proposition that personal constructs are used more meaningfully than supplied constructs. Many have adopted the rationale that greater extremity of ratings on a construct signifies greater personal meaningfulness. Isaacson (1962) and Cromwell and Caldwell (1962), among others, have demonstrated that elements tend to be rated more extremely on personal constructs than on supplied constructs. Stringer (1972) found that personal constructs account for more variance in a sorting tank than supplied constructs.

A number of studies have also compared structural characteristics derived from personal and supplied constructs. Most attention has been given to cognitive complexity or differentiation. It has been argued that a person's own constructs should give him the most differentiated view of other people. Findings have been somewhat equivocal. Tripodi and Bieri (1963) and Carr (1965) found no significant difference in the degree of cognitive complexity shown by personal and supplied constructs. Other studies, by Bonarius (1965), Caine and Smail (1967), and Landfield (1968), have found personal constructs to be significantly more cognitively complex than supplied constructs.

One reason for these contradictory findings may be the large
number of different measures of cognitive complexity that have been used. The study by Vannoy (1965), discussed earlier, has shown empirically that cognitive complexity, as measured by these diverse instruments, is a multidimensional concept and different indices may measure different aspects of structure. Kuusinen and Nystedt (1975) made direct comparisons of four measures of cognitive complexity: Bieri's index; an interaction variance measure; the number of factors from a principle components analysis; the percentage of first factor variance. They found that the difference between personal and supplied constructs varied with the measure used. Only for the number of factors was the difference in the predicted direction. The results for the interaction variance measure and the percentage of first factor variance were in the opposite direction to hypothesis: supplied constructs were significantly more cognitively complex than personal constructs. This suggests another reason for the inconsistency of other studies. In earlier chapters it has been suggested that measures of cognitive complexity based on the overall degree of inter-relationship between constructs confound differentiation and organisation. A high degree of cognitive complexity fails to discriminate between high differentiation and low organisation. Failure to find consistent differences between personal and supplied constructs may be the result of the inadequate operationalisation of differentiation. Kuusinen and Nystedt's data may show that personal constructs are more organised than supplied constructs.

In the present study less ambiguous measures of differentiation have been employed. It is also possible to investigate the effect of construct type on other aspects of structure which have not been
considered previously: organisation, balance and openness.

Kuusinen and Nystedt (1965) also suggest that differences between personal and supplied constructs may or may not be found depending on the nature of the constructs supplied. Kuusinen and Nystedt suggest that differences between personal and supplied constructs may be related to how relevant the supplied constructs are for describing behaviour in general. They carried out a study in which personal constructs were compared with two types of supplied constructs: those that can be used to describe behaviour in very broad and general terms, namely semantic differential scales, and those specifically developed for ratings of personality, namely Personality Differential Scales. Personality Differential Scales proved to be more differentiated than Semantic Differential Scales.

Following the discussion in earlier chapters of the relationship between content and structure, we would like to suggest that the relative concreteness of the two sets of constructs was an important factor. In the present study the two sets of constructs have been made as comparable as possible by selecting the supplied constructs from those psychological constructs elicited most frequently in other studies of children within the same age range.

Overall we would predict that personal constructs should be more differentiated, organised, balanced and open than supplied constructs. What of the effect of age? There have been no studies of the effect of age on the use of personal and supplied constructs. It was suggested in Chapter II that the construing of young children is likely to be more egocentric and therefore more idiosyncratic
than that of older children. If this is the case we would predict that the relevance of personal constructs over supplied constructs will be greater for the younger children in our sample than for the older children. We would therefore predict that personal constructs will be superior to supplied constructs in discrimination, differentiation, organisation, balance and openness, but that this superiority will decrease with age.

RESULTS

Results and analyses for each structural characteristic will be presented. Differences between personal and supplied constructs were tested by means of three-way, repeated measures analyses of variance by age and sex with construct type as the repeated factor. As first-order age and sex effects were discussed in preceding chapters they will not be presented.

Discrimination

As described in Chapter VIII a ranking procedure was adopted for 7 and 10 year olds and a ten point rating scale for 13 year olds. This means that comparisons cannot be made between all age groups. For 7 and 10 year olds the effects of age, sex and construct type were examined by three-way ANOVA (see Table 12.1 for mean scores and analysis). The interaction between age and construct type was significant. At 7 years of age there was no significant difference in the mean number of ranks used for personal and supplied constructs. At 10 years of age the difference between personal and supplied constructs is significant ($F = 9.73$, df = 1,50, $p<0.01$). Personal
### Table 12.1
Mean scores on discrimination broken down by age, sex, and construct type: Results and analysis.

<table>
<thead>
<tr>
<th>AGE</th>
<th>CONSTRUCT TYPE</th>
<th>PERSONAL</th>
<th>SUPPLIED</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall</td>
<td>7</td>
<td>5.74</td>
<td>6.22</td>
</tr>
<tr>
<td>Male</td>
<td>n=16</td>
<td>5.70</td>
<td>6.14</td>
</tr>
<tr>
<td>Female</td>
<td>n=12</td>
<td>5.79</td>
<td>6.30</td>
</tr>
<tr>
<td>Overall</td>
<td>10</td>
<td>7.51</td>
<td>6.76</td>
</tr>
<tr>
<td>Male</td>
<td>n=15</td>
<td>7.26</td>
<td>6.75</td>
</tr>
<tr>
<td>Female</td>
<td>n=11</td>
<td>7.76</td>
<td>6.76</td>
</tr>
<tr>
<td>Overall</td>
<td></td>
<td>6.63</td>
<td>6.49</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>SOURCE</th>
<th>TYPE</th>
<th>AGE X TYPE</th>
<th>SEX X TYPE</th>
<th>AGE X SEX X TYPE</th>
<th>ERROR</th>
</tr>
</thead>
<tbody>
<tr>
<td>D.F.</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>50</td>
</tr>
<tr>
<td>F-VALUE</td>
<td>0.01</td>
<td>14.14***</td>
<td>0.92</td>
<td>0.00</td>
<td></td>
</tr>
</tbody>
</table>

*** *P<0.001

### Table 12.2
Mean discrimination scores for 13 year-olds broken down by sex and construct type: Results and analysis.

<table>
<thead>
<tr>
<th>SEX</th>
<th>CONSTRUCT TYPE</th>
<th>PERSONAL</th>
<th>SUPPLIED</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>n=12</td>
<td>5.92</td>
<td>5.75</td>
</tr>
<tr>
<td>Female</td>
<td>n=14</td>
<td>5.19</td>
<td>5.21</td>
</tr>
<tr>
<td>Overall</td>
<td></td>
<td>5.56</td>
<td>5.49</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>SOURCE</th>
<th>TYPE</th>
<th>SEX X TYPE</th>
<th>ERROR</th>
</tr>
</thead>
<tbody>
<tr>
<td>D.F.</td>
<td>1</td>
<td>1</td>
<td>24</td>
</tr>
<tr>
<td>F-VALUE</td>
<td>0.46</td>
<td>0.85</td>
<td></td>
</tr>
</tbody>
</table>
constructs show higher discrimination. Both types of construct show a significant increase in differentiation with age, but the effect is stronger for elicited than for supplied constructs (F = 53.43, df = 1, 50, P < 0.001; F = 4.89, df = 1, 50, P < 0.05 respectively).

For 13 year olds the effect of sex and construct type were examined by a two-way analysis of variance (see Table 12.2 for means and analysis). Construct type had no significant effect on the mean number of rating intervals used. For both types of construct males show greater discrimination.

**Differentiation**

1. Number of construct clusters (0.1% Level)

   (See Table 12.3)

   The interaction effect between age and construct type is statistically significant. Comparison of cell means show that at 7 years of age there is no significant difference in the mean number of construct clusters for personal and supplied constructs. At 10 years of age personal constructs have a significantly higher mean score (F = 21.81, df = 1, 70, P < 0.001), and so are more differentiated than supplied constructs. At 13 years of age there is no significant difference between personal and supplied constructs.

   Both types of construct show an overall increase in differentiation with age. For supplied constructs the major development occurs between 10 and 13 years of age (F = 27.92, df = 1, 70, P < 0.001). For personal constructs the major development occurs between 7 and 10 years of age (F = 23.06, df = 1, 70, P < 0.001).
### Table 12.3

Mean differentiation scores (No. of clusters at 0.1% level) broken down by age, sex and construct type:

Results and analysis.

<table>
<thead>
<tr>
<th>AGE</th>
<th>CONSTRUCT TYPE</th>
<th>PERSONAL</th>
<th>SUPPLIED</th>
</tr>
</thead>
<tbody>
<tr>
<td>7 Overall</td>
<td></td>
<td>5.12</td>
<td>5.61</td>
</tr>
<tr>
<td>Male</td>
<td></td>
<td>5.35</td>
<td>5.52</td>
</tr>
<tr>
<td>Female</td>
<td></td>
<td>4.88</td>
<td>5.70</td>
</tr>
<tr>
<td>10 Overall</td>
<td></td>
<td>7.18</td>
<td>5.17</td>
</tr>
<tr>
<td>Male</td>
<td></td>
<td>7.46</td>
<td>5.38</td>
</tr>
<tr>
<td>Female</td>
<td></td>
<td>6.90</td>
<td>4.97</td>
</tr>
<tr>
<td>13 Overall</td>
<td></td>
<td>6.66</td>
<td>7.44</td>
</tr>
<tr>
<td>Male</td>
<td></td>
<td>6.70</td>
<td>7.97</td>
</tr>
<tr>
<td>Female</td>
<td></td>
<td>6.62</td>
<td>6.91</td>
</tr>
<tr>
<td>OVERALL</td>
<td></td>
<td>6.32</td>
<td>6.05</td>
</tr>
</tbody>
</table>

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<th>SEX X TYPE</th>
<th>AGE X SEX X TYPE</th>
<th>ERROR</th>
</tr>
</thead>
<tbody>
<tr>
<td>D.F.</td>
<td></td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>F-VALUE</td>
<td>1.21</td>
<td>12.4</td>
<td>0.01</td>
<td>1.36</td>
<td></td>
</tr>
</tbody>
</table>

**P<0.001**

**Table 12.3** Mean differentiation scores (No. of clusters at 0.1% level) broken down by age, sex and construct type: Results and analysis.
2. Variance of Self-Other distances

(See Table 12.4)

The interaction between age and construct type and the three way interaction between age, sex and construct type are statistically significant. At 7 years of age personal constructs show a higher mean variance and so are more differentiated. The difference is only significant for females ($F = 7.30$, df = 1,70, $P < 0.001$). At 10 years of age there is no significant effect of construct type. At 13 years of age supplied constructs are more differentiated, but again the difference is only significant for female subjects ($F = 17.33$, d.f. = 1,70, $P < 0.001$).

Organisation

1. Percentage of variance accounted for by first principal component

(See Table 12.5)

The interaction between age and construct type is statistically significant. At 7 years of age there is no significant difference between mean scores for personal and supplied constructs. At 10 years of age personal constructs have a higher mean score, so are more highly organised than supplied constructs ($F = 11.03$, df = 1,70, $P < 0.01$). At 13 years of age supplied constructs are significantly more organised than personal constructs ($F = 5.0$, df = 1,70, $P < 0.005$). For both sets of constructs the major increase in organisation occurs between 10 and 13 years of age. However the increase is more marked for supplied constructs ($F = 58.28$, df = 1,70, $P < 0.001$) than for personal constructs ($F = 4.98$, df = 1,70, $P < 0.05$).
### Table 12.4: Mean differentiation scores (variance of self-other distances) broken down by age, sex and construct type: Results and analysis.

<table>
<thead>
<tr>
<th>AGE</th>
<th>CONSTRUCT TYPE</th>
<th>PERSONAL</th>
<th>SUPPLIED</th>
</tr>
</thead>
<tbody>
<tr>
<td>7 Overall</td>
<td></td>
<td>0.11</td>
<td>0.06</td>
</tr>
<tr>
<td>Male</td>
<td></td>
<td>0.12</td>
<td>0.08</td>
</tr>
<tr>
<td>Female</td>
<td></td>
<td>0.10</td>
<td>0.04</td>
</tr>
<tr>
<td>10 Overall</td>
<td></td>
<td>0.09</td>
<td>0.08</td>
</tr>
<tr>
<td>Male</td>
<td></td>
<td>0.09</td>
<td>0.08</td>
</tr>
<tr>
<td>Female</td>
<td></td>
<td>0.09</td>
<td>0.07</td>
</tr>
<tr>
<td>13 Overall</td>
<td></td>
<td>0.13</td>
<td>0.17</td>
</tr>
<tr>
<td>Male</td>
<td></td>
<td>0.13</td>
<td>0.13</td>
</tr>
<tr>
<td>Female</td>
<td></td>
<td>0.12</td>
<td>0.21</td>
</tr>
<tr>
<td>OVERALL</td>
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<td>0.10</td>
<td>0.11</td>
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<table>
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<th>SEX X TYPE</th>
<th>AGE X SEX TYPE</th>
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<tbody>
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<td>1</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>70</td>
</tr>
<tr>
<td>F-VALUE</td>
<td>0.33</td>
<td>9.50 ***</td>
<td>0.67</td>
<td>4.17*</td>
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</tr>
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</table>

* P<0.05  *** P<0.001
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<tbody>
<tr>
<td></td>
<td>PERSONAL</td>
</tr>
<tr>
<td>7 Overall</td>
<td>55.83</td>
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<tr>
<td>Male</td>
<td>55.10</td>
</tr>
<tr>
<td>Female</td>
<td>56.56</td>
</tr>
<tr>
<td>10 Overall</td>
<td>59.33</td>
</tr>
<tr>
<td>Male</td>
<td>64.15</td>
</tr>
<tr>
<td>Female</td>
<td>54.50</td>
</tr>
<tr>
<td>13 Overall</td>
<td>64.45</td>
</tr>
<tr>
<td>Male</td>
<td>62.75</td>
</tr>
<tr>
<td>Female</td>
<td>68.14</td>
</tr>
<tr>
<td>OVERALL</td>
<td>60.20</td>
</tr>
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</table>

<table>
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<td>1</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>70</td>
</tr>
<tr>
<td>F-VALUE</td>
<td>0.24</td>
<td>7.61**</td>
<td>2.12</td>
<td>0.42</td>
<td></td>
</tr>
</tbody>
</table>

**P<0.01

**TABLE 12.5** Mean organisation scores (% of variance of 1st. component) broken down by age, sex and construct type: Results and analysis.
2. Number of significant components

(See Table 12.6)

The interaction between age and construct type is statistically significant. At 7 years of age there is no significant difference between personal and supplied constructs. At 10 years of age personal constructs are more highly organised than supplied constructs. \( F = 7.95, \) \( \text{df} = 1,70, P < 0.01 \). At 13 years of age there is no significant difference. Both types of construct show an overall increase in organisation. For personal constructs the major increase occurs between 7 and 10 years of age. For supplied constructs the major increase occurs between 10 and 13 years of age.

3. Number of significant clusters (5% Level)

(See Table 12.7)

The interaction between age and construct type is statistically significant. At 7 years of age there is no significant difference between personal and supplied constructs. At 10 years of age personal constructs are more highly organised \( F = 5.95, \) \( \text{df} = 1,70, P < 0.05 \). At 13 years of age there is no significant difference. Supplied constructs show no significant differences in organisation with age. Personal constructs show a significant increase in organisation with age. The major increase occurs between 7 and 10 years of age \( F = 5.74, \) \( \text{df} = 1,70, P < 0.05 \).

Balance

Two measures of balance were discussed in the previous chapter: the standard deviation of the first three principal components, and
### TABLE 12.6 Mean organisation scores (No. of components with eigen value $\geq 1.0$) broken down by age, sex and construct type: Results and analysis.

<table>
<thead>
<tr>
<th>AGE</th>
<th>CONSTRUCT TYPE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>PERSONAL</td>
</tr>
<tr>
<td>7 Overall</td>
<td>2.29</td>
</tr>
<tr>
<td>Male</td>
<td>2.40</td>
</tr>
<tr>
<td>Female</td>
<td>2.18</td>
</tr>
<tr>
<td>10 Overall</td>
<td>1.94</td>
</tr>
<tr>
<td>Male</td>
<td>1.77</td>
</tr>
<tr>
<td>Female</td>
<td>2.10</td>
</tr>
<tr>
<td>13 Overall</td>
<td>2.01</td>
</tr>
<tr>
<td>Male</td>
<td>2.08</td>
</tr>
<tr>
<td>Female</td>
<td>1.93</td>
</tr>
<tr>
<td>Overall</td>
<td>2.08</td>
</tr>
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</table>

<table>
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<th>AGE $\times$ TYPE</th>
<th>SEX $\times$ TYPE</th>
<th>AGE $\times$ SEX $\times$ TYPE</th>
<th>ERROR</th>
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</thead>
<tbody>
<tr>
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<td>1.0</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>70</td>
</tr>
<tr>
<td>F-VALUE</td>
<td>0.21</td>
<td>7.12**</td>
<td>0.39</td>
<td>0.82</td>
<td></td>
</tr>
</tbody>
</table>

** $p<0.01$
<table>
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<tr>
<th>AGE</th>
<th>CONSTRUCT TYPE</th>
<th>PERSONAL</th>
<th>SUPPLIED</th>
</tr>
</thead>
<tbody>
<tr>
<td>7 Overall</td>
<td>4.31</td>
<td>3.69</td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>4.53</td>
<td>3.73</td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>4.09</td>
<td>3.64</td>
<td></td>
</tr>
<tr>
<td>10 Overall</td>
<td>3.56</td>
<td>4.28</td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>3.31</td>
<td>4.15</td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>3.80</td>
<td>4.40</td>
<td></td>
</tr>
<tr>
<td>13 Overall</td>
<td>3.73</td>
<td>4.08</td>
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</tr>
<tr>
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<tr>
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</table>

*P<0.05

**TABLE 12.7** Mean organisation scores (No. of clusters at 5% level) broken down by age, sex and construct type:

Results and analysis.
Smith and Leach's cluster analytic measure. Only the latter was analysed for effects of construct type. The former was omitted due to its being confounded with measures of organisation as discussed in the previous chapter.

(See Table 12.8)

Construct type has no significant effect on mean scores for balance.

Openness

(See Table 12.9)

The interaction between age and construct type is statistically significant. Only at 10 years of age is the difference between personal and supplied significant (F = 8.15, df = 1,70, P<0.01). The mean score for personal constructs is less than that for supplied constructs signifying a higher degree of openness in personal constructs. Both construct types show a significant increase in openness with age. For supplied constructs the major development occurs between 10 and 13 years of age (F = 22.03, df = 1,70, P<0.001). For personal constructs the major change occurs earlier between 7 and 10 years of age (F = 8.67, df = 1,70, P<0.01).

Summary of Significant Results

1. Discrimination

At 10 years of age personal constructs show higher discrimination than supplied constructs. Both construct types increase in discrimination between 7 and 10 years of age but personal constructs more so.
### Table 12.8

Mean balance scores broken down by age, sex and construct type: Results and analysis.

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TABLE 12.8 Mean balance scores broken down by age, sex and construct type: Results and analysis.
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<td>Male</td>
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<th>AGE X SEX TYPE</th>
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<tbody>
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<td>2</td>
<td>70</td>
</tr>
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<td>F-VALUE</td>
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<td>3.50*</td>
<td>0.50</td>
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</table>

* P<0.05

TABLE 12.9 Mean openness scores broken down by age, sex and construct type: Results and analysis.
2. Differentiation

At 10 years of age personal constructs are more differentiated, as measured by the number of construct clusters (0.1% Level) than supplied constructs. Both construct types show an increase in differentiation with age.

At 7 years of age personal constructs are more differentiated, as measured by the variance of 'self-other' distances, than supplied constructs. At 13 years of age supplied constructs are more differentiated. These differences are only significant for females.

3. Organisation

At 10 years of age personal constructs are more organised, as measured by the size of the first component, than supplied constructs. At 13 years of age supplied constructs are more organised. Supplied constructs show a more marked increase in organisation with age.

At 10 years of age personal constructs are more organised, as measured by the number of significant components and the number of clusters (5% level), than supplied constructs.

4. Openness

Personal constructs are significantly more open than supplied constructs at 10 years of age. Both sets of a construct show an increase in openness with age but the major change occurs at an earlier age for personal constructs.
The general hypothesis regarding personal and supplied constructs stated that personal constructs should show a higher level of such structural characteristics as discrimination, differentiation, organisation, balance and openness. It was further hypothesised that this superiority should decrease with age. The results presented in the preceding sections do not offer unequivocal support for these hypotheses.

Turning first to discrimination, while 7 year olds show no difference in discrimination between personal and supplied constructs, for 10 year olds personal constructs show higher discrimination. Only the results for 10 year olds support the first hypothesis. Moreover, the increase in difference between personal and supplied constructs with age is contrary to the second hypothesis. Thirteen year olds show no difference between personal and supplied constructs although the decrease in the superiority of personal constructs between the ages of 10 and 13 supports the second hypothesis.

The results for the cluster analysis measure of differentiation show a similar pattern. Only at 10 years of age are personal constructs more highly differentiated. In the case of differentiation the pattern of relationship between personal and supplied constructs can be clarified by examining the effect of age on the two types of construct. Both types show an overall increase in differentiation between the ages of 7 and 13 years. However, the major increase in differentiation for personal constructs occurs between 7 and 10 years, at an earlier age than for supplied constructs which show little change in differentiation between 7 and 10 but a significant increase between
10 and 13 years of age. Thus at 7 years of age both construct types are low in differentiation, between the ages of 7 and 10 supplied constructs show no change while personal constructs increase and by 10 years of age show superior differentiation. From 10 to 13 years of age personal constructs show a decelerated increase in differentiation while supplied constructs show an accelerated change such that by 13 years of age they have caught up with personal constructs.

The results for discrimination may be due to the same effects of age, although from the present data it is impossible to draw conclusions about the development of discrimination between 10 and 13 years of age due to the different rating procedures used.

Personal and supplied construct differences in openness show the same pattern. Personal constructs show most development in openness between 7 and 10 years of age while supplied constructs show more increase between 10 and 13 years.

The results for organisation show a similar general pattern although the details differ according to the particular measure. For all three measures, it is, again, only at 10 years of age that personal constructs show superior organisation. However the relative effects of age on the two construct types differ from measure to measure. For the number of significant components the effects of age are similar to those for differentiation and openness. Between 7 and 10 years the major change is in personal constructs, while between 10 and 13 years supplied constructs show a sharper increase in organisation. For the size of the first component the pattern of age effects differs slightly. Neither construct type shows a significant increase in organisation between 7 and 10 years but between 10 and 13 years supplied constructs
show a sharper increase than personal constructs, as for
differentiation, etc.

Only the results for the numbers of significant clusters differs
substantially from this pattern. While personal constructs again show
a significant increase in organisation between 7 and 10 years, supplied
constructs show no significant increase in organisation throughout the
age range studied.

In summary, the results do not support the general hypothesis
that personal constructs show a higher level of structure than supplied
constructs. However, differences do exist between personal and supplied
constructs in their relative structural development at different ages.
Between the ages of 7 and 10 personal constructs show a sharper
increase in discrimination, differentiation, organisation and openness.
Between 10 and 13 years of age supplied constructs show a sharper
increase in these characteristics. What explanations can we offer for
these different rates of development?

One explanation may be developmental changes in egocentrism and
the ability to consider alternatives. Although the supplied constructs
in this study were chosen on the basis of their frequent use by
children in this age range, in many cases they do not represent the
child's characteristic way of viewing the world, but are impositions
of another's dimensions of meaning. It is only with decreasing
egocentrism that the child comes to realise the validity of alternative
ways of viewing the world to his how. According to Piaget it is only
when the child enters the formal operational stage that he develops
the capacity to generate alternative constructions of events. Harvey
et al. also argue that the ability to generate alternatives is dependent
upon a highly abstract integrated cognitive system: a relatively late
development.

The meaningful and structured use of supplied constructs may wait
upon the development of these abilities and their relatively late
appearance may account for the delayed structural development of
supplied constructs.

A second explanation relates to the equal relevance of the
supplied constructs for all age groups. It was hoped to ensure this
by the selection of supplied constructs on the basis of frequent use
by children throughout the age range. However, comparison of the
personal constructs elicited suggests that this goal may not have been
achieved. Children in the youngest age group rarely spontaneously
generated constructs identical or similarly labelled to the set of
supplied constructs. In the 13 year old group, however, children
frequently generated up to four of the supplied constructs. This
suggests that the supplied constructs may have been more meaningful and
personally relevant for the older children. It would be possible to
examine the extent to which the supplied constructs are assimilated
into the individual's construct system by considering the relationship
between personal and supplied constructs. If supplied constructs have
more meaning for older children this would be reflected in greater
assimilation and more implicative and organisational links between
personal and supplied constructs.

This increase in meaningfulness and relevance are presumably a
result of a social learning process. Through social interaction with
other children and adults, children become increasingly aware of other
dimensions of construing and of socially agreed meanings in terms of the relationships between constructs.

If this is the case we might expect older children to show greater consensus in the meanings they attribute to supplied constructs in terms of their organisational or implicative relationships. The hypothesis that the degree of shared meaning or commonality increases with age was tested in the following manner. Rank order correlations were computed between the supplied construct intercorrelation matrix of each subject in each age group. These rank order correlations were squared to transform them to a linear scale. Although the sign was retained the mean transformed scores for each age group were compared by means of a one-way analysis of variance (see Table 12.10). The effect of age was highly significant. A high mean score signifies a high degree of consensus within the age group. Consensus increases with age with the major increase occurring between 10 and 13 years of age.

The result confirms a finding by Applebee (1975). He investigated developmental changes in the amount of social consensus in grid ratings and construct implications. Between the ages of 6 and 17 years he found the development of a substantial degree of consensus for patterns of inter-construct relationships.

As well as providing evidence for the greater meaningfulness of supplied constructs in older children, the finding of increasing consensus of construct relationships has implications for the development of social behaviour. Effective social interaction and the development of social relationships requires some degree of commonality between people. The young child's construct system may contain highly
<table>
<thead>
<tr>
<th>AGE</th>
<th>MEAN</th>
</tr>
</thead>
<tbody>
<tr>
<td>7 YEARS</td>
<td>0.19</td>
</tr>
<tr>
<td>10 YEARS</td>
<td>0.24</td>
</tr>
<tr>
<td>13 YEARS</td>
<td>0.51</td>
</tr>
</tbody>
</table>

F = 107.37; df = 1,724; P < 0.001

**TABLE 12.10.** Age differences in consensus: Mean squared intercorrelations between supplied construct relationship matrices.
idiosyncratic constructs and idiosyncratic or unstable relationships between constructs. Therefore he is unable to enter into and maintain effective social relationships. The possibility for such interactions and relationships waits upon the development of shared meanings and a degree of commonality. Support for this notion comes from studies of friendship. The work of Duck (1973, 1975, 1977) has shown that commonality between persons with respect to the content of their personal construct systems provides a basis for predicting who will eventually become friends out of a previously unacquainted population. The growth of consensus or commonality revealed by the present study may well be associated with developmental changes in children's descriptions of friendships. Bigelow and La Gaipa (1974) found that young children describe the basis of friendship in situational terms, for example, 'we sit next to each other in school', 'we live close to each other'. Friendships tend to be very unstable. Older children are more likely to describe psychological reasons for friendship such as common interests or 'getting on with each other'.

SUMMARY

It was hypothesised that children's personal constructs would show a higher degree of structure than a set of supplied constructs and that this superiority should decrease with age. The results did not support these hypotheses. No significant overall differences emerged in the degree of discrimination, differentiation, organisation, balance or openness of personal and supplied constructs.

It emerged that personal and supplied constructs differ in their rates of development of discrimination, differentiation, organisation
and openness. The major increase in these characteristics for supplied constructs occurs at a later age than the major increase for personal constructs. A number of reasons were suggested for this differential rate of development. It may be that only when a certain ability to consider alternative ways of construing events, which accompanies decreasing egocentrism, is attained that children can use supplied constructs in a meaningful and structured way.

Secondly, the set of supplied constructs may be more meaningful and personally relevant for the older age groups. This suggestion receives support from the more frequent elicitation of the supplied constructs from older children and the greater consensus of meaning among older children. The implication of developing consensus for social relationships and friendship was considered.
PART THREE

A DEVELOPMENTAL STUDY OF STABILITY AND CHANGE IN

CHILDREN'S CONSTRUCT SYSTEMS
CHAPTER XIII

STABILITY AND CHANGE IN CONSTRUING

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A STUDY OF DEVELOPMENTAL ASPECTS OF STABILITY AND CHANGE: INTRODUCTION 240
In Chapter II we considered the implications of Piagetian theory for the development of personal construct systems in terms of their content, structure, and their dynamic properties. Part Two presented an empirical investigation of the development of the first two of these characteristics. In Part Three we will consider the third. The following chapters will describe a study of how the dynamic properties of construct systems; their stability and the nature and extent of how they change, vary with age. In this first chapter, however, we will consider in more detail the role of 'change' in Personal Construct Theory and review previous research in this area.

PERSONAL CONSTRUCT THEORY AND CHANGE

The basic assumptions of Personal Construct Theory envisage man as a form of motion actively engaged in interpreting and trying to extend his understanding of the world in terms of the frameworks of meaning or alternative constructions that he erects.

An individual's construct system is his theory of the world on the basis of which he can formulate specific hypotheses to anticipate events and guide his behaviour. In terms of Kelly's 'Man-the-Scientist' analogy, behaviour can be seen as a series of experiments, the form and direction of which are dictated by hypotheses and anticipations. This link between anticipation and behaviour or between hypothesis and experiment implies that the outcome of behaviour, as it is construed by the individual, is compared with the hypothesised outcome. The construed relationship between anticipation and experience manifests some degree of match or mismatch which in turn can be viewed as offering
varying degrees of support or validation for the hypothesis. To carry the scientific analogy through, the experienced outcome should have some consequences for future hypotheses and possibly for the theory that generated them. This interaction between an individual and the world provides the impetus for change which underlies the dynamic nature of construct systems.

The emphasis of Personal Construct Theory on change is stated in the Experience Corollary:

'A person's construction system varies as he successively construes the replication of events.'

Predictions and anticipations of the world only fulfil some purpose if the individual acts upon them. In doing so, he risks or tests their validity for organising and understanding the real world by exposing them to a range of validational outcomes. The principle of attempting to make sense of one's world makes it essential that one's system of understanding should vary to accommodate the results of experience. Without this dynamic relationship between construction and experience one's theory would come to bear less and less relationship to the world and the hypotheses or anticipations generated would become less and less useful for structuring events and understanding that world.

In Personal Construct Theory terms the construing process is a cyclic one embracing five phases: anticipation, based on a particular construction of events; investment, some commitment to one's anticipation and the outcome; encounter; confirmation or disconfirmation, a matching between anticipation and the construed outcome of the encounter; and constructive revision.
To quote Kelly (1955, p. 72):

'As one's anticipations or hypotheses are successively revised in the light of the unfolding sequence of events the construct system undergoes a progressive evolution.'

This statement has implications for the direction of changes in construct systems. The use of the term 'evolution' suggests that such changes automatically constitute a development of the system. The impetus for change is the need for the individual to construct an increasingly valid and efficient system for understanding his world. This means that any changes are subjectively developmental in the sense of improving the validity and efficiency of the individual's system of understanding within that particular context. This does not guarantee that the efficiency of the system for understanding other situations is improved. Indeed, it is possible that the maintenance of understanding within one context may be achieved at the cost of limiting the potential of the system for understanding other events. Should such a change be regarded as evolutionary in the sense of being a development? Therefore, rather than talking about a natural process of 'progressive evolution' as Kelly does, it is perhaps more justifiable to talk of a more general process of change and then to consider under what conditions such change can be regarded as a 'progressive evolution'.

We have seen that an essential aspect of personal construct systems is their dynamism, which springs from the interaction between an individual's anticipation and his experience. The emphasis on dynamism and change sets Personal Construct Theory apart from many other approaches to personality. Many psychologists, e.g. Eysenck and Cattell, view 'personality' as a collection of stable enduring
characteristics of the individual. With this approach it is important to be able to demonstrate that the particular characteristics that a theory holds to be important are relatively stable and enduring in any individual. This is one reason for the great importance placed upon reliability in personality tests.

The emphasis of Personal Construct Theory is clearly different. Rather than assuming the stability of an individual personality it assumes, as its starting point, that an individual's personality, conceived of in terms of his construct system, is continually open to change. It follows from this fundamental difference in emphasis that in Personal Construct Theory the concern should be with predictable stability and predictable change rather than with consistency or stability per se. Reliability, rather than being a necessity for a test of personality, becomes a subject for investigation in its own right.

Having considered the theoretical role and significance of the issue of stability and change let us turn to look at research which has investigated stability and change in construct systems.

RESEARCH INTO STABILITY

Much of the research of relevance to the stability and consistency of construct systems has, in fact, been in the context of investigations into the reliability of repertory grid methodology. Such studies are complementary to the investigation of change as they can be used to establish a baseline of stability; an indication of the 'noise' level of variation which occurs in systems which are assumed not to be under-
going any significant psychological change. Against this one can compare the nature and degree of changes which may be brought about by varying validational outcomes of an individual's constructions, either through real-life experiences or through experimental manipulation.

Reviews of research that has looked at reliability or consistency of Repertory Grids are provided by Bannister and Mair (1968), and more recently by Fransella and Bannister (1977). We will discuss briefly some of the major points which they consider.

Content Stability

A number of studies have investigated whether individuals tend to generate the same constructs on different occasions with either the same or different elements. As well as being a test of consistency of constructs, this is also a test of construct elicitation procedures which assume that constructs elicited are representative of an individual's characteristic ways of construing events and should be relatively central and enduring aspects of his construct system. Hunt (1951) examined similarities between constructs elicited, on two occasions a week apart, from two sets of elements and concluded that subjects reproduced about 70 per cent of their constructs. However, on each occasion Hunt elicited 40 constructs, many more than most grid administrations. Several investigators have suggested that most people have between 10 and 20 significant interpersonal constructs. In sampling 40 it is likely that Hunt exhausted the individual's range of constructs, so the high degree of overlap for the two occasions is not surprising.

A further study by Fjeld and Landfield (1961) found correlations
of around +0.80. It does appear that the constructs elicited from an
individual remain fairly consistent over time.

Structural Stability

Studies of structural consistency have considered either the
stability of the pattern of relationships between constructs or the
stability of overall structural measures. Comparing the construct
correlation matrices for two different occasions gives an indication
of the extent to which constructs elicited on the two occasions,
although they have the same verbal label, have the same meaning in
terms of their relationship to other constructs. Bannister and Mair
report that, with supplied constructs, normal subjects tend to show
rank order correlations between correlation matrices ranging from
+0.60 to +0.80.

Watson, Gunn and Gristwood (1976) employed Slater's (1976) measure
of overall similarity of element placement between pairs of grids, in a
study of consistency over intervals of 7 to 10 days. The measure
averaged 0.74. Watson et al. also used supplied constructs. There
do not appear to have been any studies of the stability of construct
relationships which have used elicited constructs.

Turning to studies of the stability of overall measures of
structure; Tripodi and Bieri (1963) found reliabilities for Bieri's
measure of cognitive complexity over one week of 0.86 and 0.76 for supplied
and personal constructs respectively. Eping (1972), using a similar
measure to investigate the stability of cognitive complexity in
construing social issues, found lower reliability coefficients
ranging from 0.62 to 0.65 over one week. Eping concluded that
cognitive complexity remains fairly stable. Both of these studies must be treated with suspicion as the measures of cognitive complexity employed fail to take account of relationships between the emergent pole of one construct and the implied pole of another as discussed in Chapter III. Smith and Leach (1972), using a cluster analysis measure of cognitive complexity which does not suffer from this failing, found a somewhat lower reliability coefficient of 0.46 over the same interval.

In a series of studies of essentially the same measure, although it was interpreted as reflecting Intensity, Bannister (1962) found an immediate test-retest reliability of 0.35 with different sets of elements. Bannister explained this low reliability by arguing that, as the measure of Intensity is a compounded measure, a particular score characterises a wide variety of possible structural patterns. The degree of reliability is therefore likely to be fairly low.

Only Smith and Leach (1972) have examined the consistency of integration as defined by Schroder et al. (1967). Over an interval of one week the test-retest reliability of their cluster analysis measure of hierarchical complexity, derived from a 21 x 14 grid, was 0.76. The elements were the same on both occasions but it is not clear whether the constructs were supplied or elicited.

Overall, these studies suggest that, where no significant psychological change is likely to occur, the content and certain structural characteristics of construct systems remain fairly stable. Nevertheless, these studies demonstrate a certain variability in stability. Bannister and Mair (1968) also consider some of the factors related to this variation.
FACTORS AFFECTING STABILITY

Subsystem Variance

Construct systems are composed of a number of subsystems each with a limited range of convenience. It seems likely, therefore, that there will be differences in the degree of consistency of different subsystems. Bannister and Mair (1968) found a mean test-retest reliability of 0.73 for the pattern of interrelationships between a set of interpersonal constructs and a mean reliability of 0.93 for a set of physical constructs. One explanation of this difference is that the high predictability and relatively common experience of the physical world, discussed in Chapter II, limits the tenable alternative constructions and thus limits the range of variation, in contrast to the much greater variability in possible constructions of interpersonal phenomena.

Construct Variance

As well as variations in the stability of different subsystems there are differences in the relative stability of different types of construct. Bannister and Mair suggest a number of characteristics of constructs that should influence their stability. They argue that superordinate constructs should be more stable than subordinate, core-role constructs more stable than peripheral, and tight constructs more stable than loose constructs. The problem in empirical tests of these hypotheses has been in arriving at satisfactory operationalisations of the different types of construct.

Bannister and Mair (1968) report a reanalysis of data from Bannister (1962) in which they directly compared the stability of two
constructs differing in their degree of matching with other constructs. Results showed a mean stability of 0.80 for the constructs with a large number of matches and of 0.50 for the construct with few matches. Thus, it seems that there is a relationship between the stability of a construct and the strength of the relationships with other constructs.

Hinkle (1965) examined the resistance to change of constructs varying in superordinacy. From Kelly's original definition of a superordinate construct as one which subsumes other constructs as elements, Hinkle derived an operational definition of superordinacy of a construct in terms of the number of implications held by it. Hinkle focussed on slot change, when the alternative pole of a construct dimension is used to reconstrue an event rather than an alternative dimension altogether.

Hinkle hypothesised that a superordinate construct with a large number of implications would be more resistant to slot change, as a change would necessitate a large number of related changes in implied constructs and therefore a greater risk of developing inferential incompatability within the system. Hinkle's hypothesis was strongly supported: superordinate constructs did indeed show greater resistance to slot change than subordinate constructs.

Individual Variance

As Personal Construct systems place emphasis on individuality in construing one might expect wide individual variation in the degree of stability of construct systems.

Bannister and Mair (1968), examining individual data from a large number of studies, found individual reliability coefficients for
construct interrelationships varying from negative to very high positive values.

This degree of individual variance requires investigation. What other dimensions of individual difference are related to or account for this variation in stability?

**Group Variance**

An initial attempt to answer this question has been made by studies that have identified different groups of individuals and compared the degree of stability shown by them. Bannister (1960, 1962) and Bannister and Fransella (1965) compared the reliability of construct relationship patterns of a group of normal subjects and a group of thought-disordered schizophrenics. In all three studies the normal group demonstrated significantly higher reliability coefficients.

**RESEARCH INTO CHANGE**

The research discussed in the previous section, concerned with the stability of construct systems under conditions in which no change-inducing event is thought to have occurred, provides an indication of the 'noise' variability in construct systems, and a benchmark against which to compare the results from studies which have sought to induce change.

Studies of the process of change have adopted a number of strategies. Several have examined change by placing subjects in particular situations, the nature of which are expected to lead to some change in construing. Bieri (1953) hypothesised that if a subject engaged in social interaction with another person there would be a
change in the way this other person was construed. Bieri tested this hypothesis by having his subjects fill out a questionnaire and also predict the responses of a partner before and after one or two experimental conditions. There was either no interaction between subject and partner or a discussion between them. Bieri's results suggested that engaging in interaction with another person led the subject to see the other person as more similar to himself. Subsequently, Adams-Webber (1970) found that the tendency towards assimilative projection was positively related to cognitive complexity as conceived by Bieri (1955).

Lundy (1956) extended Bieri's study by having subjects predict the questionnaire responses of co-members of a four-week therapy group before and after the first session and weekly thereafter. Lundy predicted that the initial predictions would be a guess. Following this, to provide some structure for understanding, subjects would assume that the other members were similar to themselves. After more interaction they would be provided with the necessary additional information to make a more differential prediction. Lundy's results supported these hypotheses.

Other studies have looked at the changes that occur in such situations as education (Lemcke, 1959; Abercrombie, Stringer and Terry, 1973) and therapy (Tippet, 1959).

These studies have investigated situations whose general nature is intended to produce some change. They have not attempted to control the specific experiences that the individual has had. For this reason while they illustrate the changes that have taken place over time in
these situations they offer only limited insight into change as it operates as an ongoing process.

Varying Validational Outcomes and Individual Constructs

Personal Construct Theory argues that change in construct systems is a consequence of the varying validational outcomes of an individual's anticipations of predictions. A number of studies have attempted to investigate the process of change in individual constructs by controlling the validational experiences of an individual. One of the commonest paradigms in these studies has involved the subjects completing a grid and rating a partner on the constructs elicited. The subject then predicts the responses of this partner on a questionnaire and receives feedback as to the accuracy of his predictions. At this point the experimenter can manipulate the degree of validation for these predictions by reporting varying levels of accuracy. Following this the subject re-rates the partner on the constructs.

The first such study was carried out by Poch (1952). Her subjects predicted the responses of two other people and then indicated which of their constructs formed the basis of their predictions. The predictions of one person's responses were then validated and those of the other invalidated. This procedure was repeated three weeks later. When the subject was given the opportunity to revise his grid responses Poch's design allowed for the investigation of two forms of change: abandonment, or the extent to which constructs were no longer used as the basis for predictions; and change, or the extent to which the constructs used for prediction were reworded. Poch's hypothesis was
that after invalidation those constructs which formed the basis for prediction would be abandoned and would change more than after validation. The results supported these hypotheses.

In a study of a similar design, Bieri (1953) found greater change on unvalidated dimensions than on validated dimensions. In this case change was measured by shifts in the pattern of checks and voids on a dimension or construct.

Levy (1956) used the same measure of change. Levy's design followed that of Poch except that after the second prediction procedure the subject was given exact information as to which constructs should have been attributed in the opposite way. The subject then carried out a final rating of the two target persons on his constructs. Levy found that under high invalidation the subsequent change in the ratings of elements on a construct was greater than under low invalidation.

Levy also examined the effects of invalidation on constructs classified as constellatory or propositional. Levy divided constructs into those that had a high level of interdependence on other constructs (constellatory) and those that had a low level (propositional). He argued that as constellatory constructs mediate a broader range of predictions they would only be affected when major revisions of the system were required. The investment by an individual in constellatory constructs, in terms of the anticipations involved and the disruption to the system resulting from changes to them, is so great that change will only occur under exceptional circumstances of high invalidation, when the need for reconstruction is undeniable. Therefore, under high invalidation Levy predicted greater change in constellatory
constructs and under low invalidation greater change in propositional constructs. Although the second part of this hypothesis derives fairly directly from Levy's differentiation between constellatory and proportional constructs, the rationale for the first part is not quite so clear. One might predict that at high levels of invalidation there would be no difference between changes in the two types of constructs. As a corollary to his major hypothesis, Levy predicted that constellatory constructs were more sensitive to the amount of invalidation than proportional constructs.

Levy's results supported the hypothesis that, under high invalidation, constellatory constructs changed more than proportional constructs. Under conditions of low invalidation there was no difference in the amount of change shown by the two types of constructs. Constellatory constructs also appeared to be more sensitive to the amount of invalidation than propositional ones.

Bennion (1959) carried out a similar experiment. He asked subjects to report how invalidating they found the experience. Bennion intended to enhance the personal significance of the invalidation variable. He found similar results to those of Levy. However, when he used a different index of change, the willingness of the subject to change his behaviour after invalidation, he found substantial individual differences in the nature of responses. Some subjects manifested greater change on propositional constructs. While Bennion offers no account of the parameters of individual difference which may relate to these differences in response, his study is one of the earliest to report substantial individual differences. We will consider this issue in greater detail at a later stage.
The studies discussed so far have concluded that invalidation produces greater change in constructs than validation. However, the criteria for change that have been used are varied and these studies have not considered change in construct systems.

**Varying Validational Outcomes and System Structure**

Let us now consider research into the effects of validational outcomes upon the organisation of construct systems as a whole.

Several studies have grown out of Bannister's work on schizophrenic thought-disorder. Working explicitly within the framework of Personal Construct Theory, Bannister (1960) argued that the cognitive processes of thought-disordered schizophrenics are characterised by loosened construing. They use constructs which lead to varying predictions but which retain their identity. Bannister further argued that the varying predictions of loose constructs are a consequence of weak relationships with surrounding constructs in the hierarchical systems; their predictions are not made specific or focussed by a constellation of associated construing patterns.

Bannister (1960, 1962) found that thought-disordered schizophrenics did manifest lower consistency and intensity in their construct relationships than normal subjects and subjects drawn from other psychiatric groups.

Bannister (1963) proposed that the structure of a system at any one time was a consequence of the individual's particular validational experiences. He argued that consistent invalidation of the predictions
of a system led to a loosening of the relationships between constructs. Bannister suggested that a possible cause of schizophrenic thought-disorder was the exposure of the individual to consistent serial invalidation of the predictions and hypotheses generated by his system, particularly with regard to his construction of other people. A loosening of the relationships between constructs in the face of such experiences would produce a system in which hypotheses and predictions would be vague and ambiguous. While this would lessen the possibility of the individuals being faced with further invalidational experiences it would be at the cost of being unable to make stable and meaningful predictions about interpersonal events.

In a series of studies, Bannister attempted to demonstrate experimentally that serial invalidation does lead to a loosening of the relationships between constructs. Bannister (1963) hypothesised that invalidation leads initially to the reconstruing of elements at the opposite end of a construct. After shuffling elements from pole to pole the eventual response, to avoid further invalidation, is to weaken the relationship of a construct with those constructs around it.

Bannister gave ten normal subjects the Grid Test of Schizophrenic Thought Disorder on ten successive days with a different set of elements on each day. On each day the subject was told that he had been 'successful' in ranking the photographs on five constructs and unsuccessful on the other five. For each trial, correlations between constructs were calculated, squared to produce linearly related scores, and totalled to produce an intensity score characterising the overall strength of relationships within the system.
Bannister's specific hypotheses were as follows:

(a) Total construct relationships (intensity) will vary from trial to trial.

(b) The degree of relationship between validated constructs will increase over trials.

(c) The degree of relationship between unvalidated constructs will decrease over trials.

On consideration, this methodology seems unlikely to produce the results that Bannister predicts. A construct gains its meaning not in isolation but in its relationships to other constructs. As constructs are related to one another, the invalidation or validation of one construct must have consequences for others depending on the nature of the relationship which exists. Bannister's methodology took no account of the existing relational structure between constructs. It seems unlikely therefore that this methodology would enable one to show clearly the processes of invalidation and change.

In fact, the results did not support the hypotheses. An analysis of variance of the mean intensity score for each subject, for each trial and for each treatment produced two significant interactions. No conclusions could be drawn as to the main effects of the independent variables.

Bannister interprets the significant interaction between occasions and subjects as supplying indirect support for the hypothesis that total construct relationships will vary from trial to trial. What the interaction explicitly indicates is that the variation from trial to trial varies over subjects. It might be argued that this
finding casts doubt on the generality of Bannister's first hypothesis rather than supports it.

There was also a significant interaction between treatments and subjects. This is interpreted as refuting the hypotheses about the direction of change under differing validational conditions as it shows that subjects varied in their differential responses to the two treatments.

The third interaction, between treatment and occasions, was not significant. This again is counter to the second and third hypotheses as it suggests that the curves of intensity over time for the two treatments do not differ significantly.

In a further attempt to extract significant support for his hypotheses, Bannister made a comparison of intensity on the first and last trial for each group of constructs. This showed a significant increase in intensity for validated constructs but no significant difference for invalidated constructs. The validity of these results becomes questionable if one considers the pattern of results over all ten trials. The degree of intensity shows great variability between trials. Since ten is a fairly arbitrary number of trials to select the results may just show a fortuitous rise in intensity at this point.

Bannister offers two explanations to account for the lack of support for the hypotheses. Firstly, he suggests that the initial reaction to invalidation would be for the subject to shift elements to the opposite pole of the invalidated construct rather than to weaken the relationship between constructs. This initial reaction
may succeed in maintaining the structure of a system in the face of invalidation for longer than the period of trials that Bannister used. If this is so then one would expect to find changes in the sign of the correlations between invalidated constructs rather than changes in the strength of the relationship; this effect should not be found with validated constructs.

The second explanation is related to the criticism offered earlier of his methodology. As constructs within a single subsystem are hierarchically linked and related, it is not possible to invalidate one part of the system while validating another. The effect on one part of the system 'reverberates' throughout the rest. It is not possible, as Bannister attempted to do, to isolate the effects to one part.

In a further experiment, Bannister tried to overcome this problem by entirely validating the constructs for one group of subjects and invalidating them for another group. Bannister then looked at differences in the magnitude of the two curves of intensity over trials. The validated group had higher total relationship scores than the invalidated group and a sign test of first and last trials showed a significant increase in intensity for the validated group. However, as pointed out earlier, the interpretation of this analysis must be treated with caution. The invalidated group showed a non-significant trend towards greater intensity which is contrary to Bannister's prediction. He suggests that this may be a consequence of invalidating all constructs. The effect of this may be so disruptive that it delays weakening, possibly due to a reaction of 'hostility' by the individual.
This study showed no significant differences between the two groups in the number of reversals of construct relationships. The failure of invalidation to produce a weakening of relationships is not due to the tendency to initially shift elements from one pole of a construct to another as Bannister suggested.

Bannister (1965) carried out another study to overcome the overly disruptive effects of invalidating all constructs. He returned to the original design of invalidating some constructs for each individual and validating others. The possibility of 'reverberation' was lessened by selecting two groups of constructs with strong links within each group but weak links between the groups. One group consisted of moral constructs and the other of intellectual constructs. The results from this study supported both of Bannister's directional hypotheses.

Summarising the results of this series of experiments, they do not fully support Bannister's hypotheses. While there appears to be a fairly consistent increase in the strength of construct relationships in response to validation, the process of invalidation seems to lead to a much wider range of responses than that suggested by Bannister's initial simple hypothesis.

One explanation for these findings, which receives a certain amount of support from the data, is that responses to validation or invalidation are not generalisable but show wide individual variation in nature and extent. It is possible that the range of responses makes it unlikely that a clear cut, unidirectional relationship between invalidation and structural change, as predicted by Bannister, can
be shown. If this is the case then a more fruitful direction for future research into the process of change might be to investigate those parameters of individual difference that are related to qualitative and quantitative variation in the response to varying validational experience and the ways in which such parameters might operate.

Before considering in detail what these parameters might be, let us consider one further study of the effects of validational feedback. Rehm (1970) argued that the results that Bannister found with validation, that is an increase in the strength of relationships between constructs, may have been the results of the subjects interpreting their generally high accurate performance on the validated constructs to mean that they were accurate in the whole area of construction. The relationships between constructs were validated as well as the use of individual constructs. Therefore, Rehm argued, the experimental effect may not have been caused indirectly by construct validation as Bannister hypothesised but instead, it may have been produced directly by what could be called linkage validation. Rehm's study was an attempt to differentiate between the effects of linkage validation and construct validation.

It is arguable that this distinction is misleading with regards to Bannister's studies. The feedback that Bannister provided for his subjects was extremely general, being no more than a comment on the overall accuracy of their ratings. While this information is relevant to how the subject is rating the elements on constructs, Bannister (1963) argued that the validation or invalidation is of constructions rather than constructs. This involves the network of
implications between constructs as well as the rating of an element on a particular construct. Bannister would presumably argue that, in terms of his methodology and in terms of PCT, it is meaningless to differentiate between construct and linkage validation as they are interdependent processes subsumed under the general term 'construction invalidation'.

While it is perhaps meaningless to differentiate between construct validation and linkage validation with respect to its effect on the subjects in Bannister's study, it remains a useful distinction to apply more generally to the information or feedback an individual may be faced with. Feedback may be such that, while it invalidates the rating of elements on particular constructs, the construed relationships between constructs are validated. This would represent invalidation of how the system is applied but to a certain extent would validate the system. This could be termed external invalidation and contrasted with internal invalidation in which both element ratings and construct relationships are invalidated and system is revealed to be internally as well as externally invalid. If this distinction is indeed a psychologically significant one it is clearly inappropriate to talk of invalidation and validation as a unitary process. At least two components have been identified and the question arises as to how each may contribute to the process of change in construct systems.

The study by Rehm was an attempt to answer at least part of this question. Two bipolar constructs were chosen which had a near zero correlation for a college population: 'constrained-free' and
'subjective objective'. The subjects were randomly assigned to four groups and were presented with a series of 100 photographs of students. They were asked to rate them on each construct. The feedback contingencies varied for the four groups. Group 1 received positive linkage validation. For four out of five positive linkages they made, that is rating a photograph as 'constrained' and 'objective' or 'free' and 'subjective', they were told that their assignment on both constructs was correct. Group 2 received negative linkage validation, that is validating feedback for associating the opposite poles to Group 1.

Group 3 received only construct validation. Half of the group were yoked to a subject in Group 1 and half to a subject in Group 2. Each subject received the same feedback sequence as his yoked partner. Thus they received the same overall level of validating feedback as the other groups although it was random with regard to linkage. Group 4 was a control group who received no feedback.

Analysis of the results showed that Group 1 displayed greater overall positive linkage than the other groups and that group 2 showed greater negative linkage than groups 3 or 4. The results for group 1 showed a significant linear trend over trials towards increased positive linkages. Group 2 showed a linear trend in the opposite direction which failed to reach statistical significance. The overall effect of positive linkage validation was greater than that of negative linkage validation.

Rehm concluded that the linkage between constructs could be modified by validation of the linkages and that the modification
occurs in the validated direction as a function of amount of validational experience. The results however do not support this latter conclusion with respect to negative linkages. Validation of constructs alone had no effect on linkage, contrary to Rehm's interpretation of Bannister's conclusions.

The differential effects of positive and negative linkage validation are difficult to account for if the assumption of the two constructs being independent is justified. However, the criterion for the selection of subjects with regard to prescribing links between these constructs was relatively lax: between 7 and 13 constrained-objective plus free-subjective responses in an operant block of 20 trials. Rehm gives no further information as to the actual feedback given to experimental groups. It is possible that differences between the groups led to Group 1 receiving a greater number of validating statements, thus producing a stronger effect.

There is also a more basic criticism that can be levelled at Rehm's interpretation of the results. He concludes that the results show the effects of validation on construct linkages. This ignores the complementary process of invalidation that must be occurring throughout the experimental procedure. Are the results due to the effects of invalidation, validation or an interaction between the two, and if so what is the form of this interaction? The design of Rehm's study does not allow these questions to be answered.

Overall, these studies which have attempted to investigate the process of change by the experimental manipulation of validational experiences have produced confusing or contradictory findings. Let
us now consider, in more detail, two issues which may help to clarify understanding in this area.

INTERNAL AND EXTERNAL VALIDITY

The first issue concerns the question of what is being validated or invalidated. As pointed out in the previous section, invalidation or validation can be differentiated in terms of whether they have implications for the use of individual constructs or for the network of relationships between constructs; whether they reflect what have been termed the external or internal validity of the system.

Bannister does not appear to have recognised this qualitative difference in types of validational outcome. The vagueness of the feedback to his subjects makes it impossible to tell how they might have interpreted it. Rehm's study has attempted to separate these two aspects but, while he demonstrates some differential effects, his results give little detailed information about differences in the nature and degree of change in response to these different validational conditions. In particular the use of only two constructs in Rehm's study makes it impossible to consider the effects on more sophisticated structural properties of construct systems.

It is inadequate to view validation-invalidation as a uni-dimensional aspect of an individual's experience of his world. It must be recognised that different components of validational outcomes must be considered in terms of what aspect of construction or construct system they refer to. Depending on the type of validational outcome one might expect different effects upon the degree and nature of changes that take place.
The second issue concerns the question raised earlier in the discussion of Bannister's work. What is the nature and extent of individual differences in the response to varying validational outcomes and the process of change? Bannister's studies and others have shown wide individual differences in how construct systems change in response to invalidation. What other dimensions of individual difference are related to variation in the nature and extent of flexibility, adaptability and change?

Reference back to the discussion in Chapter III may suggest a possible answer to this question. There it was argued that one of the major consequences of differences in the structural characteristics of cognitive systems lay in their effect on the versatility and adaptability of the system, and the way it changes in response to new experience.

Abstractness and Adaptability

A detailed discussion of the relationship between structure and change can be found in the work of Harvey and his colleagues (Harvey et al., 1961; Harvey, 1966). The close link that they postulate between the adaptability of a system and its structural characteristics, which they conceive of in terms of concreteness-abstractness, has already been mentioned in Chapter III, but will be reconsidered in more detail here.

They argue that the ability of a system to generate new alternatives, to assimilate diversity and to behave flexibly, is a
function of its structural features; in particular of the level of abstractness displayed by the system. A range of such strategies for dealing with novel information, particularly that which contradicts the expectations of the existing system, was considered in Chapter III. They include: denial of the information, change in the system leading to disruption, or integration of the novel information while maintaining the structure of the system. Harvey considers this third strategy to be the most adaptive and suggests that the degree of reliance upon a particular strategy is a function of the original structural characteristics of the system.

The ability of the system to solve the problem of dealing with discrepant experience in an adaptive fashion rests upon:

's multidimensional system, one that is sensitive to subtle nuances and low stimulus intensities across a wide range of stimulus domains, one that can allow the world in and dimensionalise into multiple cognitive and response alternatives, one that can recombine and synthesise the differentiated elements in ways that are appropriate to the situation but not restructured to it and one that can assimilate deviant events without disintegration of the system or disruption of its functioning. The more abstract systems, seemingly far more than the concrete ones, possess this ability.' (Harvey, 1966, p. 60)

A number of studies have been carried out by Harvey and his associates which have demonstrated aspects of the relationship between adaptability and structure. Harvey (1967) reports a study in which subjects from the extremes of the concrete-abstract dimension differed significantly in their tendency to ward off or ignore information at odds with their current conceptions. Harvey (1964) considered system differences in dependency on external cues. He examined differences between high and low abstract subjects in their
judgements of the distance between two dots in a visual field including a falsely scaled ruler. Extremely abstract individuals reported relying on the ruler least and extreme concrete relied upon it next to least. The reasons for discounting the information on the ruler differed however for the two groups. Abstract subjects reported looking at the ruler but not consciously using it while concrete subjects reported trying to exclude the ruler from their vision. Harvey concluded that concrete individuals strive to maintain their system through the exclusion of potentially conflicting inputs while abstract individuals maintain the system by admission and integration of conflicting events.

A further series of studies cited in Harvey (1967) examined the relationship between structure and the tolerance of inconsistency. A more abstract system, because of greater internal differentiation and integration, should be able to tolerate more conflict and inconsistency than a concrete system. Harvey (1964) and Harvey and Kline (1965) found that concrete individuals generated less cognitive conflict, in a role playing task, that involved arguing against their own beliefs. They achieved this by a poorer performance. At the same time, however, concrete individuals changed their opinions more. Harvey and Ware (1966) found that concrete subjects were more unwilling to attribute positive and negative characteristics to the same person.

Sandilands (1974) required subjects to read a summary of a murder trial, indicate their verdict and write a paragraph to support their position. They were then asked to indicate their willingness to read an article discrepant with their verdicts. Concrete subjects indicated less willingness and exposed themselves to the discrepant
These studies reveal a relationship between cognitive abstractness and the response to inconsistent or discrepant information. Abstract individuals are better able to integrate such information into their system while concrete individuals are more likely to ward it off or show disruptive change.

However, what is not clear is how the differences between these groups might vary with the degree of discrepancy.

Also, these studies have considered the effect of the general structural characteristic concreteness-abstractness. The results presented in Chapters X and XI suggest that the structural dimensions underlying this general characteristic, discrimination, differentiation and integration, are relatively independent. Integration itself appears to be a multidimensional characteristic embracing the relatively independent structural properties of organisation, balance and openness. It may be more appropriate to consider how each of these structural characteristics is related to the response to inconsistent information.

Cognitive Complexity and Adaptability

Crockett (1965) reviewed a number of studies of the relationship between cognitive complexity and adaptability. Most of these studies used an experimental paradigm which involved presenting subjects with potentially contradictory information about unknown others.

Gollin (1958) interpreted differences in subjects' strategies for resolving inconsistent information as indicating different levels
of development in Werner's organisational terms. Crockett argues that the theoretical description of cognitive-complexity implies that individuals with complex or more differentiated systems should be better able to reconcile potentially conflicting information. This prediction is supported in a study by Nidorf (1961) who found a correlation between integration of conflicting information and cognitive complexity.

In reviewing studies of order effects on impression formation Crockett discusses three studies of relevance. Mayo and Crockett (1964) found that subjects low in complexity showed much more extreme recency effects than highly complex individuals. Studies by Supnick (1964) and Leventhal and Singer (1964) found no relationship however. The inconsistency of these studies may be due to the inadequate operationalisation of cognitive-complexity by Bieri's measure and the confounding of differentiation and organisation.

Structure and Invalidation

There have been few studies of individual differences in adaptability and change carried out specifically within the context of Personal Construct Theory. However, those carried out suggest a significant role of structural characteristics. Bannister (1960) reported a positive correlation between intensity and consistency and Bannister (1965) found a negative correlation between intensity and susceptibility to invalidation.

More recent studies of the effects of invalidation on structure were carried out by Cochran (1973; 1977). He presented subjects with information which was assumed to be inconsistent with the implicative
links between their constructs. He found that subjects with highly correlated construct dimensions showed a decrease in the strength of construct relationships while subjects with weak correlations showed an increase.

Cochran also considered the effect of invalidation on the pattern of construct relationships. He concluded that there were two maintenance strategies for maintaining order in the system in the face of invalidation. Subjects with high relational strength, who could afford to weaken relationships yet still maintain order and structure, did so. Subjects with low relational strength, who could not afford to weaken construct relationships, changed the pattern of construct relationships instead. If such differences do exist this may help to explain Bannister's failure to find a unidirectional effect of invalidation.

Cochran did not explicitly consider the effects of different levels of invalidation. However, he attempted to provide invalidatory feedback by providing random combination of attributes. It is therefore likely that subjects were provided with differentially inconsistent feedback, which was not controlled for.

Meisel (1969) did consider the effects of differing levels of invalidation. He investigated the relationship between constellations of construct organisation, degree of invalidation, and change in use of constructs. Subjects described an individual characterised by photograph and voice recording in terms of twenty constructs. They then received differing feedback on the accuracy of their descriptions. The weak invalidation group were simply told that their impression was relatively inaccurate. The strong invalidation group were told, in addition, that they were wrong in
the application of their most central construct. Subjects were then asked to complete the description task again and the number of changes in their allocation was noted.

Meisel found that, under weak invalidation, constellatory constructors showed more change. Under strong invalidation, proportional constructors show greater change.

Crockett and Meisel (1974) report further results from the same study, concerning the relationship between degree of connectedness between constructs, invalidation and change. They interpreted degree of connectedness as reflecting organisation and found a negative correlation between organisation and change under weak invalidation, and a positive correlation under strong invalidation. Moreover, less organised subjects showed less change under strong invalidation than under weak invalidation. This is surprising as one might have expected the amount of change to increase with increasing invalidation for both groups.

Summary

In this section it has been suggested that individual differences in the flexibility and adaptability of cognitive systems are related to the structural characteristics of the system.

Harvey and others have suggested that the level of abstractness of a system is closely related to the adaptability of the system. Abstract systems are better able to assimilate diversity through the integration of novel information, while maintaining the structure of the system. Concrete systems are more likely to respond either by
ignoring such information or by disruptive change. However, the value of considering concrete-abstractness as a unidimensional structural characteristic has been questioned.

Studies of invalidation of construct systems have suggested that the response to invalidation is related to structural characteristics such as the degree of organisation and constellatoriness. The effects of structure seem to vary with the degree of invalidation.

DEVELOPMENTAL ASPECTS OF STABILITY AND CHANGE

Of particular concern in the context of the current investigation is the dynamic properties of the construct systems of children and the development of these properties. How does the stability of construct systems change with age and how do the nature and extent of responses to validational or invalidational experiences vary?

As discussed in Chapter II, Piagetian theory has several implications for the dynamic properties of the construct systems of children of different ages. The issue of change occupies a central position in Piaget's theory. One of the functional invariants is adaptation by which the organism changes to favour its preservation. Adaptation embraces two processes. The first is assimilation, by which, in any encounter with an environmental object, the object is subjected to cognitive restructuring in accord with the existing cognitive structure. The second, accommodation, refers to the process by which any encounter with an environment which is not infinitely malleable requires an adjustment of the cognitive system to the demands of that environmental reality.
All adaptive acts involve both assimilation and accommodation to some degree but they will vary as to the relative predominance of one or the other. In the terms of the discussion in earlier sections of this chapter, a predominantly assimilatory response would involve denial and distortion of inconsistent information while a predominantly accommodatory response would involve disruptive change in the face of such experience.

Piaget sees development as characterised by changes in the degree of equilibrium between these two processes. Among the dimensions along which states of equilibrium vary are permanence and stability.

Permanence refers to the tendency for the elements of a subject's cognitive system to retain their subjective value when new situations are centred. The cognitive systems of older children are more 'permanent' than those of younger children. We might, therefore, expect the construct systems of older children to show greater consistency than those of younger children.

'Stability', as used by Piaget, refers to the capacity of the system to compensate for or cancel perturbations which tend to alter the existing state of equilibrium. The cognitive systems of older children should show greater 'stability' and be better able to integrate novel experiences while maintaining the integrity of the system.

At the preoperational level there is a lack of stable equilibrium between assimilation and accommodation. The child's cognitive system tends to either rupture and dislocate itself in the process of
accommodating to new situations or the child ignores inconsistencies between cognition and experience.

When the child progresses to the concrete-operational stage, developments in the balance between assimilation and accommodation and increasing permanence and stability, mean that he is less at the mercy of changes in his environment. His cognitive system is better able to adapt to a larger degree of environmental change while maintaining its integrity and a relative degree of stability.

In the formal operational stage flexibility and the ability to consider alternatives develops further. It is only during this stage that the ability to hypothesise and adopt an experimental approach develops. Without hypothesis the idea of proof or verification has no meaning. In this stage one might predict a greater awareness of the implications of inconsistent or invalidatory information and less tendency to ignore or deny such information. The increasing balance between assimilation and accommodation and greater stability should further increase the ability to integrate discrepant experience into the existing cognitive structure.

From Piagetian theory we would predict that there are developmental changes in the stability of construct systems and also in how they respond to inconsistent or invalidatory information.

It seems that the differences between developmental levels are similar to the differences between concrete and abstract subjects discussed earlier in this chapter. However, while there have been a number of studies which have considered the relationship between structure, and stability and change in construct systems, none of
the developmental studies of construct systems have concerned themselves with stability or change.

However, there are a number of studies in the area of impression formation which offer indirect support for the developmental trends predicted above. Gollin (1958), in the study described in Chapter V, reported developmental differences in the mode of resolution of inconsistent or ambivalent information. Young children tended to either deny or ignore the discrepant information or to accept it while making little attempt to integrate it into their existing cognitive system. Such response can be interpreted as showing predominance of either assimilation or accommodation. Older children show a much more balanced response. They recognise the inconsistency but integrate it into their existing system via conceptual or inferential material.

Rosenbach, Crockett and Wapner (1973) showed children ranging from 6 to 19 years of age a film of an individual behaving inconsistently and then asked them to form an impression. They found a developmental trend from little or no recognition or resolution of inconsistency, via superficial resolution, to integrated resolution involving explanation for the inconsistency. A study by Biskin and Crano (1977) yielded similar results.

Hendrick, Franz and Hovig (1975) investigated impression formation in children between the ages of 4 and 10 years. They found that, within this age range, children combined inconsistent traits in impressions by averaging them. This again suggests little ability to integrate inconsistent information in an adaptive way.
Within a different context, Flavell et al. (1968) suggest that young children are less likely than older children or adults, to modify or alter their behaviour in response to feedback as to its effectiveness. In a study of communicative behaviour they found that young children did not modify their behaviour to an audience after a message had failed to achieve its object.

**A STUDY OF DEVELOPMENTAL ASPECTS OF STABILITY AND CHANGE: INTRODUCTION**

In the following chapter an empirical study will be described which is an attempt to test the hypothesised developmental trends outlined above. The study will examine age differences in the stability of construct systems and in the nature and extent of response to invalidatory feedback.

The response of two aspects of construct systems will be considered; the pattern of relationships between constructs, and the overall structural characteristics of the system.

The study will also examine other issues raised in this chapter. Firstly, the effects of internal and external invalidation will be considered by invalidating the rating of elements on constructs or the pattern of relationships between constructs.

Secondly, it will examine the relationship between stability and the effects of invalidation, and the individual's structural characteristics.
 CHAPTER XIV

A STUDY OF STABILITY AND CHANGE IN CONSTRUCT SYSTEMS: METHOD

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Subjects

Subjects for this study were 108 children, ranging in age from 6 years 6 months to 14 years 2 months. Subjects were divided into three groups according to age. The first group contained children ranging in age from 6, 6 to 7, 4 with a mean age of 7,0. The second group contained children ranging in age from 9,5 to 10,3 with a mean age of 9,11. The third group contained children ranging in age from 13,4 to 14,2 with a mean age of 13,9. Each group contained 36 children equally divided between males and females. The subjects were randomly selected from children of the appropriate age in a first, middle and secondary school in the same neighbourhood of Southampton.

Materials

Each subject was required to complete two repertory grids. The elements and constructs for each grid were supplied by the experimenter.
(a) Elements

A different set of six elements was supplied for each grid. Each set consisted of head and shoulders photographs of men aged between 20 and 50 years. The photographs were black and white and approximately passport sized. They were mounted on plain white card and each set was lettered A to F in the top left-hand corner.

(b) Constructs

The same set of eight constructs was supplied to each subject for both grids. The constructs used were selected on the basis of the results of the study described in Part Two. Eight psychological constructs were selected which were used relatively frequently by all three age groups. Constructs which were synonymous or bore a close relationship to each other were not selected. The constructs provided were as follows:

- Friendly-unfriendly
- Strict - not strict
- Clever - stupid
- Bad tempered - good tempered
- Funny - serious
- Dishonest - honest
- Kind - unkind
- Sad - happy

Elements and constructs were combined on a response sheet representing a 6 x 8 grid. Construct labels were printed along the top of the sheet; six different orders of constructs were used. Elements were represented down the side of the sheet by the letters A to F.

Procedure

Each group of subjects was seen together prior to the experimental
sessions. The experimenter introduced himself, explained a little about the study and emphasised that the study was nothing to do with their school work and that the results would only be known to the experimenter.

The experimental sessions were carried out individually. Each child in turn was sent by the teacher to the experimenter who was in a separate room. The child sat at a table next to the experimenter who attempted to relax the child by engaging in some incidental conversation. The degree of relaxation or nervousness varied quite widely within the sample and seemed to affect the extent to which the child was prepared to interact and converse with the experimenter. In trying to maintain a relaxed atmosphere, the experimenter engaged in conversation when it arose; but during the actual experimental procedure the degree and quality of interaction was controlled as much as possible.

Having attempted to relax the child, the experimenter explained the nature of the task in more detail and gave instructions as follows:

'I've already told you that I am studying how children of different ages think about other people. I want to know how much they can tell about a person from just seeing a photograph of them.'

(At this point one set of photographs was placed in front of the subject. For half the subjects one set of photographs was presented at this point and for the other half the other set was presented. The subject was asked if he recognised any of the elements. Some children said that some of the elements reminded them of certain
people but in no case did they actually identify any of the photographs.)

'I want you to have a good look at these people and tell me what you think they might be like.'

(At this point the first response sheet was introduced and placed in front of the subject.)

'To make it easier for you, on this piece of paper there are some words that you might use to describe someone; for example, friendly, sad or funny.'

(At this point the construct labels printed along the top of the response sheet were pointed out to the subject.)

'Let's take the first word (e.g. friendly - unfriendly) I want you to tell me which three of these people you think are the friendliest.'

(When the child had either pointed to the photographs or said their letters, the experimenter continued):

'Good. Down the side of this piece of paper are the letters that go with the photographs. I'll tick the three photographs you thought were the friendliest.'

The experimenter entered three ticks in the first column against the appropriate elements. This procedure was repeated until the child had considered all of the constructs.

This first part of the procedure was common for all subjects. However, the remainder of the experimental procedure varied according to the experimental group to which a subject was assigned.

(a) Control group

Twelve children from each age group, six boys and six girls,
were randomly assigned to a control group. When they had completed
the first part of the experiment, the procedure was repeated with
the second set of elements.

(b) Experimental groups

The remaining twenty-four children in each age group were
randomly assigned to one of four experimental groups, although
equal numbers of boys and girls were assigned to each group. For
all experimental groups, following the first part of the experiment,
there was an attempt to invalidate their construing by providing
feedback on the 'accuracy' of their judgements. The general nature
of the invalidatory procedure was similar for all groups, although
they differed in the nature and extent of the invalidatory feedback
provided. The instructions continued:

'You've told me a little about what you think these people
might be like. Now I'm going to tell you a little bit more
about them. I've asked some people who know all of them
quite well to do the same as you have just done, to say who
they thought were the three friendliest, the three kindest,
and so on. I'll tell you what they thought and we will see
if you agreed.'

With the subject's first response sheet in view, a second empty
response sheet was produced together with a sheet of paper with a
selection of grids with random ticks and blanks. This was described
as being the results from people who knew the elements. Starting
with the first construct, the experimenter placed three ticks in
the appropriate column of the second response sheet to represent the
'correct' answers.

After placing the ticks, the experimenter asked the subject to
compare them with his own responses and encouraged him to talk about
the relations between the elements, his own judgements, and the 'responses'
of those who knew the elements. Some time was spent on this procedure
as it was felt important to ensure that the subject actually took
notice of the feedback and was aware of how it related to his own
judgements if he was to experience any invalidation of his
constructions.

This procedure was repeated for the first four constructs on
the response sheet. Only four constructs were used as it was felt
that subjects would not be able to absorb any more information. When
feedback on four constructs was completed, subjects were again asked
to compare their judgements with the feedback. The invalidation
procedure used in this study differs from the serial invalidation
technique employed by Bannister; but pilot studies suggested that
subjects were aware of inconsistencies and contradictions between
their judgements and the feedback and did experience a degree of
invalidation.

For feedback to be invalidatory, the essential requirement was
that there be some divergence between the subject's responses and
the feedback. The experimental groups differed in the nature and
extent of this divergence.

In Chapter XIII, we distinguished between external invalidation
and internal invalidation. In this study both aspects of invalidation
were investigated. External invalidation was implied by feedback
which invalidated the rating of elements but maintained the relation­
ships between constructs (rating invalidation). Internal invalidation
was implied by feedback which invalidated both the rating of elements and the pattern of relationships between constructs (pattern invalidation).

The effect of each form of invalidation and the interaction between them, together with the effects of age, were examined by means of a factorial design providing two levels of each aspect of invalidation and three levels of age. The feedback received by the four experimental groups at each age level was as follows:

(a) Low rating invalidation; low pattern invalidation

The feedback received by subjects in this group was different from their initial response on the rating of one element per construct. The pattern of relationships displayed by the feedback was the same as that shown by the subject.

(b) Low rating invalidation; high pattern invalidation

The feedback received by subjects in this group differed from their initial response on the rating of one element per construct but also the pattern of relationships between constructs was different.

(c) High rating invalidation; low pattern invalidation

The feedback received by subjects in this group differed from their initial response on the rating of two elements per construct. The pattern of relationships between constructs was the same as in the subjects initial response.

(d) High rating invalidation; high pattern invalidation

The feedback received by subjects in this group differed from
their initial response of the subject on the rating of two elements per construct and also showed a different pattern of construct relationships.

The differences between these four groups are illustrated in Fig. 14.1 which gives examples of the feedback which might be provided for a subject in each experimental group.

![Feedback Grid](image)

**FIGURE 14.1** Invalidatory feedback received by a subject in each experimental group.

After the feedback had been presented and discussed the child completed a second grid with a second set of elements. The child was told that the experimenter was interested in what he thought of another group of people.

**Structural Measures**

Measures of the structural characteristics of each individual were derived from the first grid they completed. The following measures were employed:
(a) Differentiation

Because of the relatively simple rating procedure used in this study it was not possible to use the measure of differentiation, derived from the cluster analysis of constructs, described in Chapter VII. Instead, differentiation was measured in terms of differentiation between elements and was taken as the number of elements with unique rating profiles.

(b) Organisation

The measure of organisation was the percentage of variance accounted for by the first principal component generated by an INGRID principal components analysis of the grid.

(c) Balance

The measure of balance was Smith and Leach's hierarchical measure of cognitive complexity described in Chapter VII.

(d) Openness

The measure of openness was the measure described in Chapter VII, based on the ratio between the number of construct clusters as stringent and weak criterion levels for relationships between constructs. In this study, however, the measure was derived from the cluster analysis of elements rather than of constructs.

Measures of Change

Measures of the change shown by each subject on each of these structural characteristics, under either control or experimental conditions, were obtained by subtracting the score on the first grid from the score on the second grid.
In addition, two measures of changes in the pattern of construct relationships were obtained. The measures were obtained from a comparison of the matrices of construct matching scores for the two grids. The first measure reflects the number of construct relationships which show a change in value from the first grid to the second. The second measure is the overall amount of change in construct relationships from the first grid to the second. Figure 14.2 illustrates these two measures.

Matrix of construct matching scores: Grid 1

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<tr>
<th>1</th>
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Number of changes in construct relationships = Number of non-zero elements = 17

Matrix of changes in construct relationships

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Amount of change in construct relationships = Sum of elements = 18

Matrix of construct matching scores: Grid 2

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</table>

FIGURE 14.2 Illustrative example of measures of change in construct relationships.
CHAPTER XV

STABILITY IN CONSTRUCT SYSTEMS: RESULTS AND DISCUSSION

RESULTS

Stability of Construct Relationships

Stability of Structural Characteristics

Summary of Significant Results

DISCUSSION

It was argued in Chapter XIII that any analysis of the dynamics or process of change in construing must be set against a consideration of the stability of the construct system. Meaningful interpretation of the significance of changes in construct systems and of the parameters which may influence them can only be made in the context of an awareness of what might be termed the base level of fluctuations or, conversely, of consistency of a system. That is, how stable is a construct system when no events intended to induce a change have been introduced?

In the present study, changes in construing shown by the experimental groups under varying conditions of invalidation must be set against an analysis of the degree of change, or stability, shown by the control groups, i.e. those subjects who received no feedback on the 'accuracy' of their construing between completing grid A and grid B. This chapter presents results concerning the stability of construing in the control groups with respect to both construct
relationships and overall structural characteristics.

RESULTS

Stability of Construct Relationships

First, let us consider stability in construct relationships. As described in Chapter XIV, two measures of change in construct relationships were obtained from each subject; the number of construct relationships which show a change in value, and the overall size of the changes that take place.

1. The number of changes in construct relationships.

There is a significant effect of age on the mean number of changes in construct relationships (F = 4.23, df = 2,35, P<0.05). With increasing age mean scores are: 18.50, 15.28, 16.17. Comparisons of age group means show that 7 year-olds show significantly more changes than 10 or 13 year-olds (F = 10.60, df = 1,35, P<0.01; F = 5.55, df = 1,35, P<0.05 respectively).

2. Amount of change in construct relationships.

The effect of age is significant (F = 6.57, df = 2,35, P<0.01). Seven year-olds (X = 23.17) show more change than 10 or 13 year-olds (X = 16.28, F = 12.85, df = 1,35, P<0.01; X = 18.33, F = 4.00, df = 1,35, P<0.05 respectively).

The results for both of these measures suggest that the construct relationships of 7 year-olds are less stable under control conditions than those of 10 or 13 year-olds; and that there are no differences between 10 and 13 year-olds.
Stability of Structural Characteristics

In this section we will present results concerning the stability of four structural properties of construct systems; differentiation, organisation, balance and openness. We will address two issues. Firstly, are there any age differences in the amount of any structural changes that take place? Secondly, are there any changes in a particular direction, i.e. towards a higher or lower level of structure, and is any directional tendency related to age?

1. Amount of change in structural characteristics

Differences in the amount of change in structural characteristics were examined by taking the absolute difference between the structural measures for the two grids for each subject. These data were analysed by a one way analysis of variance by age. The results are summarised in Table 15.1.

(i) Differentiation

The effect of age is significant. Comparisons of age group means reveal that 7 year-olds show a significantly greater change in differentiation than 10 or 13 year-olds. The means for 10 and 13 year-olds are not significantly different.

(ii) Organisation

Age has a significant effect on the amount of change in organisation. Seven year-olds show significantly more change than 10 or 13 year-olds. Ten and 13 year-olds do not differ significantly.
<table>
<thead>
<tr>
<th>STRUCTURAL CHARACTERISTIC</th>
<th>AGE IN YEARS</th>
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<td>9.14</td>
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<tr>
<td>OPENNESS</td>
<td>0.09</td>
<td>0.15</td>
<td>0.15</td>
<td>1.51</td>
</tr>
</tbody>
</table>

*P < 0.05  **P < 0.01

**TABLE 15.1.** Amount of change in structural characteristics for control groups: Means and analysis.
(iii) Balance

Age has a significant effect on the amount of change in balance. Seven and 10 year-olds show significantly more change than 13 year-olds but do not differ significantly from each other.

(iv) Openness

Age has no significant effect on the amount of change in openness.

2. Amount and direction of change in structural characteristics.

Directional tendencies in any structural changes shown by the control groups were examined by means of repeated measures analysis of variance by age with grid administration as the repeated factor for each structural characteristic.

Age has no significant main or interaction effect for any of the four structural characteristics. The main effect of grid administration is only significant for organisation (F = 5.72, df = 1,33, P < 0.05). Mean scores show an increase from 63.36 on grid A to 69.80 on grid B.

Summary of Significant Results

1. Seven year-olds show less stability in construct relationships under control conditions of no feedback than 10 or 13 year-olds.

2. Seven year-olds show less stability in differentiation, organisation and balance under control conditions than 10 or 13 year-olds.

3. The only significant directional change in structure under
control conditions is an increase in organisation which occurs at all ages.

**DISCUSSION**

The analysis of age differences in the degree of stability of construct systems under control conditions in which subjects received no feedback on the 'accuracy' of their construing suggests that the stability of certain aspects of construing increases with age. Considering first the stability of construct relationships, 7 year-olds show less stability than older children both in terms of the number of construct relationships which show a change in value and in terms of the overall amount of change which occurs.

This finding is in line with Piaget's notion of the developmental changes which occur in the nature of the equilibrium states which characterise stages of cognitive development. In Chapters II and XIII we discussed Piaget's Equilibrium Model, in which he distinguishes between levels of equilibrium in terms of a number of dimensions including permanence and stability. Permanence refers to the tendency for the elements of a cognitive system ("elements" is here used in the Piagetian rather than the Kellian sense) to retain their value or meaning despite changes in the situation being centred. Stability is very closely related to permanence, indeed Flavell (1963) expresses doubt as to whether they are really different dimensions or are different ways of looking at the same dimension. As discussed by Flavell, stability refers to the system's capacity to compensate for or cancel out perturbations which tend to alter the existing state of
equilibrium. Stability may refer to a higher order dynamic characteristic of cognitive systems and, in that context, be one factor which contributes to the permanence of the system. According to Piaget's theory successive developmental stages are characterised by increasingly permanent and stable equilibriums.

In the present study, the subjects in the control groups were asked to apply the same set of constructs to two different sets of elements without any intervening external or explicit feedback. We cannot of course be sure that nothing is happening between the administration of the two grids. Subjects may be providing themselves with some sort of 'internal' feedback and coming to conclusions as to the validity of their construing. Some debriefing of the subjects after the experimental procedure might have thrown some light on this possibility. However, if the cognitive systems of older children have a greater degree of permanence we would expect their constructs to retain their meaning when applied to different sets of elements. As the meaning of a construct can be defined in terms of its pattern of relationships with other constructs, we would predict that the construct relationships of older children should be more stable from grid A to grid B than those of younger children. As we have seen the results of this study support this prediction.

The results for overall structural characteristics also suggest that the stability of construct systems under control conditions increases with age. Younger subjects show more change in differentiation, organisation and balance than older children, although there are no age differences in the stability of the openness of the system. As the analyses of directional tendencies in structural changes reveal
a significant result only in the case of organisation, we might conclude that the changes that do occur do represent a lack of stability rather than a systematic effect on the structural characteristics of construct systems due to completing repertory grids.

These findings have a number of serious implications for the measurement of structure and the study of change in construct systems. Firstly, they cast doubt on the validity of inferring structural characteristics on the basis of a single measurement, particularly in the case of young children. All previous studies of the structure of children's construct systems (see Chapter V), and also most studies of structure in adults, have assumed that the structure and organisation of construct systems can be adequately reflected by measurement on only one occasion. The findings of the present study suggest that this assumption is not justified for all age groups. The consistency of structural measures may have as many implications for the structural characteristics of the system as the structural measures themselves. Therefore, a more valid interpretation of structural characteristics demands a consideration of the consistency of structural measures.

The instability of construct relationships revealed by this study also has implications for the interpretation of structural characteristics. As Haynes and Phillips (1974) suggest in reference to the interpretation of scores on the Repertory Grid Test of Thought Disorder, loosened construing may be indicated, not so much by the level of intensity, as the degree of consistency of construct
relationships. It may be wrong to infer a highly organised construct system from a high intensity score on one occasion if, on a subsequent occasion, the individual shows an equally high intensity score, but one which reflects a very different pattern of construct relationships.

Secondly, the results of this study have implications for the interpretation of the responses of the experimental groups to invalidation. If a certain degree of change in construct relationships and overall structural characteristics is shown by the control group, the experimental groups can potentially differ from the control group in one of two ways, by showing either more or less change. Previous studies of the response of construct systems to invalidation (e.g. Bannister, 1963, 1965; Cochran, 1973, 1977) have equated the degree of response to invalidation with the absolute amount of change. Given the possibility of two response modes, and in Chapter XVI we will present results which suggest that either might occur, this approach is clearly inadequate.

In addition, as the degree of instability of construct relationships and structural characteristics varies with age, this needs to be taken into account when we consider the significance of changes shown by the experimental groups as a response to invalidation. Means of doing so will be discussed in Chapter XVI.
The results presented in Chapter XV showed significant age differences in the stability both of construct relationships, and of the structural characteristics of the system. It was hypothesised in Chapter XIII that the dynamic properties of construct systems, such as stability, flexibility and the response to invalidation, would also be influenced by the structural characteristics of the system. The results presented in this chapter and Chapter XVIII
represent an attempt to test this hypothesis. This chapter will focus on the relationships of differentiation, organisation, balance and openness to the stability of both construct relationships and structural characteristics. Chapter XVIII will consider the relationship of structural characteristics to the response to invalidation.

STRUCTURE AND THE STABILITY OF CONSTRUCT RELATIONSHIPS

Firstly, we will consider the effects of an individual's initial level on each of the four aspects of structure, on the stability in construct relationships he shows under control conditions of no feedback. We will present results for both the number of changes and the overall amount of change in construct relationships.

To test for the effects of structure the control group for each age group was divided into two sub-groups at the median score on each of the structural characteristics. A two-way analysis of variance, age by initial level of structure, was then carried out. In some cases, where it proved impossible to divide the control group into two equal sub-groups, some adjustments for unequal cells were carried out. This accounts for the fact that the results presented in this chapter do not correspond exactly with those presented in Chapter XV. The effects of each structural aspect will be considered in turn. As the main effects of age were considered in Chapter XV, only the main effects of structure and the interaction effects will be considered.

Differentiation

1. Number of changes in construct relationships (see Table 16.1).
### Table 16.1

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<td></td>
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<td>HIGH</td>
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<td>7</td>
<td>18.50</td>
<td>18.50</td>
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<td>10</td>
<td>8.50</td>
<td>15.00</td>
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<td>13</td>
<td>15.25</td>
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\[ F_{L,H}(7) = 0.00 \quad F_{L,H}(10) = 8.50** \quad F_{L,H}(13) = 1.08 \]

* ** P<0.05 ** ** P<0.01

**TABLE 16.1** Number of changes in construct relationships for control groups x age x initial level of differentiation: Means and analysis.

### Table 16.2

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<thead>
<tr>
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<td>OVERALL</td>
<td>16.75</td>
<td>18.07</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>SOURCE</th>
<th>AGE</th>
<th>D</th>
<th>AGE X D</th>
<th>ERROR</th>
</tr>
</thead>
<tbody>
<tr>
<td>DF</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>30</td>
</tr>
<tr>
<td>F-VALUE</td>
<td>11.75***</td>
<td>0.51</td>
<td>4.00*</td>
<td></td>
</tr>
</tbody>
</table>

\[ F_{L,H}(7) = 0.78 \quad F_{L,H}(10) = 7.38* \quad F_{L,H}(13) = 1.47 \]

* ** P<0.01 *** P<0.001

**TABLE 16.2** Amount of change in construct relationships for control groups x age x initial level of differentiation: Means and analysis.
There is a significant interaction effect between age and initial level of differentiation. Initial level of differentiation has no significant effect on the number of changes in construct relationships at 7 or 13 years of age. At 10 years of age, however, highly differentiated subjects show more changes than less differentiated subjects.

2. Amount of change in construct relationships (see Table 16.2)

The interaction between age and initial level of differentiation is significant. At 10 years of age, highly differentiated subjects show more change than less differentiated subjects. At 7 and 13 years of age, initial level of differentiation has no significant effect.

Organisation

1. Number of changes in construct relationships (see Table 16.3)

Initial level of organisation has no significant effect on the number of changes in construct relationships under control conditions.

2. Amount of change in construct relationships (see Table 16.4)

Initial level of organisation has no significant effect on the amount of change in construct relationships under control conditions.

Balance

1. Number of changes in construct relationships (see Table 16.5)
<table>
<thead>
<tr>
<th>AGE IN YEARS</th>
<th>INITIAL LEVEL OF ORGANISATION (0)</th>
<th>LOW</th>
<th>HIGH</th>
</tr>
</thead>
<tbody>
<tr>
<td>7</td>
<td>17.67</td>
<td>19.33</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>14.25</td>
<td>11.67</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>15.00</td>
<td>14.33</td>
<td></td>
</tr>
<tr>
<td>OVERALL</td>
<td>15.64</td>
<td>15.11</td>
<td></td>
</tr>
</tbody>
</table>

** **P<0.01

TABLE 16.3  Number of changes in construct relationships for control groups x age x initial level of organisation: Means and analysis.

<table>
<thead>
<tr>
<th>SOURCE</th>
<th>AGE</th>
<th>0</th>
<th>AGE X 0</th>
<th>ERROR</th>
</tr>
</thead>
<tbody>
<tr>
<td>DF</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>30</td>
</tr>
<tr>
<td>F-VALUE</td>
<td>6.11**</td>
<td>0.16</td>
<td>0.86</td>
<td></td>
</tr>
</tbody>
</table>

** **P<0.01

TABLE 16.4  Amount of change in construct relationships for control groups x age x initial level of organisation: Means and analysis.

<table>
<thead>
<tr>
<th>AGE IN YEARS</th>
<th>INITIAL LEVEL OF ORGANISATION (0)</th>
<th>LOW</th>
<th>HIGH</th>
</tr>
</thead>
<tbody>
<tr>
<td>7</td>
<td>22.00</td>
<td>24.33</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>14.75</td>
<td>14.67</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>16.66</td>
<td>16.00</td>
<td></td>
</tr>
<tr>
<td>OVERALL</td>
<td>17.80</td>
<td>18.33</td>
<td></td>
</tr>
</tbody>
</table>

*** P<0.001

TABLE 16.4  Amount of change in construct relationships for control groups x age x initial level of organisation: Means and analysis.
### Table 16.5
Number of changes in construct relationships for control groups \( x \) age \( x \) initial level of balance: Means and analysis.

<table>
<thead>
<tr>
<th>AGE IN YEARS</th>
<th>INITIAL LEVEL OF BALANCE (B)</th>
<th>( \text{LOW} )</th>
<th>( \text{HIGH} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>7</td>
<td>18.67</td>
<td>18.33</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>15.75</td>
<td>9.67</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>17.00</td>
<td>12.33</td>
<td></td>
</tr>
<tr>
<td>OVERALL</td>
<td>17.14</td>
<td>13.44</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>SOURCE</th>
<th>AGE</th>
<th>B</th>
<th>AGE X B</th>
<th>ERROR</th>
<th>DF</th>
<th>F-VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>30</td>
<td>2</td>
<td>8.06**</td>
</tr>
</tbody>
</table>

\(* P<0.01\)

### Table 16.6
Amount of change in construct relationships for control groups \( x \) age \( x \) initial level of balance: Means and analysis.

<table>
<thead>
<tr>
<th>AGE IN YEARS</th>
<th>INITIAL LEVEL OF BALANCE (B)</th>
<th>( \text{LOW} )</th>
<th>( \text{HIGH} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>7</td>
<td>21.33</td>
<td>25.00</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>18.50</td>
<td>9.67</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>19.33</td>
<td>13.33</td>
<td></td>
</tr>
<tr>
<td>OVERALL</td>
<td>19.72</td>
<td>16.00</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>SOURCE</th>
<th>AGE</th>
<th>B</th>
<th>AGE X B</th>
<th>ERROR</th>
<th>DF</th>
<th>F-VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>30</td>
<td>2</td>
<td>10.51***</td>
</tr>
</tbody>
</table>

\(* P<0.05\) \( ** P<0.01\) \( *** P<0.001\)

\( F_{L,H(7)}=3.16 \) \( F_{L,H(10)}=9.16** \) \( F_{L,H(13)}=4.23* \)

\(* P<0.05\) \( ** P<0.01\) \( *** P<0.001\)
Initial level of balance has a significant effect on the number of changes in construct relationships under control conditions. Subjects with a high initial level of balance show fewer changes than subjects with a low initial level of balance.

2. Amount of change in construct relationships (see Table 16.6)

Initial level of balance has a significant effect. Subjects with a high initial level of balance show less change in construct relationships than subjects with a low initial level of balance.

There is also a significant interaction between age and initial level of balance. At 10 and 13 years of age, subjects with a high initial level of balance show less change than subjects with a low initial level of balance. At 7 years of age initial level of balance has no significant effect.

Openness

1. Number of changes in construct relationships (see Table 16.7)

Initial level of openness has no significant effect on the number of changes in construct relationships under control conditions.

2. Amount of change in construct relationships (see Table 16.8)

Initial level of openness has no significant effect on the overall amount of change in construct relationships under control conditions.
<table>
<thead>
<tr>
<th>AGE IN YEARS</th>
<th>INITIAL LEVEL OF OPENNESS (OP)</th>
<th>LOW</th>
<th>HIGH</th>
</tr>
</thead>
<tbody>
<tr>
<td>7</td>
<td></td>
<td>19.25</td>
<td>17.00</td>
</tr>
<tr>
<td>10</td>
<td></td>
<td>13.50</td>
<td>16.25</td>
</tr>
<tr>
<td>13</td>
<td></td>
<td>15.00</td>
<td>14.33</td>
</tr>
<tr>
<td>OVERALL</td>
<td></td>
<td>15.92</td>
<td>15.86</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>SOURCE</th>
<th>AGE</th>
<th>OP</th>
<th>AGE X OP</th>
<th>ERROR</th>
</tr>
</thead>
<tbody>
<tr>
<td>DF</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>30</td>
</tr>
<tr>
<td>F-VALUE</td>
<td>5.83**</td>
<td>0.00</td>
<td>2.53</td>
<td></td>
</tr>
</tbody>
</table>

**P<0.01

**TABLE 16.7** Number of changes in construct relationships for control groups x age x initial level of openness: Means and analysis.

<table>
<thead>
<tr>
<th>AGE IN YEARS</th>
<th>INITIAL LEVEL OF OPENNESS (OP)</th>
<th>LOW</th>
<th>HIGH</th>
</tr>
</thead>
<tbody>
<tr>
<td>7</td>
<td></td>
<td>25.75</td>
<td>18.00</td>
</tr>
<tr>
<td>10</td>
<td></td>
<td>14.50</td>
<td>14.80</td>
</tr>
<tr>
<td>13</td>
<td></td>
<td>16.67</td>
<td>16.00</td>
</tr>
<tr>
<td>OVERALL</td>
<td></td>
<td>18.27</td>
<td>11.27</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>SOURCE</th>
<th>AGE</th>
<th>OP</th>
<th>AGE X OP</th>
<th>ERROR</th>
</tr>
</thead>
<tbody>
<tr>
<td>DF</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>30</td>
</tr>
<tr>
<td>F-VALUE</td>
<td>5.81</td>
<td>2.23</td>
<td>1.96</td>
<td></td>
</tr>
</tbody>
</table>

**TABLE 16.8** Amount of change in construct relationships for control groups x age x initial level of openness: Means and analysis.
Summary of Significant Results

1. At 10 years of age, highly differentiated subjects show more stability in construct relationships than less differentiated subjects.

2. At 10 and 13 years of age, subjects with a high initial level of balance show more stability in construct relationships than subjects with a low initial level of balance.

STRUCTURE AND THE STABILITY OF STRUCTURAL CHARACTERISTICS

In this section we will present results for the effect of initial level of a structural characteristic on the stability of that characteristic. We will consider the effect on both the amount of change and the amount and direction of any change.

Differentiation

1. Amount of change (see Table 16.9)

Initial level of differentiation has a significant effect on the amount of change in differentiation under control conditions. Highly differentiated subjects show less change than less differentiated subjects.

2. Amount and direction of change (see Table 16.10)

Initial level of differentiation has no significant effect on the amount and direction of change in differentiation.
<table>
<thead>
<tr>
<th>AGE IN YEARS</th>
<th>INITIAL LEVEL OF DIFFERENTIATION (D)</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>LOW</td>
<td>HIGH</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>2.50</td>
<td>0.50</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>1.00</td>
<td>0.50</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>1.00</td>
<td>0.25</td>
<td></td>
</tr>
<tr>
<td>OVERALL</td>
<td>1.50</td>
<td>0.42</td>
<td></td>
</tr>
</tbody>
</table>

**TABLE 16.9** Amount of change in differentiation for control groups x age x initial level of differentiation: Means and analysis.

<table>
<thead>
<tr>
<th>SOURCE</th>
<th>AGE</th>
<th>D</th>
<th>AGE X D</th>
<th>ERROR</th>
</tr>
</thead>
<tbody>
<tr>
<td>DF</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>30</td>
</tr>
<tr>
<td>F-VALUE</td>
<td>3.09</td>
<td>12.05**</td>
<td>2.23</td>
<td></td>
</tr>
</tbody>
</table>

**P<0.01**

<table>
<thead>
<tr>
<th>AGE IN YEARS</th>
<th>INITIAL LEVEL OF DIFFERENTIATION (D)</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>LOW</td>
<td>HIGH</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>-0.05</td>
<td>-0.05</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>0.60</td>
<td>0.50</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>1.00</td>
<td>-0.25</td>
<td></td>
</tr>
<tr>
<td>OVERALL</td>
<td>0.52</td>
<td>0.07</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>SOURCE</th>
<th>AGE</th>
<th>D</th>
<th>AGE X D</th>
<th>ERROR</th>
</tr>
</thead>
<tbody>
<tr>
<td>DF</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>30</td>
</tr>
<tr>
<td>F-VALUE</td>
<td>1.73</td>
<td>0.83</td>
<td>0.66</td>
<td></td>
</tr>
</tbody>
</table>

**TABLE 16.10** Amount and direction of change in differentiation for control groups x age x initial level of differentiation: Means and analysis.
Organisation

1. Amount of change (see Table 16.11)

Initial level of organisation has a significant effect on the amount of change in organisation. Highly organised subjects show more change than less organised subjects.

2. Amount and direction of change (see Table 16.12)

Initial level of organisation has a significant effect on the amount and direction of change in organisation. Highly organised subjects show a decrease in organisation while less organised subjects show an increase.

Balance

1. Amount of change (see Table 16.13)

Initial level of balance has no significant effect on the amount of change in balance under control conditions.

2. Amount and direction of change (see Table 16.14)

Initial level of balance has a significant effect on the amount and direction of change in balance. High balance subjects show a decrease in balance; low balance subjects show an increase.

There is also a significant interaction between age and initial level of balance. The difference between high and low balance subjects is most significant in 7 year-olds, is less marked but still significant for 13 year-olds, and is not significant for 10 year-olds.
<table>
<thead>
<tr>
<th>AGE IN YEARS</th>
<th>INITIAL LEVEL OF ORGANISATION (O)</th>
<th>LOW</th>
<th>HIGH</th>
</tr>
</thead>
<tbody>
<tr>
<td>7</td>
<td>20.75</td>
<td>25.20</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>9.09</td>
<td>22.07</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>14.12</td>
<td>25.62</td>
<td></td>
</tr>
<tr>
<td>OVERALL</td>
<td>14.65</td>
<td>24.30</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>SOURCE</th>
<th>AGE</th>
<th>O</th>
<th>AGE X O</th>
<th>ERROR</th>
</tr>
</thead>
<tbody>
<tr>
<td>DF</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>30</td>
</tr>
<tr>
<td>F-VALUE</td>
<td>1.35</td>
<td>6.83*</td>
<td>0.63</td>
<td></td>
</tr>
</tbody>
</table>

*P<0.05

**TABLE 16.11** Amount of change in organisation for control groups x age x initial level of organisation: Means and analysis.

<table>
<thead>
<tr>
<th>AGE IN YEARS</th>
<th>INITIAL LEVEL OF ORGANISATION (O)</th>
<th>LOW</th>
<th>HIGH</th>
</tr>
</thead>
<tbody>
<tr>
<td>7</td>
<td>20.75</td>
<td>3.56</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>4.37</td>
<td>-22.01</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>7.62</td>
<td>-25.62</td>
<td></td>
</tr>
<tr>
<td>OVERALL</td>
<td>10.97</td>
<td>-14.69</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
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<th>D</th>
<th>AGE X D</th>
<th>ERROR</th>
</tr>
</thead>
<tbody>
<tr>
<td>DF</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>30</td>
</tr>
<tr>
<td>F-VALUE</td>
<td>6.15**</td>
<td>20.39***</td>
<td>0.70</td>
<td></td>
</tr>
</tbody>
</table>

**P<0.01  ***P<0.001

**TABLE 16.12** Amount and direction of change in organisation for control groups x age x initial level of organisation: Means and analysis.
### TABLE 16.13 Amount of change in balance for control groups x age x initial level of balance: Means and analysis.

<table>
<thead>
<tr>
<th>AGE IN YEARS</th>
<th>INITIAL LEVEL OF BALANCE (B)</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>LOW</td>
<td>HIGH</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>11.00</td>
<td>-6.33</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>-0.50</td>
<td>-2.67</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>1.67</td>
<td>-8.33</td>
<td></td>
</tr>
<tr>
<td>OVERALL</td>
<td>4.06</td>
<td>-5.78</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>SOURCE</th>
<th>AGE</th>
<th>B</th>
<th>AGE X B</th>
<th>ERROR</th>
</tr>
</thead>
<tbody>
<tr>
<td>DF</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>30</td>
</tr>
<tr>
<td>F-VALUE</td>
<td>1.34</td>
<td>0.12</td>
<td>3.01</td>
<td></td>
</tr>
</tbody>
</table>

### TABLE 16.14 Amount and direction of change in balance for control group x age x initial level of balance: Means and analysis.

<table>
<thead>
<tr>
<th>AGE IN YEARS</th>
<th>INITIAL LEVEL OF BALANCE (B)</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>LOW</td>
<td>HIGH</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>11.00</td>
<td>-6.33</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>-0.50</td>
<td>-2.67</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>1.67</td>
<td>-8.33</td>
<td></td>
</tr>
<tr>
<td>OVERALL</td>
<td>4.06</td>
<td>-5.78</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>SOURCE</th>
<th>AGE</th>
<th>B</th>
<th>AGE X B</th>
<th>ERROR</th>
</tr>
</thead>
<tbody>
<tr>
<td>DF</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>30</td>
</tr>
<tr>
<td>F-VALUE</td>
<td>2.72</td>
<td>23.40</td>
<td>4.64</td>
<td></td>
</tr>
</tbody>
</table>

\[ F_{L,H}(7) = 24.24^{***} \quad F_{L,H}(10) = 0.38 \quad F_{L,H}(13) = 8.07^{**} \]

\* \* \* P<0.01 \quad \* \* \* P<0.001
Openness

1. Amount of change (see Table 16.15)

There is a significant interaction between age and initial level of openness. At 10 years of age, low openness subjects show significantly more change in openness than high openness subjects. At 13 years of age, low openness subjects show significantly less change. At 7 years of age, initial level of openness has no significant effect.

2. Amount and direction of change (see Table 16.16)

Initial level of openness has a significant effect on the amount and direction of change in openness. High openness subjects show a decrease in openness while low openness subjects show an increase.

The interaction between initial level of openness and age is significant. The effect of initial level of openness is more marked in 10 year-olds than in 13 year-olds. It has no significant effect for 7 year-olds.

Summary of Significant Results

1. Those subjects who are highly differentiated initially show greater stability of their level of differentiation than those subjects who are less differentiated initially.

2. Those subjects who are highly organised initially show less stability of their level of organisation than those who are less
### Table 16.15 Amount of change in openness for control groups x age x initial level of openness: Means and analysis.

<table>
<thead>
<tr>
<th>AGE IN YEARS</th>
<th>INITIAL LEVEL OF OPENNESS (OP)</th>
<th>LOW</th>
<th>HIGH</th>
</tr>
</thead>
<tbody>
<tr>
<td>7</td>
<td></td>
<td>0.14</td>
<td>0.10</td>
</tr>
<tr>
<td>10</td>
<td></td>
<td>0.33</td>
<td>0.11</td>
</tr>
<tr>
<td>13</td>
<td></td>
<td>0.00</td>
<td>0.35</td>
</tr>
<tr>
<td>OVERALL</td>
<td></td>
<td>0.16</td>
<td>0.19</td>
</tr>
</tbody>
</table>

Negative scores indicate an increase in openness.

### Table 16.16 Amount and direction of change in openness for control groups x age x initial level of openness: Means and analysis.

<table>
<thead>
<tr>
<th>SOURCE</th>
<th>AGE</th>
<th>OP</th>
<th>AGE X OP</th>
<th>ERROR</th>
</tr>
</thead>
<tbody>
<tr>
<td>DF</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>30</td>
</tr>
<tr>
<td>F-VALUE</td>
<td>3.00</td>
<td>1.00</td>
<td>26.00***</td>
<td></td>
</tr>
</tbody>
</table>

\[ F_{L,H(7)} = 0.47 \quad F_{L,H(10)} = 14.33*** \quad F_{L,H(13)} = 37.42*** \]

***P<0.001

**TABLE 16.16** Amount and direction of change in openness for control groups x age x initial level of openness: Means and analysis.
organised initially.

Those subjects who are highly organised initially show a decrease in organisation, those who are less organised initially show an increase.

3. Those subjects who show a high level of balance initially show a decrease in balance, those who show a low level show an increase. This is more marked in 7 year-olds than in 13 year-olds; but is not significant in 10 year-olds.

4. At 10 years of age, subjects initially high in openness show less stability in their level of openness than those initially low. At 13 years of age, they show more stability.

At 10 and 13 years of age, those subjects initially high in openness show a decrease in their level of openness, those initially low show an increase.

DISCUSSION

The results discussed in Chapter XV reveal significant age differences in the stability of both construct relationships and overall structural characteristics under conditions of no feedback. Stability increases with age. This increase was interpreted as supporting the Piagetian notion of increasing permanence in the equilibrium states which characterise stages of cognitive development.

In Chapter XIII it was suggested that the dynamic characteristics of construct systems, including stability, flexibility and adaptability, were influenced by the structural characteristics of an individual as
well as by his age. Of course these factors are not unrelated. The results discussed in Chapters X and XI reveal a developmental trend towards increasingly complex cognitive structures characterised by greater differentiation, organisation, balance and openness. If structural characteristics per se do have a significant effect on the stability of construct systems, we would expect that those functioning at a higher level of structure within each age group would show greater stability than those functioning at a lower level.

The relationship between structure and stability in children or in adults has rarely been considered. Bannister (1960) found that intensity was positively correlated with the consistency of construct relationships. The effects of other structural characteristics or the effects upon overall structural characteristics have not been considered.

Before discussing the effects of initial level of structure on stability it must be noted that the results discussed in Chapter XV suggest that there are problems in inferring structural characteristics from a measure on one occasion, particularly in the case of young children.

With this in mind, let us first consider the stability of construct relationships. The results offer little support for the hypothesis. Only initial level of balance has a significant main effect on stability. Subjects with a high initial level of balance show less change, and therefore greater stability in construct relationships, than subjects initially low in balance. This effect is only significant for 10 and 13 year-olds and is stronger in 10 year-olds. The
differential strength of the effect may be due to the wider range of balance scores in the middle age group. The variance in scores is significantly greater within the 10 year old group than within the 7 or 13 year old groups. This age group may include both children still functioning at a level characteristic of younger age groups and those who are functioning at a higher level more characteristic of older children.

The only other significant effect on the stability of construct relationships is that of differentiation at 10 years of age. The stronger effect of initial level of differentiation within this age group may again be due to the wider range of differentiation scores. The variance in differentiation scores is greater in this age group than in the other two, although not significantly so. The direction of the effect in 10 year-olds, however, is contrary to prediction. Those subjects who are initially highly differentiated show more change, or less stability, in construct relationships than those who are less differentiated initially. While contrary to the general prediction that structural level is positively correlated to stability, if we consider more closely the characteristics of a highly differentiated system, the results may not be so surprising.

In the grid of a less differentiated individual, the eight different construct labels may represent perhaps only two true constructs or functionally distinct ways of construing other people; while in the case of a highly differentiated individual they may represent six or seven different constructs. Therefore the number of construct relationships present and free to change is less in the case of a less differentiated individual than in a more differentiated
subject. If the source of inconsistency between the two grids is instability of the relationships between functionally independent constructs, as opposed to those between nominally different but functionally identical constructs, which might be expected to remain more fixed, the direction of the effect of initial level of differentiation in this study may be due to a real difference in the number of construct relationships being examined for stability.

Turning to the stability of overall structural characteristics, the effects of initial level of structural characteristics vary. Highly differentiated subjects, at all ages, show greater stability in their level of differentiation than less differentiated subjects. Initial level of organisation has the opposite effect on stability; highly organised subjects show more change in organisation.

One reason for this difference in the direction of the effect may be a certain degree of interdependence between the measures of differentiation and organisation. Both measures are based on the degree of relationship between elements and between constructs in the grid. In Chapter X, differentiation and organisation were distinguished in terms of different criteria for relationships between constructs. In the present study, however, the limited number of elements and constructs in the grid, together with the crude dichotomous rating scale used, may have led to a lack of discrimination between these two structural characteristics. This conclusion is supported by a significant negative correlation between differentiation and organisation in this study.

The effects of initial level of openness are equivocal. At 10 years of age, high openness subjects show greater stability in
openness; at 13 years of age, low openness subjects show greater stability.

Turning to consider the amount and direction of change in structural characteristics, the effect of initial level of structure is essentially the same for all four structural characteristics except differentiation, which has no significant effect. Those subjects who manifest a high level of organisation, balance or openness initially show a decrease in that characteristic, while those who manifest a low level initially show an increase. In Chapter XV, the absence of overall directional tendencies in change in structural characteristics was interpreted as evidence against any systematic effect on structure due simply to completing a repertory grid. In the light of the results presented in this chapter, this conclusion perhaps needs revising. The consistent directional tendencies that emerge when the subject's initial level of structure is taken into account suggest that there may be a systematic effect on structure due simply to the completion of a grid. If so, the nature of the effect depends on the individual's structural characteristics.

An alternative explanation of these directional tendencies is regression of scores on the second grid to the mean of scores on the first grid, i.e. a negative correlation between initial score and gain score with, therefore, a decrease for those initially high and an increase for those initially low. Such a negative correlation is due, in part, to the attenuating effect of errors of measurement and, in part, to whatever factors contribute to real differential changes from initial to final score. McNemar (1969) suggests procedures for correcting for the effect of errors of measurement which
require a reliability coefficient for the measure being used. In the present case such reliability coefficients are not available and therefore such corrections cannot be made. The phenomenon of regression to the mean must therefore be recognised as a possible confounding factor. Evidence that regression to the mean is not the sole cause of the observed results, at least for balance and openness, comes from the significant interaction between age and initial level for these characteristics, which suggests the existence of some real effect which varies with age.

Summary

It was predicted that initial level of differentiation, organisation, balance and openness are positively related to the stability of construct relationships and structural characteristics. The results offer little support for this hypothesis. Only initial level of balance has a significant overall effect on the stability of construct relationships in the predicted direction. Initial level of differentiation has a significant effect at 10 years of age but in the opposite direction. It was suggested that this result was due to a real difference in the number of construct relationships present in the grids of high and low differentiated subjects.

With respect to the stability of structural characteristics; the effect of initial level of differentiation is in the predicted direction, the effect of initial level of organisation is in the opposite direction and for openness the direction of the effect varies with age. It was suggested that the contrary effects of differentiation and organisation might be due to a certain degree of interdependence between these two measures.
The effect of initial level on the amount and direction of change is the same for all structural characteristics. Those initially high show a decrease while those initially low show an increase. The possible role of regression to the mean as a confounding factor to any real differential effect of structure on change was discussed.
CHAPTER XVII

INVALIDATION AND CONSTRUCT RELATIONSHIPS: RESULTS

COMPARISONS OF EXPERIMENTAL GROUPS WITH CONTROL GROUPS

AGE AND THE EFFECTS OF INVALIDATION ON CONSTRUCT RELATIONSHIPS
- Number of Changes in Construct Relationships
- Overall Amount of Change in Construct Relationships
- Summary of Significant Results

STRUCTURE AND THE EFFECTS OF INVALIDATION ON CONSTRUCT RELATIONSHIPS
- Differentiation
- Organisation
- Balance
- Openness
- Summary of Significant Results

In this chapter we will present results concerning the effects of invalidatory feedback on the pattern of construct relationships. In the first section we will compare the responses of the experimental groups with those of the control groups. In the second section we will consider the relationship between age, invalidation and response. In the third section we will consider the relationship of the individual's structural characteristics. Discussion of these results will follow in Chapter XIX.

Two different aspects of invalidation were examined in this study: rating invalidation (RI), in which the feedback invalidated the construing of elements but maintained the relationships between
constructs; and pattern invalidation (Pi) in which the feedback invalidated both the construing of elements and implicitly the relationships between constructs. Two levels of each form of invalidation were employed, giving four experimental conditions within each age group.

COMPARISONS OF EXPERIMENTAL GROUPS WITH CONTROL GROUPS

In Chapter XV we presented results describing the degree of change in construct relationships shown by the control groups. In this section we will compare the experimental groups and control group in each age group. Comparisons of the means for each group were made by carrying out F-tests for experimental groups overall with a single control group. Comparisons of each experimental group with the appropriate control group were made by t-test (see Winer, 1971, p. 468).

Table 17.1 shows the mean number of construct relationships which show a change for each control and experimental group with associated F and t values for the comparisons. In addition, the table shows results and analysis for the overall amount of change in construct relationships.

The comparison between control and experimental groups overall is only significant for 7 year-olds on the overall amount of change in construct relationships. The experimental groups show less change than the control group.

Comparison of individual groups, however, shows that the difference is only significant for the low PI groups.
<table>
<thead>
<tr>
<th>ASPECT OF CHANGE</th>
<th>AGE IN YEARS</th>
<th>CONTROL GROUPS</th>
<th>EXPERIMENTAL GROUPS</th>
<th>OVERALL</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>LOW PI</td>
<td>HIGH PI</td>
<td>LOW PI</td>
</tr>
<tr>
<td>NUMBER OF CHANGES IN CONSTRUCT RELATIONSHIPS</td>
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<td>18.50</td>
<td>15.00</td>
<td>15.83</td>
</tr>
<tr>
<td></td>
<td>t,F</td>
<td>-2.31*</td>
<td>-1.77</td>
<td>-1.39</td>
</tr>
<tr>
<td></td>
<td>10</td>
<td>15.28</td>
<td>16.50</td>
<td>17.40</td>
</tr>
<tr>
<td></td>
<td>t,F</td>
<td>0.60</td>
<td>1.05</td>
<td>1.25</td>
</tr>
<tr>
<td></td>
<td>13</td>
<td>16.17</td>
<td>15.50</td>
<td>16.80</td>
</tr>
<tr>
<td></td>
<td>t,F</td>
<td>-0.42</td>
<td>0.40</td>
<td>0.05</td>
</tr>
<tr>
<td>OVERALL AMOUNT OF CHANGE IN CONSTRUCT RELATIONSHIPS</td>
<td>7</td>
<td>23.17</td>
<td>17.17</td>
<td>18.17</td>
</tr>
<tr>
<td></td>
<td>t,F</td>
<td>-2.53*</td>
<td>-2.11</td>
<td>-2.53*</td>
</tr>
<tr>
<td></td>
<td>10</td>
<td>16.28</td>
<td>19.50</td>
<td>22.00</td>
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<tr>
<td></td>
<td>t,F</td>
<td>1.00</td>
<td>1.78</td>
<td>1.71</td>
</tr>
<tr>
<td></td>
<td>13</td>
<td>19.33</td>
<td>17.75</td>
<td>20.20</td>
</tr>
<tr>
<td></td>
<td>t,F</td>
<td>-0.53</td>
<td>-0.29</td>
<td>0.27</td>
</tr>
</tbody>
</table>

* P < 0.05  ** P < 0.01

**TABLE 17.1.** Comparison between change in construct relationships by control and experimental groups: Means and analysis.
For the number of changes in construct relationships the only group significantly different from the control group is low RI/low PI at 7 years of age.

These results are perhaps surprising in that only in the youngest age group do the experimental groups differ significantly from the control group and also in that the differences are in the opposite direction to what might be expected as the control group shows more change. However, the main focus of the present study is on age differences in the response to invalidation and the effect of varying levels and types of invalidation.

AGE AND THE EFFECTS OF INVALIDATION ON CONSTRUCT RELATIONSHIPS

This section presents results on age differences in the response of construct relationships to varying levels and types of invalidation.

In Chapter XV, it was pointed out that there are significant age differences in the degree of stability of construct relationships under control conditions. Therefore, to make meaningful comparisons of the response to invalidation shown by different age groups, it is important to take these variations in stability into account.

In order to do this, it was decided to transform the change scores for each experimental subject to express them in relation to the amount of change shown by the appropriate control group. The derivation of the transformed score was as follows:

\[
\text{transformed score} = \frac{\text{subject's raw score} - \text{control group mean}}{\text{control group standard deviation}}
\]
Other studies of the effects of invalidation on construct systems (e.g. Bannister, 1963, 1965; Cochran, 1973) have considered the response solely in terms of the absolute amount of change. Lack of change has been equated with absence of response. However, change is only one possible response strategy. One alternative might be to respond by rigidifying the system, restricting its flexibility. The results discussed in Chapter XV suggested the potential for this type of response. Given a degree of instability or change in the control group, the response to invalidation shown by the experimental groups could differ in either of two ways. They might show either more or less change than the control group. The comparisons between the control and experimental groups presented in the preceding section suggest that the latter is a response shown by many of the subjects. In the light of this we will present results concerning two aspects of the response to invalidation:

(a) The extent of response

This refers to the deviation of an experimental subject's response from that of the appropriate control group irrespective of its direction, i.e. whether it represents a response of change or of rigidification relative to the control group. This has been operationalised in terms of the subject's transformed score irrespective of sign.

(b) The nature of response

This refers to both the extent and direction of the deviation of a subject's response from the control group. It thus distinguishes between the two modes of response. It has been operationalised by retaining the sign with a subject's transformed score. A positive
score indicates greater change than the control group and represents a response of change. A negative score indicates less change than the control group and represents a response of relative rigidification.

The distinction between these two aspects of the response can perhaps be made clearer by means of an example. If two subjects of the same age show three and nine changes respectively in the value of construct relationships and the mean and standard deviation for the relevant control group are 6.0 and 2.0, the transformed scores for these subjects are -1.5 and +1.5. The same absolute value for these scores indicates that both differ from the control group to the same extent and therefore might be assumed to be responding to invalidation to the same degree. The difference in sign, however, shows that although the extent of their responses is the same, their nature differs. The first shows less change than the control group and responds by rigidification, the second shows more change and therefore responds with a real change in construct relationships.

We will present results for the effects of age, RI and PI on these two aspects of response for both the number of changes in construct relationships and the overall amount of change. The analyses throughout are three-way analyses of variance.

Number of Changes in Construct Relationships

1. Extent of response

Results and analysis are summarised in Table 17.2. The only significant effect is the interaction between age and RI. At 13 years of age the extent of response to invalidation is significantly greater under high RI (X = 0.68) than under low (X = 1.56, F = 4.05,
### TABLE 17.2
Number of changes in construct relationships (extent of response) x age x RI x PI: Means and analysis.

<table>
<thead>
<tr>
<th>AGE IN YEARS</th>
<th>EXPERIMENTAL CONDITION</th>
<th>OVERALL</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>LOW PI</td>
<td>HIGH PI</td>
</tr>
<tr>
<td>7</td>
<td>2.39</td>
<td>1.86</td>
</tr>
<tr>
<td>10</td>
<td>0.98</td>
<td>1.13</td>
</tr>
<tr>
<td>13</td>
<td>0.60</td>
<td>0.75</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>SOURCE</th>
<th>AGE(A)</th>
<th>RI(R)</th>
<th>PI(P)</th>
<th>A X R</th>
<th>A X P</th>
<th>R X P</th>
<th>A X R X P</th>
<th>ERROR</th>
</tr>
</thead>
<tbody>
<tr>
<td>DF</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>60</td>
</tr>
<tr>
<td>F-VALUE</td>
<td>2.63</td>
<td>1.34</td>
<td>0.31</td>
<td>4.21*</td>
<td>1.71</td>
<td>0.77</td>
<td>0.17</td>
<td></td>
</tr>
</tbody>
</table>

*P<0.05

### TABLE 17.3
Number of changes in construct relationships (nature of response) x age x RI x PI: Means and analysis.

<table>
<thead>
<tr>
<th>AGE IN YEARS</th>
<th>EXPERIMENTAL CONDITION</th>
<th>OVERALL</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>LOW PI</td>
<td>HIGH PI</td>
</tr>
<tr>
<td>7</td>
<td>-1.93</td>
<td>-1.42</td>
</tr>
<tr>
<td>10</td>
<td>0.44</td>
<td>0.76</td>
</tr>
<tr>
<td>13</td>
<td>-0.27</td>
<td>0.25</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>SOURCE</th>
<th>AGE(A)</th>
<th>RI(R)</th>
<th>PI(P)</th>
<th>A X R</th>
<th>A X P</th>
<th>R X P</th>
<th>A X R X P</th>
<th>ERROR</th>
</tr>
</thead>
<tbody>
<tr>
<td>DF</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>60</td>
</tr>
<tr>
<td>F-VALUE</td>
<td>4.87*</td>
<td>0.01</td>
<td>0.00</td>
<td>1.48</td>
<td>1.09</td>
<td>1.21</td>
<td>0.83</td>
<td></td>
</tr>
</tbody>
</table>

F<sub>7,10</sub>=9.29**,  F<sub>7,13</sub>=4.59*,  F<sub>10,13</sub>=0.82

*P<0.05    **P<0.01
df = 1,33, P < 0.05). At 7 and 10 years of age RI has no significant effect.

2. Nature of response (see Table 17.3)

The main effect of age is significant. Comparison of age group means shows that 10 and 13 year-olds show significantly more changes in construct relationships than 7 year-olds. The means for 10 and 13 year-olds are not significantly different.

Overall Amount of Change in Construct Relationships

1. Extent of response (see Table 17.4)

Age has a significant effect on the extent of response to invalidation in terms of the overall amount of change in construct relationships. Seven and 10 year-olds show a significantly greater response than 13 year-olds but are not significantly different from each other.

2. Nature of response (see Table 17.5)

Age has a significant effect on the amount of change in construct relationships. Thirteen year-olds show a similar amount of change to the control group. Seven year-olds show significantly less change than 13 year-olds; 10 year-olds show significantly more change.

Summary of Significant Results

1. Age and RI interact significantly in their effect on the extent of response to invalidation in terms of the number of changes in construct relationships. For 10 and 13 year-olds the extent of response is greater at high RI than at low RI. For 7 year-olds response is less at low RI.
<table>
<thead>
<tr>
<th>AGE</th>
<th>EXPERIMENTAL CONDITION</th>
<th></th>
<th></th>
<th>OVERALL</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>LOW RI</td>
<td>HIGH RI</td>
<td></td>
<td></td>
</tr>
<tr>
<td>YEARS</td>
<td>LOW PI</td>
<td>HIGH PI</td>
<td>LOW PI</td>
<td>HIGH PI</td>
</tr>
<tr>
<td>7</td>
<td>1.38</td>
<td>1.54</td>
<td>1.47</td>
<td>1.35</td>
</tr>
<tr>
<td>10</td>
<td>1.23</td>
<td>1.95</td>
<td>1.43</td>
<td>1.88</td>
</tr>
<tr>
<td>13</td>
<td>0.49</td>
<td>0.42</td>
<td>0.93</td>
<td>1.17</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>SOURCE</th>
<th>AGE(A)</th>
<th>RI(R)</th>
<th>PI(P)</th>
<th>AXR</th>
<th>AXP</th>
<th>RXP</th>
<th>AXRXP</th>
<th>ERROR</th>
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<td>1</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>60</td>
</tr>
<tr>
<td>F-VALUE</td>
<td>4.96*</td>
<td>0.72</td>
<td>0.95</td>
<td>0.71</td>
<td>0.67</td>
<td>0.03</td>
<td>0.18</td>
<td></td>
</tr>
</tbody>
</table>

$F_{7,10} = 0.43$  $F_{7,13} = 5.49^*$  $F_{10,13} = 8.99^{**}$

* $P < 0.05$  ** $P < 0.01$

**TABLE 17.4** Amount of change in construct relationships (extent of response) x age x RI x PI: Means and analysis.

<table>
<thead>
<tr>
<th>AGE</th>
<th>EXPERIMENTAL CONDITION</th>
<th></th>
<th></th>
<th>OVERALL</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>LOW RI</td>
<td>HIGH RI</td>
<td></td>
<td></td>
</tr>
<tr>
<td>YEARS</td>
<td>LOW PI</td>
<td>HIGH PI</td>
<td>LOW PI</td>
<td>HIGH PI</td>
</tr>
<tr>
<td>7</td>
<td>-1.27</td>
<td>-1.23</td>
<td>-1.47</td>
<td>-0.68</td>
</tr>
<tr>
<td>10</td>
<td>0.83</td>
<td>1.48</td>
<td>1.43</td>
<td>-0.53</td>
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<tr>
<td>13</td>
<td>-0.27</td>
<td>0.15</td>
<td>-0.14</td>
<td>-0.10</td>
</tr>
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</table>

<table>
<thead>
<tr>
<th>SOURCE</th>
<th>AGE(A)</th>
<th>RI(R)</th>
<th>PI(P)</th>
<th>AXR</th>
<th>AXP</th>
<th>RXP</th>
<th>AXRXP</th>
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<td>2</td>
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<td>2</td>
<td>2</td>
<td>60</td>
</tr>
<tr>
<td>F-VALUE</td>
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<td>0.00</td>
<td>0.60</td>
<td>0.93</td>
<td>1.19</td>
<td>2.09</td>
<td></td>
</tr>
</tbody>
</table>

$F_{7,10} = 22.09^{***}$  $F_{7,13} = 6.7^*$  $F_{10,13} = 4.55^*$

* $P < 0.05$  ** $P < 0.01$

**TABLE 17.5** Amount of change in construct relationships (nature of response) x age x RI x PI: Means and analysis.
While there are no age differences in the mean extent of response to invalidation, there are significant age differences in the nature of the response in terms of the number of changes in construct relationships. Seven year-olds show fewer changes than 10 or 13 year-olds which represents a more rigidifying response.

2. There are significant age differences in the extent of response in terms of the overall amount of change in construct relationships. Seven and 10 year-olds show a greater response than 13 year-olds.

While 7 and 10 year-olds do not differ significantly in the extent of response in terms of the amount of change, the nature of their responses are significantly different. Seven year-olds show a response of rigidification while 10 year-olds show a response of change.

STRUCTURE AND THE EFFECTS OF INVALIDATION ON CONSTRUCT RELATIONSHIPS

The results presented in this section concern the effects of initial level of structure on the extent and nature of the response of construct relationships to invalidation. We shall consider the response in terms of both the number and overall amount of change in construct relationships. As few significant effects of level of invalidation emerged the four experimental groups were combined to maintain sufficient group sizes and the effects of age and initial level of structure were tested by means of two-way analyses of variance. We shall consider the effects of each structural characteristic in turn.
Differentiation

1. Number of changes in construct relationships
   (i) Extent of response (see Table 17.6)

   Initial level of differentiation has no significant effect on the extent of response to invalidation in terms of the number of changes in construct relationships.

   (ii) Nature of response (see Table 17.7)

   Initial level of differentiation has no significant effect on the number of changes in construct relationships in response to invalidation.

2. Amount of change in construct relationships
   (i) Extent of response (see Table 17.8)

   There is a significant interaction between initial level of differentiation and age. At 10 and 13 years of age highly differentiated subjects show less response than less differentiated subjects, although the difference is only significant for 10 year-olds. At 7 years of age there is a slight, non-significant tendency for more differentiated subjects to show a greater response.

   (ii) Nature of response (see Table 17.9)

   Initial level of differentiation has no significant effect on the amount of change in construct relationships in response to invalidation.

Organisation

1. Number of changes in construct relationships
### Table 17.6
Number of changes in construct relationships (extent of response) x age x initial level of differentiation: Means and analysis.

<table>
<thead>
<tr>
<th>AGE IN YEARS</th>
<th>INITIAL LEVEL OF DIFFERENTIATION (D)</th>
<th>LOW</th>
<th>HIGH</th>
</tr>
</thead>
<tbody>
<tr>
<td>7</td>
<td></td>
<td>1.77</td>
<td>2.39</td>
</tr>
<tr>
<td>10</td>
<td></td>
<td>1.47</td>
<td>1.19</td>
</tr>
<tr>
<td>13</td>
<td></td>
<td>1.41</td>
<td>0.87</td>
</tr>
<tr>
<td>OVERALL</td>
<td></td>
<td>1.55</td>
<td>1.48</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>SOURCE</th>
<th>AGE</th>
<th>D</th>
<th>AGE X D</th>
<th>ERROR</th>
</tr>
</thead>
<tbody>
<tr>
<td>DF</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>66</td>
</tr>
</tbody>
</table>
| F-VALUE    | 6.31** | 0.43 | 2.00 | **P<0.01 **

### Table 17.7
Number of changes in construct relationships (nature of response) x age x initial level of differentiation: Means and analysis.

<table>
<thead>
<tr>
<th>AGE IN YEARS</th>
<th>INITIAL LEVEL OF DIFFERENTIATION (D)</th>
<th>LOW</th>
<th>HIGH</th>
</tr>
</thead>
<tbody>
<tr>
<td>7</td>
<td></td>
<td>-0.74</td>
<td>-1.63</td>
</tr>
<tr>
<td>10</td>
<td></td>
<td>0.00</td>
<td>0.73</td>
</tr>
<tr>
<td>13</td>
<td></td>
<td>-0.36</td>
<td>0.15</td>
</tr>
<tr>
<td>OVERALL</td>
<td></td>
<td>-0.37</td>
<td>-0.25</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>SOURCE</th>
<th>AGE</th>
<th>D</th>
<th>AGE X D</th>
<th>ERROR</th>
</tr>
</thead>
<tbody>
<tr>
<td>DF</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>66</td>
</tr>
</tbody>
</table>
| F-VALUE    | 5.55** | 0.10 | 1.69 | **P<0.01 **
<table>
<thead>
<tr>
<th>AGE IN YEARS</th>
<th>INITIAL LEVEL OF DIFFERENTIATION (D)</th>
<th>LOW</th>
<th>HIGH</th>
</tr>
</thead>
<tbody>
<tr>
<td>7</td>
<td>1.11</td>
<td>1.67</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>2.04</td>
<td>1.21</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>0.93</td>
<td>0.56</td>
<td></td>
</tr>
<tr>
<td>OVERALL</td>
<td>1.36</td>
<td>1.15</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>SOURCE</th>
<th>AGE</th>
<th>D</th>
<th>AGE x D</th>
<th>ERROR</th>
</tr>
</thead>
<tbody>
<tr>
<td>DF</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>66</td>
</tr>
<tr>
<td>F-VALUE</td>
<td>5.57**</td>
<td>0.89</td>
<td>3.36*</td>
<td></td>
</tr>
</tbody>
</table>

\[ F_{L,H}(7) = 2.05, \quad F_{L,H}(10) = 4.49*, \quad F_{L,H}(13) = 0.89 \]

* \( P < 0.05 \)  ** \( P < 0.01 \)

**TABLE 17.8** Amount of change in construct relationships (extent of response) \( \times \) age \( \times \) initial level of differentiation: Means and analysis.

<table>
<thead>
<tr>
<th>AGE IN YEARS</th>
<th>INITIAL LEVEL OF DIFFERENTIATION (D)</th>
<th>LOW</th>
<th>HIGH</th>
</tr>
</thead>
<tbody>
<tr>
<td>7</td>
<td>-0.68</td>
<td>-1.68</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>0.90</td>
<td>0.84</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>-0.40</td>
<td>0.21</td>
<td></td>
</tr>
<tr>
<td>OVERALL</td>
<td>-0.06</td>
<td>0.21</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>SOURCE</th>
<th>AGE</th>
<th>D</th>
<th>AGE x D</th>
<th>ERROR</th>
</tr>
</thead>
<tbody>
<tr>
<td>DF</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>66</td>
</tr>
<tr>
<td>F-VALUE</td>
<td>12.80**</td>
<td>0.21</td>
<td>1.96</td>
<td></td>
</tr>
</tbody>
</table>

*** \( P < 0.001 \)

**TABLE 17.9** Amount of change in construct relationships (nature of response) \( \times \) age \( \times \) initial level of differentiation: Means and analysis.
(i) Extent of response (see Table 17.10)

Initial level of organisation has no significant effect on the extent of response to invalidation in terms of the number of changes in construct relationships.

(ii) Nature of response (see Table 17.11)

Initial level of organisation has no significant effect on the number of changes in construct relationships in response to invalidation.

2. Amount of change in construct relationships

(i) Extent of response (see Table 17.12)

There is a significant interaction between initial level of organisation and age. At 10 years of age, highly organised show a greater response to invalidation than less organised subjects. At 7 years of age, highly organised subjects show a slight, non-significant tendency to respond less than less organised subjects. At 13 years of age, initial level of organisation has no effect on the extent of response to invalidation.

(ii) Nature of response (see Table 17.13)

Initial level of organisation has no significant effect on the amount of change in construct relationships in response to invalidation.

Balance

1. Number of changes in construct relationships

(i) Extent of response (see Table 17.14)

Initial level of balance has no significant effect on
<table>
<thead>
<tr>
<th>AGE IN YEARS</th>
<th>INITIAL LEVEL OF ORGANISATION (O)</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>LOW</td>
<td>HIGH</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>1.92</td>
<td>1.69</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>1.22</td>
<td>1.47</td>
<td></td>
</tr>
<tr>
<td>13</td>
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<td>1.19</td>
<td></td>
</tr>
<tr>
<td>OVERALL</td>
<td>1.39</td>
<td>1.45</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
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<th>AGE X 0</th>
<th>ERROR</th>
</tr>
</thead>
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<tr>
<td>DF</td>
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<td>1</td>
<td>2</td>
<td>66</td>
</tr>
<tr>
<td>F-VALUE</td>
<td>3.03</td>
<td>0.06</td>
<td>0.40</td>
<td></td>
</tr>
</tbody>
</table>

**TABLE 17.10** Number of changes in construct relationships (extent of response) x age x initial level of organisation: Means and analysis.

<table>
<thead>
<tr>
<th>AGE IN YEARS</th>
<th>INITIAL LEVEL OF ORGANISATION (O)</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>LOW</td>
<td>HIGH</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>-1.41</td>
<td>-0.80</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>0.21</td>
<td>0.44</td>
<td></td>
</tr>
<tr>
<td>13</td>
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</tr>
<tr>
<td>OVERALL</td>
<td>-0.53</td>
<td>-0.01</td>
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</table>

<table>
<thead>
<tr>
<th>SOURCE</th>
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<th>AGE X 0</th>
<th>ERROR</th>
</tr>
</thead>
<tbody>
<tr>
<td>DF</td>
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<td>1</td>
<td>2</td>
<td>66</td>
</tr>
<tr>
<td>F-VALUE</td>
<td>4.69*</td>
<td>1.92</td>
<td>0.12</td>
<td></td>
</tr>
</tbody>
</table>

*P < 0.05

**TABLE 17.11** Number of changes in construct relationships (nature of response) x age x initial level of organisation: Means and analysis.
### Table 17.12
Amount of change in construct relationships (extent of response) $\times$ age $\times$ initial level of organisation and analysis.

<table>
<thead>
<tr>
<th>AGE IN YEARS</th>
<th>INITIAL LEVEL OF ORGANISATION (O)</th>
<th>LOW</th>
<th>HIGH</th>
</tr>
</thead>
<tbody>
<tr>
<td>7</td>
<td></td>
<td>1.65</td>
<td>1.19</td>
</tr>
<tr>
<td>10</td>
<td></td>
<td>1.08</td>
<td>2.09</td>
</tr>
<tr>
<td>13</td>
<td></td>
<td>0.70</td>
<td>0.78</td>
</tr>
<tr>
<td>OVERALL</td>
<td></td>
<td>1.14</td>
<td>1.35</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>SOURCE</th>
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<th>O</th>
<th>AGE X O</th>
<th>ERROR</th>
</tr>
</thead>
<tbody>
<tr>
<td>DF</td>
<td>2</td>
<td>1</td>
<td></td>
<td>66</td>
</tr>
<tr>
<td>F-VALUE</td>
<td>5.73**</td>
<td>0.96</td>
<td>3.76*</td>
<td></td>
</tr>
</tbody>
</table>

$F_{L,H(7)} = 1.44$  $F_{L,H(10)} = 6.97^*$  $F_{L,H(13)} = 0.04$

* $P<0.05$  ** $P<0.01$

### Table 17.13
Amount of change in construct relationships (nature of response) $\times$ age $\times$ initial level of organisation: Means and analysis.

<table>
<thead>
<tr>
<th>AGE IN YEARS</th>
<th>INITIAL LEVEL OF ORGANISATION (O)</th>
<th>LOW</th>
<th>HIGH</th>
</tr>
</thead>
<tbody>
<tr>
<td>7</td>
<td></td>
<td>-1.52</td>
<td>-0.81</td>
</tr>
<tr>
<td>10</td>
<td></td>
<td>0.68</td>
<td>1.07</td>
</tr>
<tr>
<td>13</td>
<td></td>
<td>-0.29</td>
<td>0.23</td>
</tr>
<tr>
<td>OVERALL</td>
<td></td>
<td>-0.38</td>
<td>0.16</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>SOURCE</th>
<th>AGE</th>
<th>O</th>
<th>AGE X O</th>
<th>ERROR</th>
</tr>
</thead>
<tbody>
<tr>
<td>DF</td>
<td>2</td>
<td>1</td>
<td></td>
<td>66</td>
</tr>
<tr>
<td>F-VALUE</td>
<td>12.48***</td>
<td>2.66</td>
<td>0.09</td>
<td></td>
</tr>
</tbody>
</table>

*** $P<0.001$
### AGE IN YEARS

<table>
<thead>
<tr>
<th>AGE IN YEARS</th>
<th>INITIAL LEVEL OF BALANCE (B)</th>
<th>LOW</th>
<th>HIGH</th>
</tr>
</thead>
<tbody>
<tr>
<td>7</td>
<td>2.13</td>
<td>1.60</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>1.33</td>
<td>1.39</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>1.10</td>
<td>1.15</td>
<td></td>
</tr>
<tr>
<td><strong>OVERALL</strong></td>
<td>1.52</td>
<td>1.38</td>
<td></td>
</tr>
</tbody>
</table>

### SOURCE

<table>
<thead>
<tr>
<th>SOURCE</th>
<th>AGE</th>
<th>B</th>
<th>AGE X B</th>
<th>ERROR</th>
</tr>
</thead>
<tbody>
<tr>
<td>DF</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>66</td>
</tr>
<tr>
<td><strong>F-VALUE</strong></td>
<td>6.69**</td>
<td>0.34</td>
<td>1.91**</td>
<td></td>
</tr>
</tbody>
</table>

**P<0.01**

**TABLE 17.14** Number of changes in construct relationships (extent of response) x age x initial level of balance: Means and analysis.

### AGE IN YEARS

<table>
<thead>
<tr>
<th>AGE IN YEARS</th>
<th>INITIAL LEVEL OF BALANCE (B)</th>
<th>LOW</th>
<th>HIGH</th>
</tr>
</thead>
<tbody>
<tr>
<td>7</td>
<td>-1.14</td>
<td>-1.37</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>0.88</td>
<td>-0.45</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>-0.94</td>
<td>1.13</td>
<td></td>
</tr>
<tr>
<td><strong>OVERALL</strong></td>
<td>-0.40</td>
<td>-0.23</td>
<td></td>
</tr>
</tbody>
</table>

### SOURCE

<table>
<thead>
<tr>
<th>SOURCE</th>
<th>AGE</th>
<th>B</th>
<th>AGE X B</th>
<th>ERROR</th>
</tr>
</thead>
<tbody>
<tr>
<td>DF</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>66</td>
</tr>
<tr>
<td><strong>F-VALUE</strong></td>
<td>6.69**</td>
<td>0.21</td>
<td>7.58**</td>
<td></td>
</tr>
</tbody>
</table>

\[ F_{L,H}(7)=0.12 \quad F_{L,H}(10)=4.43* \quad F_{L,H}(13)=10.94** \]

* P<0.05 \quad ** P<0.01

**TABLE 17.15** Number of changes in construct relationships (nature of response) x age x initial level of balance: Means and analysis.
the extent of response to invalidation in terms of the number of changes in construct relationships.

(ii) Nature of response (see Table 17.15)

There is a significant interaction between initial level of balance and age. At 10 years of age, high balance subjects show significantly fewer changes in construct relationships in response to invalidation than low balance subjects. At 13 years of age the pattern is reversed: high balance subjects show significantly more changes than low balance subjects. At 7 years of age, initial level of balance has no significant effect.

2. Amount of change in construct relationships
   (i) Extent of response (see Table 17.16)

   Initial level of balance has no significant effect on the response to invalidation in terms of the overall amount of change in construct relationships.

   (ii) Nature of response (see Table 17.17)

   There is a significant interaction between initial level of balance and age. At 10 years of age, high balance subjects show less change in construct relationships in response to invalidation than low balance subjects; at 13 years of age, high balance subjects show significantly more change. At 7 years of age, initial level of balance has no significant effect.

Openness

1. Number of changes in construct relationships
### Table 17.16

<table>
<thead>
<tr>
<th>AGE IN YEARS</th>
<th>INITIAL LEVEL OF BALANCE (B)</th>
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<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>LOW</td>
<td>HIGH</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>1.47</td>
<td>1.41</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>1.91</td>
<td>1.31</td>
<td></td>
</tr>
<tr>
<td>13</td>
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</tr>
<tr>
<td>OVERALL</td>
<td>1.38</td>
<td>1.14</td>
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</table>

**Source**

<table>
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<th>ERROR</th>
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</thead>
<tbody>
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<td>2</td>
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<td>2</td>
<td>66</td>
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</tbody>
</table>

**F-value**

<p>| | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td><strong>5.53</strong></td>
<td><strong>1.11</strong></td>
<td><strong>0.63</strong></td>
<td></td>
</tr>
</tbody>
</table>

**P < 0.01**

**Table 17.16** Amount of change in construct relationships (extent of response) x age x initial level of balance: Means and analysis.

### Table 17.17

<table>
<thead>
<tr>
<th>AGE IN YEARS</th>
<th>INITIAL LEVEL OF BALANCE (B)</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>LOW</td>
<td>HIGH</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>-0.91</td>
<td>-1.41</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>1.39</td>
<td>0.24</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>-0.60</td>
<td>0.67</td>
<td></td>
</tr>
<tr>
<td>OVERALL</td>
<td>-0.04</td>
<td>-0.17</td>
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**Source**

<table>
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<td>2</td>
<td>66</td>
<td></td>
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**F-value**

<p>| | | | |</p>
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<tr>
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<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>12.68</strong></td>
<td><strong>0.15</strong></td>
<td><strong>5.00</strong></td>
<td></td>
</tr>
</tbody>
</table>

**FL,H(7) = 0.80**  **FL,H(10) = 4.22**  **FL,H(13) = 5.15**

**P < 0.05**  **P < 0.01**  **P < 0.001**

**Table 17.17** Amount of change in construct relationships (nature of response) x age x initial level of balance: Means and analysis.
(i) Extent of response (see Table 17.18)

The effect of initial level of openness on the extent of response to invalidation just fails to reach statistical significance. High openness subjects show a greater response than low openness subjects.

(ii) Nature of response (see Table 17.19)

Initial level of openness has no significant effect on the number of changes in construct relationships in response to invalidation.

2. Amount of change in construct relationships

(i) Extent of response (see Table 17.20)

Initial level of openness has no significant effect on the extent of response to invalidation in terms of the overall amount of change in construct relationships.

(ii) Nature of response (see Table 17.21)

Initial level of openness has no significant effect on the overall amount of change in construct relationships in response to invalidation.

Summary of Significant Results

1. At 10 years of age, more differentiated subjects show less response to invalidation, in terms of overall amount of change in construct relationships, than less differentiated subjects.

2. At 10 years of age, more organised subjects show more response to invalidation, in terms of overall amount of change in construct relationships, than less organised subjects.
<table>
<thead>
<tr>
<th>AGE IN YEARS</th>
<th>INITIAL LEVEL OF OPENNESS (OP)</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>LOW</td>
<td>HIGH</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>1.57</td>
<td>2.08</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>1.09</td>
<td>1.68</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>0.96</td>
<td>1.31</td>
<td></td>
</tr>
<tr>
<td>OVERALL</td>
<td>1.21</td>
<td>1.66</td>
<td></td>
</tr>
</tbody>
</table>

<table>
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<th>AGE</th>
<th>OP</th>
<th>AGE X OP</th>
<th>ERROR</th>
</tr>
</thead>
<tbody>
<tr>
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<td>1</td>
<td>2</td>
<td>66</td>
</tr>
<tr>
<td>F-VALUE</td>
<td>2.53</td>
<td>3.90</td>
<td>0.11</td>
<td></td>
</tr>
</tbody>
</table>

**TABLE 17.18** Number of changes in construct relationships (extent of response) x age x initial level of openness: Means and analysis.

<table>
<thead>
<tr>
<th>AGE IN YEARS</th>
<th>INITIAL LEVEL OF OPENNESS (OP)</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>LOW</td>
<td>HIGH</td>
<td></td>
</tr>
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<td>7</td>
<td>-3.24</td>
<td>-1.92</td>
<td></td>
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<td>10</td>
<td>1.27</td>
<td>0.01</td>
<td></td>
</tr>
<tr>
<td>13</td>
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<td>-0.31</td>
<td></td>
</tr>
<tr>
<td>OVERALL</td>
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<th>ERROR</th>
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</thead>
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<tr>
<td>DF</td>
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<td>1</td>
<td>2</td>
<td>66</td>
</tr>
<tr>
<td>F-VALUE</td>
<td>6.08**</td>
<td>0.01</td>
<td>0.92</td>
<td></td>
</tr>
</tbody>
</table>

**P<0.01**

**TABLE 17.19** Number of changes in construct relationships (nature of response) x age x initial level of openness: Means and analysis.
### Table 17.20
Amount of change in construct relationships (extent of response) x age x initial level of openness: Means and analysis.

<table>
<thead>
<tr>
<th>AGE IN YEARS</th>
<th>INITIAL LEVEL OF OPENNESS (OP)</th>
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<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>LOW</td>
<td>HIGH</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>1.50</td>
<td>1.39</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>1.37</td>
<td>1.81</td>
<td></td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>0.51</td>
<td>0.82</td>
<td></td>
<td></td>
</tr>
<tr>
<td>OVERALL</td>
<td>1.13</td>
<td>1.34</td>
<td></td>
<td></td>
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</tbody>
</table>

<table>
<thead>
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<th>AGE</th>
<th>OP</th>
<th>AGE X OP</th>
<th>ERROR</th>
</tr>
</thead>
<tbody>
<tr>
<td>DF</td>
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<td>1</td>
<td>2</td>
<td>66</td>
</tr>
<tr>
<td>F-VALUE</td>
<td>4.93*</td>
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</tr>
</tbody>
</table>

* P<0.05

### Table 17.21
Amount of change in construct relationships (nature of response) x age x initial level of openness: Means and analysis.

<table>
<thead>
<tr>
<th>AGE IN YEARS</th>
<th>INITIAL LEVEL OF OPENNESS (OP)</th>
<th></th>
<th></th>
<th></th>
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<td>HIGH</td>
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<td></td>
</tr>
<tr>
<td>7</td>
<td>-1.50</td>
<td>-1.03</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
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<td>0.44</td>
<td></td>
<td></td>
</tr>
<tr>
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<tr>
<td>OVERALL</td>
<td>-0.09</td>
<td>-0.23</td>
<td></td>
<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>SOURCE</th>
<th>AGE</th>
<th>OP</th>
<th>AGE X OP</th>
<th>ERROR</th>
</tr>
</thead>
<tbody>
<tr>
<td>DF</td>
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<td>1</td>
<td>2</td>
<td>66</td>
</tr>
<tr>
<td>F-VALUE</td>
<td>12.78***</td>
<td>0.15</td>
<td>2.43</td>
<td></td>
</tr>
</tbody>
</table>

*** P<0.001
3. At 10 years of age, high balance subjects show fewer changes and less change overall in construct relationships in response to invalidation than low balance subjects.

At 13 years of age, there is a significant difference in the nature of the response to invalidation of high and low balance subjects. High balance subjects display a change response; low balance subjects display a rigidifying response.
In this chapter we will present results on the effects of invalidatory feedback on the structural characteristics of the individual. In the first section we will compare the responses of the experimental groups with those of the control groups. In the second section we will consider the relationship between age and the effects of invalidation. In the third section we will consider the relationship of the individual's initial structural characteristics. Discussion of these results will
COMPARISONS OF EXPERIMENTAL GROUPS WITH CONTROL GROUPS

We will first present comparisons between control and experimental groups in the amount of change in structure irrespective of the direction of change, followed by comparisons of the amount and direction of change.

Amount of Change

Table 18.1 shows the mean amount of change in differentiation, organisation, balance and openness, together with F and t values for overall and group comparisons.

At 7 years of age the amount of change shown by the experimental groups overall is significantly less than that shown by the control group for differentiation, organisation and balance. Comparisons of individual groups show that for differentiation the effect is significant for all experimental groups. For organisation the effect is limited to the low RI/high PI group. For balance the effect is limited to the high RI/low PI group.

At 10 years of age the overall experimental-control group comparison is only significant for organisation. The effect is limited to the low RI groups who show less change than the control group. Comparisons of individual groups also show that the high RI/low PI group shows less change in balance than the control group.

At 13 years of age none of the overall or individual group comparisons are significant.
<table>
<thead>
<tr>
<th>STRUCTURAL CHARACTERISTIC</th>
<th>AGE IN YEARS</th>
<th>CONTROL GROUP</th>
<th>EXPERIMENTAL GROUPS</th>
<th>OVERALL</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>LOW PI</td>
<td>HIGH PI</td>
</tr>
<tr>
<td>DIFFERENTIATION</td>
<td>7</td>
<td>1.83</td>
<td>0.67</td>
<td>0.67</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>-2.56*</td>
<td>-2.56*</td>
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<tr>
<td></td>
<td>10</td>
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<td>0.67</td>
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</tr>
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<td></td>
<td></td>
<td>-0.15</td>
<td>-1.15</td>
</tr>
<tr>
<td></td>
<td>13</td>
<td>0.67</td>
<td>0.25</td>
<td>1.00</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>-1.16</td>
<td>-0.89</td>
</tr>
<tr>
<td>ORGANISATION</td>
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<td>22.98</td>
<td>15.72</td>
<td>17.32</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>-1.40</td>
<td>-2.46*</td>
</tr>
<tr>
<td></td>
<td>10</td>
<td>7.29</td>
<td>23.50</td>
<td>20.83</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>3.20**</td>
<td>2.68*</td>
</tr>
<tr>
<td></td>
<td>13</td>
<td>10.87</td>
<td>7.12</td>
<td>16.73</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>-0.98</td>
<td>1.53</td>
</tr>
<tr>
<td>BALANCE</td>
<td>7</td>
<td>9.33</td>
<td>4.72</td>
<td>5.33</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>-2.05</td>
<td>-1.78</td>
</tr>
<tr>
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<td>10</td>
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<td>7.17</td>
<td>4.00</td>
</tr>
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<td>-1.81</td>
</tr>
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<td>6.50</td>
<td>7.00</td>
</tr>
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<td></td>
<td></td>
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<td>0.89</td>
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<td>0.22</td>
</tr>
<tr>
<td></td>
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<td></td>
<td>1.19</td>
<td>1.94</td>
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<td>0.17</td>
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<td>-0.17</td>
<td>0.33</td>
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<td></td>
<td>13</td>
<td>0.16</td>
<td>0.09</td>
<td>0.26</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>-0.96</td>
<td>1.62</td>
</tr>
</tbody>
</table>

*P < 0.05  **P < 0.01

**TABLE 18.1.** Comparisons between amount of change in structural characteristics by control and experimental groups: Means and analysis.
Amount and Direction of Change

Table 18.2 shows the mean amount and direction of change in the four structural characteristics for each control and experimental group together with F and t values.

The only significant overall comparison is for change in openness at 7 years of age. All experimental groups except high RI/high PI show a significantly greater decrease in openness than the control group (negative scores indicate an increase in the case of openness). Individual group comparisons show that 7 year-olds in the low RI/low PI group show a significantly greater decrease in organisation than the control group.

Thirteen year-olds in the low RI/high PI group show a significantly greater increase in differentiation than the control group, and a significantly greater decrease in organisation.

With change in structure as with change in construct relationships, there are few significant differences between the experimental and control groups. Again those differences that are significant show the control group changing more than the experimental groups. These results are contrary to the expectation that the response to invalidation is one of change in construing with the extent of change depending on the amount of invalidation and the age and structural characteristics of the subject. The results suggest a much wider range of possible responses and the remainder of this chapter will present a more detailed analysis of the response to invalidation of structural characteristics and the effects of age and initial level of structure.
<table>
<thead>
<tr>
<th>STRUCTURAL CHARACTERISTIC</th>
<th>AGE IN YEARS</th>
<th>CONTROL GROUP</th>
<th>EXPERIMENTAL GROUPS</th>
<th>OVERALL</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>LOW RI</td>
<td>HIGH RI</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>LOW PI</td>
<td>HIGH PI</td>
</tr>
<tr>
<td><strong>DIFFERENTIATION</strong></td>
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<td></td>
<td></td>
<td></td>
</tr>
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<td>0.29</td>
<td>-0.67</td>
<td>0.20</td>
</tr>
<tr>
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<td>-0.14</td>
<td>-0.33</td>
<td>0.40</td>
<td>0.20</td>
</tr>
<tr>
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<td>0.25</td>
<td>1.00</td>
<td>0.75</td>
</tr>
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<td>t,F</td>
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<td>1.79</td>
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<td><strong>ORGANISATION</strong></td>
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<td></td>
<td></td>
</tr>
<tr>
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<td>-12.22</td>
<td>3.96</td>
<td>-1.36</td>
</tr>
<tr>
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<td>-0.82</td>
<td>-1.35</td>
<td>-0.68</td>
</tr>
<tr>
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<td>-5.01</td>
</tr>
<tr>
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<td>-1.00</td>
<td>-0.07</td>
</tr>
<tr>
<td>t,F</td>
<td>3.09</td>
<td>-1.78</td>
<td>-12.82</td>
<td>-0.52</td>
</tr>
<tr>
<td>t,F</td>
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<td>-2.38*</td>
<td>-0.59</td>
<td>-0.92</td>
</tr>
<tr>
<td>t,F</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td><strong>BALANCE</strong></td>
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<td></td>
</tr>
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<td>4.14</td>
<td>1.33</td>
<td>0.00</td>
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<td>-0.61</td>
<td>-0.87</td>
</tr>
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<td>-2.00</td>
<td>-2.00</td>
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<td>-1.13</td>
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<td>2.24</td>
<td>1.16</td>
<td>0.50</td>
</tr>
<tr>
<td><strong>OPENNESS</strong></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>t,F</td>
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<td>0.17</td>
<td>0.05</td>
<td>0.04</td>
</tr>
<tr>
<td>t,F</td>
<td>3.78**</td>
<td>2.44*</td>
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<td>2.22</td>
</tr>
<tr>
<td>t,F</td>
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<td>-0.02</td>
<td>-0.07</td>
<td>0.03</td>
</tr>
<tr>
<td>t,F</td>
<td>0.11</td>
<td>-0.44</td>
<td>0.67</td>
<td>0.33</td>
</tr>
<tr>
<td>t,F</td>
<td>-0.02</td>
<td>0.09</td>
<td>0.21</td>
<td>0.00</td>
</tr>
<tr>
<td>t,F</td>
<td>1.00</td>
<td>2.09</td>
<td>0.18</td>
<td>0.91</td>
</tr>
</tbody>
</table>

* P < 0.05   ** P < 0.01

**TABLE 18.2.** Comparisons between amount and direction of change in structural characteristics by control and experimental groups: Means and analysis.
AGE AND THE EFFECTS OF INVALIDATION ON STRUCTURAL CHARACTERISTICS

In this section we will present results concerning the effects of invalidation on the level of differentiation, organisation, balance and openness of construct systems. The results discussed in Chapter XV reveal age differences in the stability of the structural characteristics of the system as well as in the stability of construct relationships. These differences must be taken into account when considering the effects of invalidation. Therefore, a similar transformation to that described in Chapter XVII for the response of construct relationships was carried out on the raw scores for changes in structural characteristics.

In Chapter XVII the distinction was made between the extent and the nature of the response to invalidation. In the case of structural aspects a further distinction can be made between the nature of the response in terms of whether it reflects more or less change than the control group and the nature of the response in terms of the direction of this change, i.e. whether it represents an increase or a decrease in the level of a particular structural aspect. This second aspect of the nature of the response was operationalised by a transformation of the directional change shown by a subject to express it in relation to the mean and standard deviation of the directional change shown by the control group. The sign of the transformed score was retained.

The effects of age, RI and PI on each of these aspects of the response to invalidation of the structural characteristics of the system were examined by means of three-way analyses of variance.
Differentiation

1. Extent of response (see Table 18.3)

Age has a significant effect on the extent of response of differentiation to invalidation. The effect is curvilinear. Seven and 13 year-olds show significantly less response than 10 year-olds but do not differ significantly from each other.

The main effect of PI is also significant. The extent of the response to invalidation is greater at high PI than at low PI.

2. Nature of response I: Amount of change (see Table 18.4).

None of the independent variables have a significant effect on the amount of change in differentiation in response to invalidation.

3. Nature of response II: Amount and direction of change (see Table 18.5).

None of the independent variables have a significant effect on the amount and direction of change in differentiation in response to invalidation.

Organisation

1. Extent of response (see Table 18.6)

Age has a significant effect on the extent of response of organisation to invalidation. Seven and 10 year-olds show a significantly greater response than 13 year-olds. There is no significant difference between 7 and 10 year-olds.

There is also a significant interaction between age and RI. The effect of RI is only significant for 10 year-olds (F = 18.87, df = 1,60, P < 0.001). Their response is significantly greater at low RI (X̄ = 2.58) than at high RI (X̄ = 0.72).
### Table 18.3: Extent of response of differentiation x age x RI x PI: Means and analysis.

<table>
<thead>
<tr>
<th>AGE IN YEARS</th>
<th>EXPERIMENTAL CONDITION</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>LOW RI</td>
</tr>
<tr>
<td></td>
<td>LOW PI</td>
</tr>
<tr>
<td>7</td>
<td>0.76</td>
</tr>
<tr>
<td>10</td>
<td>1.41</td>
</tr>
<tr>
<td>13</td>
<td>0.69</td>
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</table>

<table>
<thead>
<tr>
<th>SOURCE</th>
<th>AGE(A)</th>
<th>RI(R)</th>
<th>PI(P)</th>
<th>A X R</th>
<th>A X P</th>
<th>R X P</th>
<th>A X R X P</th>
<th>ERROR</th>
</tr>
</thead>
<tbody>
<tr>
<td>DF</td>
<td>2</td>
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<td>1</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>60</td>
</tr>
<tr>
<td>F-VALUE</td>
<td>6.34**</td>
<td>3.57</td>
<td>4.25*</td>
<td>3.15*</td>
<td>1.82</td>
<td>3.61</td>
<td>0.33</td>
<td></td>
</tr>
</tbody>
</table>

F<sub>7,10</sub> = 7.02*  
F<sub>7,13</sub> = 0.01  
F<sub>10,13</sub> = 7.65**

* P<0.05  ** P<0.01

### Table 18.4: Amount of change in differentiation x age x RI x PI: Means and analysis.

<table>
<thead>
<tr>
<th>AGE IN YEARS</th>
<th>EXPERIMENTAL CONDITION</th>
</tr>
</thead>
<tbody>
<tr>
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<td>LOW RI</td>
</tr>
<tr>
<td></td>
<td>LOW PI</td>
</tr>
<tr>
<td>7</td>
<td>-0.46</td>
</tr>
<tr>
<td>10</td>
<td>-0.10</td>
</tr>
<tr>
<td>13</td>
<td>-0.54</td>
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</table>

<table>
<thead>
<tr>
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<th>RI(R)</th>
<th>PI(P)</th>
<th>A X R</th>
<th>A X P</th>
<th>R X P</th>
<th>A X R X P</th>
<th>ERROR</th>
</tr>
</thead>
<tbody>
<tr>
<td>DF</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>2</td>
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</tr>
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<td>F-VALUE</td>
<td>1.95</td>
<td>2.62</td>
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<td>0.67</td>
<td>0.03</td>
<td>3.46</td>
<td>1.01</td>
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</tbody>
</table>

TABLE 18.3: Extent of response of differentiation x age x RI x PI: Means and analysis.

TABLE 18.4: Amount of change in differentiation x age x RI x PI: Means and analysis.
### Table 18.5
Amount and direction of change in differentiation x age x RI x PI: Means and analysis.

<table>
<thead>
<tr>
<th>AGE IN YEARS</th>
<th>EXPERIMENTAL CONDITION</th>
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</tr>
</thead>
<tbody>
<tr>
<td></td>
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<td>HIGH PI</td>
</tr>
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<td>0.96</td>
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<table>
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<th>RI(R)</th>
<th>PI(P)</th>
<th>A X R</th>
<th>A X P</th>
<th>R X P</th>
<th>A X R X P</th>
<th>ERROR</th>
</tr>
</thead>
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<td>1</td>
<td>1</td>
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<td>3.48</td>
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### Table 18.6
Extent of response of organisation x age x RI x PI: Means and analysis.

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<td>10</td>
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<td>2.01</td>
</tr>
<tr>
<td>13</td>
<td>0.46</td>
<td>0.85</td>
</tr>
</tbody>
</table>

<table>
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<th>PI(P)</th>
<th>A X R</th>
<th>A X P</th>
<th>R X P</th>
<th>A X R X P</th>
<th>ERROR</th>
</tr>
</thead>
<tbody>
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<td>DF</td>
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<td>1</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>60</td>
</tr>
<tr>
<td>F-VALUE</td>
<td>4.98**</td>
<td>3.75</td>
<td>0.01</td>
<td>5.25**</td>
<td>1.11</td>
<td>0.65</td>
<td>0.45</td>
<td></td>
</tr>
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</table>

$F_{7,10} = 0.07 \quad F_{7,13} = 6.81^{*} \quad F_{10,13} = 8.26^{**}$

* $P < 0.05$  ** $P < 0.01$
2. Nature of response I: Amount of change (see Table 18.7)

Age has a significant effect on the amount of change in organisation in response to invalidation. The effect is curvilinear. Thirteen year-olds show a similar amount of change to their control group. Seven year-olds show significantly less change than 13 year-olds and 10 year-olds show significantly more change.

The main effect of RI is also significant. More change in organisation occurs at low RI than at high RI. Examination of the means suggests that this effect is due largely to the difference within the 10 year-old group.

3. Nature of response II: Amount and direction of change (see Table 18.8).

None of the independent variables have a significant effect on the amount and direction of change in organisation in response to invalidation.

Balance

1. Extent of response (see Table 18.9)

None of the independent variables have a significant effect on the extent of the response of the level of balance of the system to invalidation.

2. Nature of response I: Amount of change (see Table 18.10)

There is a significant interaction between age and RI. At a low level of RI, 13 year-olds show significantly more change in balance ($\bar{x} = 0.40$) than 7 or 10 year-olds ($\bar{x} = -0.70$, $F = 8.07$, df = 1,60, $P < 0.01$; $\bar{x} = -0.82$, $F = 10.02$, df = 1,60, $P < 0.01$). At a high
<table>
<thead>
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<th>AGE IN YEARS</th>
<th>EXPERIMENTAL CONDITION</th>
<th>OVERALL</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>LOW PI</td>
<td>HIGH PI</td>
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<td>7</td>
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<th>A X P</th>
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<td>1</td>
<td>2</td>
<td>60</td>
</tr>
<tr>
<td>F-VALUE</td>
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<td>6.62*</td>
<td>0.03</td>
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<td>1.14</td>
<td>0.08</td>
<td>0.69</td>
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</tr>
</tbody>
</table>

\[ F_{7,10} = 41.83^{***} \quad F_{7,13} = 7.13^{**} \quad F_{10,13} = 7.96^{**} \]

** P<0.01    *** P<0.001

**TABLE 18.7** Amount of change in organisation x age x RI x PI: Means and analysis.

<table>
<thead>
<tr>
<th>AGE IN YEARS</th>
<th>EXPERIMENTAL CONDITION</th>
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<tbody>
<tr>
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<td>10</td>
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<td>-0.36</td>
<td>-1.17</td>
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<th>A X R</th>
<th>A X P</th>
<th>R X P</th>
<th>A X R X P</th>
<th>ERROR</th>
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<td>2</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>60</td>
</tr>
<tr>
<td>F-VALUE</td>
<td>0.18</td>
<td>0.12</td>
<td>0.00</td>
<td>0.16</td>
<td>0.48</td>
<td>0.26</td>
<td>0.95</td>
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**TABLE 18.8** Amount and direction of change in organisation x age x RI x PI: Means and analysis.
<table>
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<th>AGE IN YEARS</th>
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<td>HIGH PI</td>
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<td>1.17</td>
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<tr>
<td>10</td>
<td>0.73</td>
<td>0.80</td>
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<td>13</td>
<td>1.16</td>
<td>0.79</td>
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<th>A X P</th>
<th>R X P</th>
<th>A X R X P</th>
<th>ERROR</th>
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</thead>
<tbody>
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<td>1</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>60</td>
</tr>
<tr>
<td>F-VALUE</td>
<td>0.76</td>
<td>0.22</td>
<td>0.30</td>
<td>0.14</td>
<td>0.81</td>
<td>0.78</td>
<td>1.68</td>
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</table>

TABLE 18.9 Extent of response of balance x age x RI x PI: Means and analysis.

<table>
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<th>AGE IN YEARS</th>
<th>EXPERIMENTAL CONDITION</th>
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</thead>
<tbody>
<tr>
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<td>LOW PI</td>
<td>HIGH PI</td>
</tr>
<tr>
<td>7</td>
<td>-0.79</td>
<td>-0.61</td>
</tr>
<tr>
<td>10</td>
<td>-0.45</td>
<td>-1.17</td>
</tr>
<tr>
<td>13</td>
<td>0.30</td>
<td>0.49</td>
</tr>
</tbody>
</table>

<table>
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<th>RI(R)</th>
<th>PI(P)</th>
<th>A X R</th>
<th>A X P</th>
<th>R X P</th>
<th>A X R X P</th>
<th>ERROR</th>
</tr>
</thead>
<tbody>
<tr>
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<td>2</td>
<td>2</td>
<td>1</td>
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<td>60</td>
</tr>
<tr>
<td>F-VALUE</td>
<td>1.73</td>
<td>2.02</td>
<td>0.10</td>
<td>4.94*</td>
<td>0.07</td>
<td>0.71</td>
<td>1.60</td>
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</tbody>
</table>

* P<0.05

TABLE 18.10 Amount of change in balance x age x RI x PI: Means and analysis.
level of RI the amount of change shown by 13 year-olds is less and there are no significant differences between the three age groups.

3. Nature of response II: Amount and direction of change (see Table 18.11).

Age has a significant effect on the amount and direction of change in balance in response to invalidation. Seven year-olds show a decrease in balance relative to the control group and are significantly different from 10 and 13 year-olds who show a relative increase. There is no significant difference between 10 and 13 year-olds.

Openness

1. Extent of response (see Table 18.12)

None of the independent variables have a significant effect on the extent of response of the openness of the system to invalidation.

2. Nature of response I: Amount of change (see Table 18.13)

There is a significant interaction between RI and PI. Under conditions of high RI, there is significantly more change at low PI ($\bar{X} = 0.66$) than at high PI ($\bar{X} = -0.42$). Under conditions of low RI, PI has no significant effect: both high and low PI groups show a similar amount of change to the control group.

3. Nature of response II: Amount and direction of change (see Table 18.14)

Age has a significant effect on the amount and direction of change in openness in response to invalidation. Seven year-olds show a significantly greater decrease in openness than 10 or 13 year-olds. There is no significant difference between 10 and 13 year-olds.
<table>
<thead>
<tr>
<th>AGE IN YEARS</th>
<th>EXPERIMENTAL CONDITION</th>
<th>OVERALL</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>LOW PI</td>
<td>HIGH PI</td>
</tr>
<tr>
<td>7</td>
<td>0.15</td>
<td>-0.97</td>
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<tr>
<td>10</td>
<td>0.24</td>
<td>0.83</td>
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<tr>
<td>13</td>
<td>0.35</td>
<td>1.19</td>
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<table>
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<th>AGE(A)</th>
<th>RI(R)</th>
<th>PI(P)</th>
<th>A X R</th>
<th>A X P</th>
<th>R X P</th>
<th>A X R X P</th>
<th>ERROR</th>
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<td>2</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>60</td>
</tr>
<tr>
<td>F-VALUE</td>
<td>4.96* 3.94 0.00 0.12 0.43 4.28* 1.53</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

\( F_{7,10} = 7.11^{*} \quad F_{7,13} = 15.49^{**} \quad \frac{F_{10,13}}{1.61} \)

*\( P<0.05 \)  **\( P<0.01 \)

**TABLE 18.11** Amount and direction of change in balance x age x RI x PI: Means and analysis.

<table>
<thead>
<tr>
<th>AGE IN YEARS</th>
<th>EXPERIMENTAL CONDITION</th>
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<td>LOW PI</td>
<td>HIGH PI</td>
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<td>0.93</td>
<td>1.79</td>
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<td>1.09</td>
<td>0.54</td>
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<tr>
<td>13</td>
<td>0.92</td>
<td>1.64</td>
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<th>PI(P)</th>
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<th>A X P</th>
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<th>A X R X P</th>
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<td>DF</td>
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<td>1</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>60</td>
</tr>
<tr>
<td>F-VALUE</td>
<td>1.73  1.27 3.29 0.25 1.75 0.01 1.44</td>
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<td></td>
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<td></td>
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**TABLE 18.12** Extent of response of openness x age x RI x PI: Means and analysis.
### Table 18.13
Amount of change in openness x age x RI x PI: Means and analysis.

<table>
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<td>7</td>
<td>-0.02</td>
<td>-0.74</td>
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<td>0.27</td>
<td>0.03</td>
</tr>
<tr>
<td>13</td>
<td>-0.62</td>
<td>0.94</td>
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</table>

<table>
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<th>AGE(A)</th>
<th>RI(R)</th>
<th>PI(P)</th>
<th>A X R</th>
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<td>1</td>
<td>2</td>
<td>2</td>
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<td>2</td>
<td>60</td>
</tr>
<tr>
<td>F-VALUE</td>
<td>1.59</td>
<td>2.63</td>
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<td>1.94</td>
<td>0.34</td>
<td>4.97*</td>
<td>0.74</td>
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*P<0.05

### Table 18.14
Amount and direction of change in openness x age x RI x PI: Means and analysis.

<table>
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<td>-0.18</td>
</tr>
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<td>13</td>
<td>0.60</td>
<td>0.12</td>
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<table>
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<th>PI(P)</th>
<th>A X R</th>
<th>A X P</th>
<th>R X P</th>
<th>A X R X P</th>
<th>ERROR</th>
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<td>1</td>
<td>2</td>
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<td>1</td>
<td>2</td>
<td>60</td>
</tr>
<tr>
<td>F-VALUE</td>
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</tr>
</tbody>
</table>

F<sub>7,10</sub>=30.32***
F<sub>7,13</sub>=17.92***
F<sub>10,13</sub>=1.60

***P<0.001

**TABLE 18.14** Amount and direction of change in openness x age x RI x PI: Means and analysis.
Summary of Significant Results

1. There are significant age differences in the extent of the response of differentiation to invalidation. Seven and 13 year-olds show less response than 10 year-olds.

2. There are significant age differences in the extent of response of organisation to invalidation. Seven and 10 year-olds show more response than 13 year-olds. RI has a significant effect for 10 year-olds who show a greater response at low RI.

   While 7 and 10 year-olds do not differ in extent of response, the nature of their responses are different. Seven year-olds show less change than the control group; a rigidifying response. Ten year-olds show more change than the control group; a change response.

   More change in organisation occurs at low RI than at high RI, particularly at 10 years of age.

3. At low RI there are significant age differences in the amount of change in balance in response to invalidation. Seven and 10 year-olds show a rigidifying response; 13 year-olds show a slight change response.

   While 7 and 10 year-olds do not differ in the amount of change in balance, the direction of change is different. Seven year-olds show a decrease in balance; 10 year-olds show an increase.

4. Under conditions of high RI, PI has a significant effect on the amount of change in openness in response to invalidation. At low PI, the response is one of change; at high PI, one of rigidification.
While there are no age differences in the amount of change in openness, there are significant differences in the amount and direction of change. Seven year-olds show a greater decrease in openness than 10 or 13 year-olds.

STRUCTURE AND THE EFFECTS OF INVALIDATION ON STRUCTURAL CHARACTERISTICS

The results presented in this section concern the relationship between an individual's initial level of a structural characteristic and the response of that characteristic to invalidation. We shall consider the extent of response of each characteristic, the amount of change, irrespective of direction and the amount and direction of change.

Differentiation

1. Extent of response (see Table 18.15)
   Initial level of differentiation has no significant effect on the extent of response of differentiation to invalidation.

2. Nature of response I: Amount of change (see Table 18.16)
   Initial level of differentiation has a significant effect on the amount of change in differentiation in response to invalidation. Highly differentiated subjects show significantly less change than less differentiated subjects.

3. Nature of response II; Amount and direction of change (see Table 18.17).
   Initial level of differentiation has a significant effect on the amount and direction of change in differentiation in response to invalidation. Highly differentiated subjects show a slight
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<th>AGE X D</th>
<th>ERROR</th>
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<td>0.02</td>
<td>0.23</td>
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</tbody>
</table>

*P<0.05

**TABLE 18.15** Extent of response of differentiation x age x initial level of differentiation: Means and analysis.

<table>
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<tr>
<th>AGE IN YEARS</th>
<th>INITIAL LEVEL OF DIFFERENTIATION (D)</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>LOW</td>
<td>HIGH</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>-0.82</td>
<td>-0.82</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>0.40</td>
<td>-0.45</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>0.59</td>
<td>-0.86</td>
<td></td>
</tr>
<tr>
<td>OVERALL</td>
<td>0.06</td>
<td>-0.71</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
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<th>AGE X D</th>
<th>ERROR</th>
</tr>
</thead>
<tbody>
<tr>
<td>DF</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>66</td>
</tr>
<tr>
<td>F-VALUE</td>
<td>2.34</td>
<td>5.59*</td>
<td>1.69</td>
<td></td>
</tr>
</tbody>
</table>

*P<0.05

**TABLE 18.16** Amount of change in differentiation x age x initial level of differentiation: Means and analysis.
### Table 18.17

<table>
<thead>
<tr>
<th>AGE IN YEARS</th>
<th>INITIAL LEVEL OF DIFFERENTIATION (D)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>LOW</td>
</tr>
<tr>
<td>7</td>
<td>0.32</td>
</tr>
<tr>
<td>10</td>
<td>0.77</td>
</tr>
<tr>
<td>13</td>
<td>1.08</td>
</tr>
<tr>
<td>OVERALL</td>
<td>0.72</td>
</tr>
</tbody>
</table>

<table>
<thead>
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<th>D</th>
<th>AGE X D</th>
<th>ERROR</th>
</tr>
</thead>
<tbody>
<tr>
<td>DF</td>
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<td>1</td>
<td></td>
<td>66</td>
</tr>
<tr>
<td>F-VALUE</td>
<td></td>
<td>1.42</td>
<td>17.14***</td>
<td>8.23***</td>
</tr>
</tbody>
</table>

\[ F_{L,H}(7) = 0.81 \quad F_{L,H}(10) = 10.44 \quad F_{L,H}(13) = 9.21 \]

**P<0.01 ** ***P<0.001 **

**Table 18.17** Amount and direction of change in differentiation x age x initial level of differentiation: Means and analysis.

### Table 18.18

<table>
<thead>
<tr>
<th>AGE IN YEARS</th>
<th>INITIAL LEVEL OF ORGANISATION (O)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>LOW</td>
</tr>
<tr>
<td>7</td>
<td>1.82</td>
</tr>
<tr>
<td>10</td>
<td>1.02</td>
</tr>
<tr>
<td>13</td>
<td>0.57</td>
</tr>
<tr>
<td>OVERALL</td>
<td>1.14</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>SOURCE</th>
<th>AGE</th>
<th>O</th>
<th>AGE X O</th>
<th>ERROR</th>
</tr>
</thead>
<tbody>
<tr>
<td>DF</td>
<td>2</td>
<td>1</td>
<td></td>
<td>66</td>
</tr>
<tr>
<td>F-VALUE</td>
<td></td>
<td>5.16**</td>
<td>0.37</td>
<td>5.95**</td>
</tr>
</tbody>
</table>

\[ F_{L,H}(7) = 5.77* \quad F_{L,H}(10) = 5.22* \quad F_{L,H}(13) = 1.29 \]

*P<0.05 ** **P<0.01**

**Table 18.18** Extent of response of organisation x age x initial level of organisation: Means and analysis.
decrease in differentiation, relative to the control group; less differentiated subjects show an increase. The significant interaction between initial level of differentiation and age reveals that this difference is significant for 10 and 13 year-olds, but not for 7 year-olds.

Organisation

1. Extent of response (see Table 18.18)

There is a significant interaction between initial level of organisation and age. At 7 years of age, highly organised subjects show less response in terms of organisation than less organised subjects. At 10 years of age, highly organised subjects show more response than less organised subjects. At 13 years of age, initial level of organisation has no significant effect on the extent of response.

2. Nature of response I: Amount of change (see Table 18.19)

Initial level of organisation has a significant effect on the amount of change in organisation in response to invalidation. Highly organised subjects show more change than the control group and significantly more change than less organised subjects who change less than the control group.

3. Nature of response II: Amount and direction of change (see Table 18.20)

Initial level of organisation has a significant effect on the amount and direction of change in organisation in response to invalidation. Highly organised subjects show a decrease in organisation relative to the control group, while less organised
### Table 18.19

<table>
<thead>
<tr>
<th>AGE IN YEARS</th>
<th>INITIAL LEVEL OF ORGANISATION (0)</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>LOW</td>
<td>HIGH</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>-1.46</td>
<td>-0.31</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>1.07</td>
<td>1.62</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>-0.38</td>
<td>0.91</td>
<td></td>
</tr>
<tr>
<td>OVERALL</td>
<td>-0.26</td>
<td>0.74</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>SOURCE</th>
<th>AGE</th>
<th>O</th>
<th>AGE X O</th>
<th>ERROR</th>
</tr>
</thead>
<tbody>
<tr>
<td>DF</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>66</td>
</tr>
<tr>
<td>F-VALUE</td>
<td>15.28***</td>
<td>9.86**</td>
<td>0.08</td>
<td></td>
</tr>
</tbody>
</table>

**P<0.01  ***P<0.001

**Table 18.19** Amount of change in organisation x age x initial level of organisation: Means and analysis.

### Table 18.20

<table>
<thead>
<tr>
<th>AGE IN YEARS</th>
<th>INITIAL LEVEL OF ORGANISATION (0)</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>LOW</td>
<td>HIGH</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>-0.32</td>
<td>1.31</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>1.01</td>
<td>-2.30</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>-0.06</td>
<td>-1.36</td>
<td></td>
</tr>
<tr>
<td>OVERALL</td>
<td>0.21</td>
<td>-0.78</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>SOURCE</th>
<th>AGE</th>
<th>O</th>
<th>AGE X O</th>
<th>ERROR</th>
</tr>
</thead>
<tbody>
<tr>
<td>DF</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>66</td>
</tr>
<tr>
<td>F-VALUE</td>
<td>0.14</td>
<td>51.77***</td>
<td>7.83**</td>
<td></td>
</tr>
</tbody>
</table>

**P<0.05  ***P<0.001

**Table 18.20** Amount and direction of change in organisation x age x initial level of organisation: Means and analysis.
subjects show a slight increase. The significant interaction between initial level of organisation and age reveals that, although the effect of initial level of organisation is significant for all age groups, the strength of the effect varies with age. It is most marked in 10 year-olds, less marked in 13 year-olds, and least marked in 7 year-olds.

**Balance**

1. **Extent of response (see Table 18.21)**

   Initial level of balance has no significant effect on the extent of response to invalidation in terms of balance.

2. **Nature of response I: Amount of change (see Table 18.22)**

   There is a significant interaction between initial level of balance and age. At 10 years of age, high balance subjects show more change in balance in response to invalidation than less balanced subjects. At 7 and 13 years of age, initial level of balance has no significant effect on the amount of change.

3. **Nature of response II: Amount and direction of change (see Table 18.23)**

   Initial level of balance has a significant effect on the amount and direction of change in balance in response to invalidation. High balance subjects show a slight decrease in balance relative to the control group; low balance subjects show an increase. The significant interaction between initial level of balance and age reveals this pattern of results only for 10 and 13 year-olds. At 7 years of age, high balance subjects show a slight increase in balance relative to the control group, while low balance subjects show a decrease.
### Table 18.21: Extent of response of balance x age x initial level of balance: Means and analysis.

<table>
<thead>
<tr>
<th>AGE IN YEARS</th>
<th>INITIAL LEVEL OF BALANCE (B)</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>LOW</td>
<td>HIGH</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>1.00</td>
<td>0.93</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>1.08</td>
<td>0.60</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>1.20</td>
<td>0.95</td>
<td></td>
</tr>
<tr>
<td>OVERALL</td>
<td>1.09</td>
<td>0.83</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>SOURCE</th>
<th>AGE</th>
<th>B</th>
<th>AGE X B</th>
<th>ERROR</th>
</tr>
</thead>
<tbody>
<tr>
<td>DF</td>
<td>2</td>
<td>1</td>
<td></td>
<td>66</td>
</tr>
<tr>
<td>F-VALUE</td>
<td>1.00</td>
<td>3.74</td>
<td>0.79</td>
<td></td>
</tr>
</tbody>
</table>

### Table 18.22: Amount of change in balance x age x initial level of balance: Means and analysis.

<table>
<thead>
<tr>
<th>AGE IN YEARS</th>
<th>INITIAL LEVEL OF BALANCE (B)</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>LOW</td>
<td>HIGH</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>-0.98</td>
<td>-0.64</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>-1.09</td>
<td>-0.10</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>-0.11</td>
<td>-0.31</td>
<td></td>
</tr>
<tr>
<td>OVERALL</td>
<td>-0.73</td>
<td>-0.35</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>SOURCE</th>
<th>AGE</th>
<th>B</th>
<th>AGE X B</th>
<th>ERROR</th>
</tr>
</thead>
<tbody>
<tr>
<td>DF</td>
<td>2</td>
<td>1</td>
<td></td>
<td>66</td>
</tr>
<tr>
<td>F-VALUE</td>
<td>2.50</td>
<td>3.64</td>
<td>3.73*</td>
<td></td>
</tr>
</tbody>
</table>

\[ F_{L,H}(7) = 1.02 \]
\[ F_{L,H}(10) = 8.33^{**} \]
\[ F_{L,H}(13) = 0.34 \]

*P<0.05   **P<0.01
| AGE IN YEARS | INITIAL LEVEL OF BALANCE (B) |ource | AGE | B | AGE X B | ERROR |
|-------------|-----------------------------|------|-----|-------|--------|
|             | LOW | HIGH |      |      |        |
| 7           | -0.48 | 0.25 |      |      |        |
| 10          | 0.83 | -0.34 |      |      |        |
| 13          | 1.26 | -0.20 |      |      |        |
| OVERALL     | 0.54 | -0.10 |      |      |        |

<table>
<thead>
<tr>
<th>SOURCE</th>
<th>AGE</th>
<th>B</th>
<th>AGE X B</th>
<th>ERROR</th>
</tr>
</thead>
<tbody>
<tr>
<td>DF</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>66</td>
</tr>
<tr>
<td>F-VALUE</td>
<td>6.74**</td>
<td>18.97***</td>
<td>22.24***</td>
<td></td>
</tr>
</tbody>
</table>

**P<0.01 ***P<0.001

TABLE 18.23 Amount and direction of change in balance x age x initial level of balance: Means and analysis.

| AGE IN YEARS | INITIAL LEVEL OF OPENNESS (OP) |source | AGE | OP | AGE X OP | ERROR |
|-------------|--------------------------------|------|-----|------|----------|
|             | LOW | HIGH |      |      |          |
| 7           | 1.51 | 0.97 |      |      |          |
| 10          | 1.02 | 0.59 |      |      |          |
| 13          | 0.91 | 1.42 |      |      |          |
| OVERALL     | 1.15 | 0.99 |      |      |          |

<table>
<thead>
<tr>
<th>SOURCE</th>
<th>AGE</th>
<th>OP</th>
<th>AGE X OP</th>
<th>ERROR</th>
</tr>
</thead>
<tbody>
<tr>
<td>DF</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>66</td>
</tr>
<tr>
<td>F-VALUE</td>
<td>1.05</td>
<td>0.33</td>
<td>1.73</td>
<td></td>
</tr>
</tbody>
</table>

**P<0.01 ***P<0.001

TABLE 18.24 Extent of response of openness x age x initial level of openness: Means and analysis.
Openness

1. Extent of response (see Table 18.24)

Initial level of openness has no significant effect on the extent of response to invalidation in terms of openness.

2. Nature of response I: Amount of change (see Table 18.25)

Initial level of openness has a significant effect on the amount of change in openness in response to invalidation. High openness subjects show more change than the control group and significantly more change than low openness subjects who show less change than the control group.

3. Nature of response II: Amount and direction of change (see Table 18.26)

Initial level of openness has a significant effect on the amount and direction of change in openness in response to invalidation. High openness subjects show a greater decrease in openness, relative to the control group, than low openness subjects. There is a significant interaction between initial level of openness and age. The effect of initial level of openness is most marked at 7 years of age: high openness subjects show a greater decrease in openness, relative to the control group, than low openness subjects. At 10 and 13 years of age the effect of initial level of openness is less marked, although still significant. In these age groups, high openness subjects show a decrease in openness relative to the control group; low balance subjects show an increase.
### Table 18.25: Amount of change in openness x age x initial level of openness: Means and analysis.

<table>
<thead>
<tr>
<th>AGE IN YEARS</th>
<th>INITIAL LEVEL OF OPENNESS (OP)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>LOW</td>
<td>HIGH</td>
</tr>
<tr>
<td>7</td>
<td>-0.87</td>
<td>0.37</td>
</tr>
<tr>
<td>10</td>
<td>0.03</td>
<td>-0.16</td>
</tr>
<tr>
<td>13</td>
<td>-0.25</td>
<td>1.03</td>
</tr>
<tr>
<td>OVERALL</td>
<td>-0.36</td>
<td>0.41</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>SOURCE</th>
<th>AGE</th>
<th>OP</th>
<th>AGE X OP</th>
<th>ERROR</th>
</tr>
</thead>
<tbody>
<tr>
<td>DF</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>66</td>
</tr>
<tr>
<td>F-VALUE</td>
<td>1.18</td>
<td>4.99*</td>
<td>1.91</td>
<td></td>
</tr>
</tbody>
</table>

* P<0.05

### Table 18.26: Amount and direction of change in openness x age x initial level of openness: Means and analysis.

<table>
<thead>
<tr>
<th>AGE IN YEARS</th>
<th>INITIAL LEVEL OF OPENNESS (OP)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>LOW</td>
<td>HIGH</td>
</tr>
<tr>
<td>7</td>
<td>1.10</td>
<td>4.16</td>
</tr>
<tr>
<td>10</td>
<td>-0.54</td>
<td>0.65</td>
</tr>
<tr>
<td>13</td>
<td>-0.13</td>
<td>1.32</td>
</tr>
<tr>
<td>OVERALL</td>
<td>0.15</td>
<td>2.04</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>SOURCE</th>
<th>AGE</th>
<th>OP</th>
<th>AGE X OP</th>
<th>ERROR</th>
</tr>
</thead>
<tbody>
<tr>
<td>DF</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>66</td>
</tr>
<tr>
<td>F-VALUE</td>
<td>35.46***</td>
<td>51.86***</td>
<td>4.91*</td>
<td></td>
</tr>
</tbody>
</table>

F<sub>L,H(7)=44.82***</sub> F<sub>L,H(10)=6.79*</sub> F<sub>L,H(13)=10.07**</sub>

* P<0.05 ** P<0.01 *** P<0.001

TABLE 18.25: Amount of change in openness x age x initial level of openness: Means and analysis.

TABLE 18.26: Amount and direction of change in openness x age x initial level of openness: Means and analysis.
Summary of Significant Results

1. The amount of change in differentiation shown by less differentiated subjects is similar to the amount of change shown by the control group. Highly differentiated subjects show significantly less change than less differentiated subjects: a rigidifying response.

At 10 and 13 years of age, high and low differentiated subjects differ in the direction of the change in differentiation in response to invalidation. Highly differentiated subjects show a decrease, relative to the control group: less differentiated subjects show an increase.

2. At 7 years of age, highly organised subjects show less response to invalidation, in terms of organisation, than less organised subjects. At 10 and 13 years of age, highly organised subjects show more response.

Highly organised subjects show a decrease in organisation, relative to the control group, in response to invalidation: less organised subjects show an increase.

3. At 10 years of age, low balance subjects show significantly less change in balance in response to invalidation than high balance subjects. Both groups show less change in balance than the control group; a rigidifying response.

At 10 and 13 years of age, high balance subjects show a decrease in balance, relative to the control group, in response to invalidation: less balanced subjects show an increase. At 7 years of age, the changes are in the opposite direction.
4. High and low openness subjects differ significantly in the nature of their response to invalidation, in terms of openness. High openness subjects show a change response, relative to the control group; low openness subjects show a rigidifying response.

At 7 years of age, both high and low openness subjects show a decrease in openness, relative to the control group, in response to invalidation. However, high openness subjects show a significantly greater decrease. At 10 and 13 years of age, high openness subjects show a decrease in openness, relative to the control group, while low openness subjects show an increase.
RESPONSE TO INVALIDATION

AGE AND RESPONSE TO INVALIDATION

The Extent of Response

The Nature of Response

Summary

STRUCTURE AND RESPONSE TO INVALIDATION

The Extent of Response

The Nature of Response

Summary

In this chapter we will discuss the results presented in Chapter XVII concerning the effects of type and amount of invalidatory feedback on the pattern of relationships between constructs. We will also discuss how these effects vary with the age and structural characteristics of the individual. A summary of significant main and interaction effects is presented in Table 19.1.

RESPONSE TO INVALIDATION

Before discussing the effects of age and structure on the response of the pattern of construct relationships to invalidatory feedback, let us consider in more detail exactly what we mean by the term
### TABLE 19.1. Summary of significant main and interaction effects on the response of construct relationships to invalidatory feedback.

<table>
<thead>
<tr>
<th>VARIABLE</th>
<th>EFFECT</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>NUMBER OF CHANGES IN CONSTRUCT RELATIONSHIPS</strong></td>
<td></td>
</tr>
<tr>
<td>EXTENT OF RESPONSE</td>
<td>AGE(A)</td>
</tr>
<tr>
<td>NATURE OF RESPONSE</td>
<td>RI(R)</td>
</tr>
</tbody>
</table>

| OVERALL AMOUNT OF CHANGE IN CONSTRUCT RELATIONSHIPS | 
| EXTENT OF RESPONSE | PI(P) |
| NATURE OF RESPONSE | A X R |

<table>
<thead>
<tr>
<th>DIFF.</th>
<th>DIFF. X A</th>
<th>ORG.</th>
<th>ORG. X A</th>
<th>BAL.</th>
<th>BAL. X A</th>
<th>OPEN.</th>
<th>OPEN. X A</th>
</tr>
</thead>
<tbody>
<tr>
<td>EXTENT OF RESPONSE</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NATURE OF RESPONSE</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*P < 0.05  **P < 0.01  ***P < 0.001
'response'. As pointed out in Chapter XV, previous studies of the effects of invalidation (Bannister, 1963, 1965; Cochran, 1973, 1977) have equated 'response' with change. No change has been interpreted as indicating 'no response'. However, the results of the present study show a certain amount of change in construing by control groups who had received no invalidatory feedback (see Chapter XV). Such a finding suggests the possibility for experimental subjects, who had received invalidatory feedback, to differ from the control group in more than one way. They may respond either by changing more than the control group, as assumed by previous studies, or by changing less.

The results for the experimental subjects in this study reveal that this latter response is a commonly adopted one, at least by children between the ages of 7 and 14 years. It presumably reflects the tendency to rigidify the system in the face of invalidation. In PCT terms it might be seen as an expression of hostility: the continued attempt to extract validational evidence in favour of a type of social prediction which has already proved itself a failure.

Therefore, an absence of change in construing in the face of invalidation does not necessarily reflect the absence of response so much as a response strategy in its own right. If this is the case we must differentiate between the extent of response irrespective of whether it reflects a change or rigidification, and the specific nature of the response.
AGE AND RESPONSE TO INVALIDATION

The Extent of Response

Let us consider first the extent of response in terms of the overall amount of change in the pattern of construct relationships. This decreases with age particularly between 10 and 13 years of age. This result suggests that younger children are more affected by information discrepant with their expectations, are less able to tolerate and integrate such discrepancy, and therefore show greater response. This is consistent with Piaget's theoretical account of cognitive development (Piaget, 1957). As discussed in Chapter XIII, Piaget argues that in older children the state of equilibrium is more 'stable': that is, their cognitive systems are more able to compensate for or cancel out perturbations which tend to alter the existing state of equilibrium. They should be better able to integrate discrepant information.

Support for this interpretation comes from the work of Harvey and his associates (Harvey, Hunt and Schroder, 1961; Harvey, 1966, 1967). Piaget proposes a developmental trend towards increasing complexity of cognitive structure, a trend which was demonstrated by the results presented in Chapters IX, X and XI. Harvey et al. (1961) argue that more complex and abstract systems are more able to consider alternatives and are more tolerant of ambiguity and discrepancy between expectation and experience. There are several studies offering support for this hypothesis (e.g. Harvey, 1966, 1967; Reich, 1966).

Thus, one interpretation of the results is that older children,
possibly due to greater structural complexity, are more able to integrates discrepant or contradictory information into their exist-
ing cognitive system without making extensive changes or rigidifying the system. This is consistent with the hypothesis offered in Chapter XIII. However, an alternative explanation of the smaller response by older children can be offered. It may be that older children are more prone to ward off discrepant information than younger children. This is contrary to the hypothesis offered in Chapter XIII.

It may help to decide the validity of these conflicting interpre-
tations if we consider the results for the extent of response in terms of the number of changes in construct relationships. The results show an interaction between age and the amount of rating invalidation. Seven year olds show a decrease in response as the amount of invalidation increases, 10 and 13 year olds show an increase. An adaptive strategy would presumably demand that as the degree of invalidation increases the response of the system should increase. Why then do the systems of younger children show less response as invalidatory feedback increases?

It may be that once the perceived degree of discrepancy reaches a certain level, the response demanded becomes too great in terms of either unjustifiable rigidification or too disruptive a change. The only alternative is to ignore or ward off the discrepant inform-
ation with a consequent decrease in the response.

An alternative explanation for the decrease in response relates to the perceived validity of the feedback. Once the discrepancy between expectation and feedback reaches a certain level, the valid-
ity of the information or the source of the information may be questioned. The feedback may be discounted and, therefore, the response decrease. This emphasises that we must distinguish between the objective degree of discrepancy between expectation and feedback and the subjective awareness of invalidation. If the validity of the feedback is rejected at high levels of discrepancy, the actual degree of invalidation experienced has decreased.

Both of these explanations of the results, although highly speculative, suggest a curvilinear, inverted U-shaped relationship between extent of response and amount of discrepancy. The response increases with increasing discrepancy up to a certain point. Beyond that, as the discrepancy increases still further, the response diminishes.

Given this curvilinear relationship between discrepancy and response, how can we account for the differences in results for younger and older children? The difference between 7 year olds and older children in the direction of the effect of increasing rating invalidation suggests that, within the range of feedback provided by this study, we are seeing different parts of the response curve for younger and older children. The decrease in response between low and high rating invalidation, shown by 7 year olds, suggests that the response curve for this age group has reached its peak and is beginning to decline. For the older age groups, the increase in response as rating invalidation increases suggests that the results reflect the upward slope of the response curve. This hypothesis is illustrated in Fig: 19.1.

Figure 19.1 shows that the response curve for older children is shifted relative to that for younger children such that the peak and decrease in response occur at a higher level of discrepancy than for younger children.

The age differences in the results and this interpretation of them again emphasise that we must distinguish between the objective amount of discrepancy between expectation and feedback and the degree of invalidation actually experienced. The results suggest that younger children experience a different level of invalidation at a particular level of discrepancy, than older children.

One possible confounding factor contributing to this age difference may be the nature of the relationship between the subject and the experimenter. It may be that the experimenter is construed as a more awesome and infallible source of information by younger children than by older children. If the degree of invalidation experienced
at a particular level of discrepancy is, in part, a consequence of the construed status of the source, as suggested by a study by Harvey (1967), this may explain some of the age difference in the extent of response at a particular level of discrepancy.

Within the limits of the present data, this account of the results can only be offered very tentatively. An adequate test would require an examination of age differences in response across a wider and more closely controlled range of discrepant feedback. A variety of other questions should also be asked. Does the response curve follow essentially the same form for all age groups? Does the height of the peak of the response curve vary with age?

Nature of Response

Let us now consider the nature of the response of the pattern of construct relationships to invalidatory feedback. Is the response one of change or one of rigidification?

There are significant age differences in both the number of changes in construct relationships and the overall amount of change, although the nature of the differences varies. In general, 13 year olds differ little from the control group in their response. Ten year olds respond to invalidation by changing the pattern of construct relationships. Seven year-olds respond by rigidifying their system; they maintain relationships between constructs even more strongly than the control group, despite invalidatory feedback.

It has already been pointed out that, in previous studies of the
effects of invalidation and discrepant information, this latter response has been equated with a lack of response as it indicates a lack of change. We have suggested, instead, that it represents a mode of response in its own right. A similar response strategy has been found in some studies of attitude change. Subjects have been found to hold an attitude or opinion even more strongly after being exposed to counter-attitudinal information. This response has been termed the 'contrast' or 'boomerang' effect (Williams, 1947; Cohen, 1962).

Hovland, Janis and Kelley (1953) reviewed a number of studies which had found this response and suggested that one of the conditions under which it occurred was when the counter-attitudinal information was far removed from the individual's initial position. This idea was developed by Sherif and Hovland (1961). They proposed an assimilation-contrast theory of social judgement which argued that the amount and direction of change in attitude is a function of the degree of discrepancy between the subject's position and the communication. They proposed a curvilinear relationship between discrepancy and attitude change which is illustrated in Fig. 19.2.

![Figure 19.2](image)

**FIGURE 19.2.** Sherif and Hovland's hypothesised relationship between discrepancy and attitude change.
At a small discrepancy between communication and initial position a small positive change in attitude occurs. At a moderate degree of discrepancy a larger positive change occurs. This range of discrepancy Sherif and Hovland termed the 'latitude of acceptance' within which an assimilative response takes place. As the degree of discrepancy increases further it enters the 'latitude of rejection'. The amount of positive change decreases and eventually a negative or contrast response occurs. At a very high level of discrepancy no response of any kind occurs. There is a body of empirical support for this hypothesis (Hovland, Harvey and Sherif, 1957; Whittaker, 1963; Petersen and Koulak, 1969).

This theory throws some light on the results of the present study. The age differences in the amount of change in construct relationships suggest that 7 year olds are demonstrating a negative or contrast response. Ten year olds show a change response, although it is not clear whether it reflects the upward slope in the latitude of acceptance or the downward slope in the latitude of rejection. Thirteen year olds appear to be at the beginning of the response curve.

This interpretation of the results again suggests age shifts in the position of a curvilinear relationship. For younger children the latitude of acceptance is narrower and therefore the amount of change peaks and begins to decrease at a lower level of discrepancy than for older children. This also suggests that the invalidation experienced at a particular level of discrepancy varies with age.
An adequate test of this hypothesis would again require examination of the nature of the response across a wider range of discrepant information.

A comparison of the number of changes in construct relationships and the overall amount of change by different age groups reveals a further difference between the nature of the responses of 10 and 13 year olds. Ten year olds show more overall change than 13 year olds, but the two groups do not differ in the number of changes in construct relationships. This suggests that the response to invalidation is not spread more widely through the system for 10 year olds, but that the changes which they show are more extreme.

Mention must also be made of the relative effects of the two types of invalidation; rating invalidation and pattern invalidation. Neither the extent or nature of the response of the pattern of construct relationships was significantly affected by the level of pattern invalidation. Only one measure, extent of response in terms of number of changes, was significantly affected by the level of rating invalidation. These results suggest that subjects did not differentiate between levels or types of invalidation, but, in general, responded to the overall message that they were somehow wrong in their judgements. Examination of the data suggests that the sensitivity to differences in amount of invalidatory feedback may increase with age. However, this is only significant in one instance; for the extent of response in terms of the number of changes in construct relationships.
In this section we have pointed out the importance of differentiating between the extent of response to discrepant feedback and the nature of that response. One can differentiate, also, between a response strategy of changing the pattern of construct relationships in the face of invalidation, or rigidifying the pattern of relationships.

A curvilinear relationship was proposed between extent of response of the pattern of construct relationships and the amount of discrepancy between expectation and feedback. It was suggested that there are age shifts in the position of this curve. The peak response occurs at a lower level of discrepancy for younger children than for older children.

It was also pointed out that one must differentiate between the objective degree of discrepancy and the experience of invalidation. It was suggested that the degree of invalidation experienced at a certain level of discrepancy varies with age.

A curvilinear relationship was also proposed between the nature of the response and the amount of discrepancy. At low to moderate levels of discrepancy a change response occurs. At higher levels of discrepancy a rigidifying response occurs. It was suggested that this was similar to the contrast effect found in studies of attitude change. There appears to be an age shift in the position of this relationship also. The contrast effect occurs at lower levels of discrepancy for younger children than for older children.
STRUCTURE AND RESPONSE TO INVALIDATION

In Chapter XIII the relationship between the structural characteristics of an individual's construct system and its dynamic properties was discussed. A series of studies by Harvey and others (e.g. Harvey, 1963; Harvey and Kline, 1965; Harvey and Ware, 1966; Sandilands, 1974) have demonstrated a relationship between abstractness and a variety of dynamic properties such as the tendency to ward off discrepant information, the tolerance of inconsistency, and attitude change. However, the results discussed in Chapters X and XI reveal that the structural characteristics of differentiation, organisation, balance, and openness, which Harvey et al. (1961) see as underlying the dimension of 'concrete-abstractness', are relatively independent. In the present study, therefore, we have examined the effects of each structural characteristic independently.

In the previous section it was suggested that some of the age differences in the nature and extent of response may be due to developmental changes in complexity of structure. In this section we will consider the effects of structure explicitly and examine how specific structural characteristics are related to the nature and extent of response of the pattern of construct relationships.

The Extent of Response

The effect of initial level of differentiation on the extent of response varies with age. At 7 years of age more differentiated subjects show greater response. At 10 and 13 years of age more differentiated subjects show less response.
These results are consistent with the hypothesis, offered in the previous section, of a curvilinear relationship between discrepancy and extent of response, and of changes in the position of this relationship with age. It was suggested that the results of this study represent the upward slope for older children and the downward slope for younger children (see Fig. 19.1). If initial degree of differentiation has a similar effect to age, we would predict a similar shift in the response curve. This would account for the age differences in the effect of initial degree of differentiation. This hypothesis is illustrated in Fig. 19.3.

There is also an interaction between initial degree of organisation and age. However, the pattern of results is opposite to that for differentiation. At 7 years of age highly organised subjects show less response. At 10 and 13 years of age they show more response. This is contrary to the prediction that higher levels of structure are related to more advanced and adaptive response to discrepant
information as reflected by a shift in the response curve such that the peak response occurs at a higher level of discrepancy.

One reason for this finding may be a degree of interdependence between the measures of differentiation and organisation employed in this study. This was discussed in Chapter XVI.

Both measures are based on the degree of relationship between constructs in the grid. A consequence of a high degree of inter-relationship between constructs may be that discrepant information relating to one part of the system has wider implications throughout the system than may be the case where constructs are minimally related. The effect of a particular degree of discrepancy should therefore be greater for those individuals with closely related constructs, i.e. those identified as less differentiated or more organised in the present study. This would account for the suggested shifts in the response curve.

Initial level of balance has no significant effect on the extent of response of construct relationships. One reason for the absence of any effect may have been the failure to control for the centrality of the constructs to which the feedback applied. In a highly balanced system in which all constructs are of approximately equal centrality, the impact of discrepant feedback is likely to be the same regardless of the constructs to which the feedback applies. In a less balanced system, however, in which some constructs are central and others peripheral, the impact of discrepant feedback is likely to vary according to the centrality of the constructs for which feedback is provided. This variation among less balanced
subjects may lead to there being no difference between the mean extent of response for high and low balanced subjects.

It was impossible to control the centrality of invalidated constructs in the present study. This may be possible in future studies due to the advent of interactive computer programs for grid elicitation such as PETRA (Shaw, 1979). Structural analysis could be built into such a program to provide immediate information on structural characteristics such as the centrality of constructs.

There is a tendency, which just fails to reach statistical significance, for high openness subjects to show a greater response than low openness subjects. According to Harvey et al. (1961), the greater the openness of the system, the greater its receptivity to deviant events and its capacity to admit information from outside. At a low level of discrepancy we would predict that more open subjects experience less invalidation than less open subjects due to their greater capacity to tolerate the different and novel. Therefore, they should show less response. At high levels of discrepancy, however, the greater receptivity of more open subjects should give them a higher threshold of discrepancy before they begin to ward off information. At high levels of discrepancy, therefore, more open subjects should show more response than less open subjects. It seems that the level of discrepancy provided by this study is relatively high so the findings are consistent with this prediction.

The Nature of Response

Only initial level of balance has any significant effect on
the nature of the response of construct relationships. The effect of balance interacts with age. At 7 years of age balance does not have a significant effect. At 10 years of age high balance subjects show less change than low balance subjects. At 13 years of age high balance subjects show more change. The results for 13 year olds are not consistent with a prediction of an adaptive shift in the position of the response curve with increasing complexity of structure. However, the possible confounding effects of the centrality of invalidated constructs must be taken into account.

Summary

Initial level of differentiation and organisation have opposite effects on the extent of response. It was suggested that close relationships between constructs lead to the effects of discrepant information being spread more widely throughout the system. This leads to a shift in the position of the curvilinear relationship between discrepancy and extent of response. For those with closely related constructs, the peak and decrease in response occur at lower levels of discrepancy.

Initial level of openness also has an effect on the relationship between discrepancy and extent of response. High openness subjects appear to have a higher threshold of discrepant information before warding off feedback and showing a decrease in response.

Only initial level of balance has a significant effect on the nature of response. The results are equivocal with the centrality of invalidated constructs as a possible confounding factor.
In this chapter we will discuss the results presented in Chapter XVIII concerning the effects of invalidatory feedback on the structural characteristics of construct systems and how these effects vary with the age and existing structural characteristics of the individual. A summary of significant main and interaction effects is presented in Table 20.1.

As well as distinguishing between the extent and nature of the response, as we did for the pattern of construct relationships, we must also distinguish between the nature of the response in terms of whether it represents change or rigidification relative to the control group; and the nature of the response in terms of whether it represents an increase or a decrease in the level of a particular structural characteristic.

**EXTENT OF RESPONSE**

The age differences in the extent of response of differentiation
## TABLE 20.1a. Summary of significant main and interaction effects on the response of structural characteristics to invalidatory feedback.

<table>
<thead>
<tr>
<th>VARIABLE</th>
<th>EFFECT</th>
<th>AGE(A)</th>
<th>RI(R)</th>
<th>PI(P)</th>
<th>A X R</th>
<th>A X P</th>
<th>R X P</th>
<th>A X R X P</th>
<th>INITIAL LEVEL OF STRUCTURE</th>
<th>INITIAL LEVEL X AGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>DIFFERENTIATION</td>
<td>EXTENT OF RESPONSE</td>
<td>**</td>
<td>*</td>
<td>*</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ORGANISATION</td>
<td>EXTENT OF RESPONSE</td>
<td>**</td>
<td>**</td>
<td></td>
<td></td>
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<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td></td>
<td>AMOUNT OF CHANGE</td>
<td>***</td>
<td>*</td>
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<td></td>
</tr>
<tr>
<td></td>
<td>AMOUNT AND DIRECTION OF CHANGE</td>
<td>***</td>
<td>***</td>
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<td></td>
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</tr>
</tbody>
</table>

* $P < 0.05$  ** $P < 0.01$  *** $P < 0.001$
<table>
<thead>
<tr>
<th>VARIABLE</th>
<th>EFFECT</th>
</tr>
</thead>
<tbody>
<tr>
<td>BALANCE</td>
<td>AGE(A)</td>
</tr>
<tr>
<td>EXENT OF RESPONSE</td>
<td></td>
</tr>
<tr>
<td>AMOUNT OF CHANGE</td>
<td></td>
</tr>
<tr>
<td>AMOUNT AND DIRECTION OF CHANGE</td>
<td>*</td>
</tr>
<tr>
<td>OPENNESS</td>
<td>AGE(A)</td>
</tr>
<tr>
<td>EXENT OF RESPONSE</td>
<td></td>
</tr>
<tr>
<td>AMOUNT OF CHANGE</td>
<td></td>
</tr>
<tr>
<td>AMOUNT AND DIRECTION OF CHANGE</td>
<td>***</td>
</tr>
</tbody>
</table>

* \( P < 0.05 \)
** \( P < 0.01 \)
*** \( P < 0.001 \)

**Table 20.1b.** Summary of significant main and interaction effects on the response of structural characteristics to invalidatory feedback (continued).
to discrepant feedback can be interpreted in terms of shifts in a curvilinear relationship between extent of response and degree of discrepancy, similar to that proposed for the extent of response of the pattern of construct relationships. Both 7 and 13 year olds show less response than 10 year olds but do not differ significantly from each other. It is suggested that the results reflect the downward slope of the response curve for 7 year olds and the upward slope for 13 year olds.

The results for the extent of response of organisation also show an age effect. Seven and 10 year olds show greater response than 13 year olds. The effect of initial level of organisation is opposite to expectation. Highly organised subjects show more change at 13 years of age and less change at 7 and 10 years of age. As discussed in Chapter XVI, this may be due to the interdependence between the measures of organisation and differentiation. However, the results suggest that the response of the overall degree of relationship between constructs is affected by the initial degree of relationship. As discussed in Chapter XIX, this may be due to the effects of discrepant feedback being greater and spread more widely throughout the system of an individual with close links between constructs.

NATURE OF RESPONSE: CHANGE OR RIGIDIFICATION

The age differences in the amount of change in organisation are also consistent with an interpretation in terms of an age shift in a curvilinear relationship between discrepancy and amount of change,
as proposed in Chapter XIX for the amount of change in construct relationships. The response by 7 year olds, who show less change in organisation than the control group, is analogous to the contrast response discussed in the previous chapter. This supports the conclusion that, for younger children, the discrepant feedback lies well within the latitude of rejection. For 10 year olds the significant decrease in the amount of change in organisation as rating invalidation increases suggest that, for them, the feedback is within the latitude of rejection but not far enough to elicit a contrast response. The low positive score for 13 year olds is interpreted as reflecting a response at the beginning of the latitude of acceptance.

The results for the effect of initial level of organisation are equivocal. In Chapter XIX we suggested that those with a high initial score, i.e. those with closely related constructs, should experience a different degree of invalidation at a particular level of discrepancy than those with a low initial score. We would predict a shift in the relationship between change and discrepancy due to initial level of organisation such that, at 7 and 10 years of age, those with a high score would show less change in organisation, while at 13 years of age, they would show more change. The results point to more change by those with a high score in all three age groups.

Although there were no significant differences in the extent of response of balance, the amount of change in balance varies with age and the amount of rating invalidation. The results for all three
age groups show a decrease in the amount of change as rating invalidation increases. In terms of the relationship between amount of change and discrepancy proposed in Chapter XIX, the results suggest that, for balance, the response at this level of discrepancy is within the latitude of rejection, and for 7 and 10 year olds is one of contrast or rigidification.

The effect of initial level of balance is to shift the response curve. High balance subjects show more change than low balance subjects, although the difference is only significant for 10 year olds. As expected, the direction of the shift is such that the latitude of acceptance is wider for high balance subjects and they should show a peak in the amount of change at a higher level of discrepancy than low balance subjects.

The amount of change in openness is subject to an interaction effect between rating invalidation and pattern invalidation. The response of openness seems to be more sensitive to the degree of discrepancy than other structural characteristics. The amount of change is least at either low levels of both forms of invalidation or at high levels of both. This provides further evidence of a curvilinear relationship between amount of change and degree of discrepancy between expectation and feedback. Examination of age differences, although not significant, suggests similar age shifts in the position of the relationship between discrepancy and change to those hypothesised for changes in construct relationships and other structural characteristics.
NATURE OF RESPONSE: DIRECTION OF CHANGE

Let us now consider the direction of structural changes in response to discrepant feedback. It is this aspect of the response that relates most closely to much of the previous work into the effects of invalidation.

Bannister (1963, 1965) and Cochran (1973, 1977) examined the hypothesis that invalidation leads to a weakening of the relationships between constructs. Applying Bannister's hypothesis to the present study, we would predict that subjects faced with discrepant information would show an increase in differentiation and a decrease in organisation. The results reported in Chapter XVIII do not support this hypothesis. While the mean change scores are in the predicted direction they are relatively low, which suggests that there is no overall directional tendency in the response. Age has no significant effect on the direction of the change.

Although these results do not support Bannister's hypothesis, they are consistent with the results of many of his studies (see Chapter XIII) which failed to find any consistent weakening of construct relationships following invalidation.

However, when the individual's initial level of differentiation or organisation is taken into account, consistent directional tendencies do emerge. When an individual has a low initial score his response to discrepant feedback is to show a slight increase in that structural characteristic relative to the control group. If he has a high initial score, his response is to decrease his level of struc-
ture relative to the control group. The interaction between age and initial level of structure shows that the differential effect of initial level increases with age.

These results suggest that Bannister's initial hypothesis may have been mistaken. While invalidation may have an effect on the strength of relationships between constructs, the direction of this effect varies with the structural characteristics of the individual.

This finding corresponds with the results of the studies by Cochran (1973, 1977). He found that, when faced with contradictory information, adult subjects who were highly organised showed a decrease in relational strength. Those with less strongly correlated constructs responded with an increase in relational strength.

Cochran suggested that subjects are highly resistant to weakening relationships between constructs but quite susceptible to strengthening them. He argued that only those who can afford to weaken relationships and still maintain some degree of pattern, which is essential for forming coherent impressions and understandings of other people, would so.

An alternative explanation of his results, not considered by Cochran, is the phenomenon of regression to the mean. As pointed out in Chapter XVI, a negative correlation between initial and gain score may be due to two factors; an attenuating effect of measurement error, and any real differential effect on the amount of change.

While regression to the mean remains a possible explanation for
Cochran's findings, three factors suggest that it is not the sole cause of the results in the present study.

Firstly, the change scores for the experimental subjects are transformed in such a way that they are not expressed in relation to their own initial score but in relation to the mean change shown by the appropriate control group.

Secondly, the amount of change varies with direction. The mean increase in differentiation and organisation is greater than the mean decrease. If the effect were due solely to regression to the mean one would expect equal amounts of change in both directions.

Thirdly, the increase in the differential effect of initial structural score with age does not support an interpretation in terms of regression to the mean. Age differences in the effect of regression to the mean might be expected if there were age differences in the variance of initial structural scores. Examination of the data reveals no such differences in the variance of initial differentiation or organisation scores.

The results for the overall effect of initial level of balance on the direction of change in balance show a similar pattern to those for differentiation and organisation. Those initially high in balance respond to discrepant feedback respond with a decrease in balance, those initially low respond with an increase. Examination of age differences shows that this effect only holds for 10 and 13 year olds. Among 7 year olds the direction of change is reversed. This differential effect of age again suggests that
regression to the mean is not an adequate explanation. The results may reflect a developmental change in the nature of the response or they may reflect the failure to control for the centrality of the constructs invalidated. In a highly balanced system, in which all parts are of approximately equal importance, the effect of invalidation of any part of the system might be to reduce the importance placed on it and therefore its centrality. This would have the effect of reducing the overall level of balance in the system: the result observed for 10 and 13 year-olds.

In a less balanced system, in which some parts are more important than others, we might expect the direction of change to vary with the centrality of the invalidated constructs. If minimally important constructs were invalidated we would expect little redistribution of importance and, therefore, little change in balance. If important and highly central constructs were invalidated, however, we might expect a shift towards reliance on previously less important constructs with a consequent increase in balance. The possibility exists that there are age differences in the centrality of invalidated constructs, which could give rise to the observed age differences in the pattern of results.

In Chapter XIX, the difficulty of controlling the centrality of invalidated constructs was pointed out. The use of interactive elicitation programs may enable such control to be exercised in future studies.

Turning finally to the direction of change in openness, the overall response, by all age groups, is to show a decrease in
openness. Examination of the effects of initial level of openness and the interaction with age shows that for 10 and 13 year olds the direction of change is affected by initial level. As for other structural characteristics, those with a high initial score show a decrease while those with a low initial score show a slight increase. At 7 years of age both groups show a decrease, although as might be expected, the decrease is significantly greater for those with an initially high score.

**SUMMARY**

It was suggested that the extent of response of differentiation and organisation to discrepant information follows a similar pattern to the extent of response of construct relationships: i.e. a curvilinear, inverted U-shaped relationship between discrepancy and extent of response. The effect of age is to shift the position of this relationship. For older children the peak response occurs at a higher level of discrepancy than for younger children.

Initial strength of relationships between constructs has the opposite effect to that of age. Subjects with high differentiation scores or low organisation scores show a shift in the response curve in the direction associated with greater age. It was suggested that this is because, in a system with closely related constructs, the impact of discrepant feedback is spread more widely throughout the system.

The results for the amount of change in organisation, balance and openness were interpreted in terms of the curvilinear relation-
ship between change and amount of discrepancy which was proposed in Chapter XIX to account for the results for the amount of change in construct relationships. As the amount of discrepancy increases so does the amount of change, up to a certain point. As the amount of change increases further, the amount of change decreases. At very high levels of discrepancy a contrast response is elicited; subjects maintain their structural characteristics more strongly than control subjects who have received no feedback. It was also suggested that the effect of age is to shift the position of this relationship such that the peak change and decrease occur at a higher level of discrepancy in older children.

There do appear to be differences between the structural characteristics in the pattern of responses. The response of balance and openness appear to be more sensitive to the amount of discrepancy than the response of organisation. In addition, balance appears to be more strongly affected by the level of discrepancy provided by this study. The response for all age groups appears to be on the downward slope of the curve, and 7 and 10 year olds show a rigidification response.

The results for the direction of change in structure show that the direction of change varies with the initial structural characteristics of the individual. Those with a high score on a structural characteristic tend to respond to discrepant feedback with a decrease in that structural characteristic, relative to the control group. Those with a low score tend to respond with an increase. The possible confounding effect of regression to the mean was discussed and rejected as the sole factor accounting for the results.
PART FOUR

CONCLUSIONS
CHAPTER XXI

CONCLUSIONS

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In the introductory chapter to this thesis, the question was raised as to the likely course of development of construct systems and the process of construing from infancy to adulthood. It was pointed out that while PCT, as proposed by George Kelly, can account for changes in construing taking place at all and for the general direction of change towards the evolution of a better system of understanding of the world, it tells us nothing about the nature of construct systems at different ages or the major parameters of developmental change.

Chapter II explored the relevance of Piaget's theory of cognitive development to the development of interpersonal construing. Fundamental similarities in the underlying features of Piagetian theory and PCT were pointed out. They include a common emphasis on the dynamic nature of the individual, Kelly's theory construes man as a process, a form of perpetual motion, and Piaget too sees motion as implicit in cognitive structures. Neither model sees man as a passive object at the mercy of the environment but as actively engaged in trying to structure and understand his world. He extends his understanding by adopting his cognitive structures or systems of constructs through anticipation, experience and subsequent reconstruction. Both Piaget and Kelly also stress the importance of organization, Piaget talks of cognitive structures while Kelly talks of construct systems.

Having considered the fundamental similarities between Piagetian
theory and PCT we considered the implications of Piagetian theory for developmental changes in construct systems. It was hypothesised that there should be developmental changes in both the content and structure of children's construct systems and in the degree of sociality and commonality.

CONTENT

It was hypothesised that there should be a shift from construing the world in predominantly concrete terms to the use of more abstract constructs. The younger child should construe others in terms of overt objective characteristics such as appearance, while the older child should place greater stress on more abstract covert characteristics such as values, attitudes and dispositions.

The results presented in Chapter IX do indeed show this general shift in the type of constructs elicited from children. From 7 to 14 years of age there is an increase in the use of constructs classified as psychological with a corresponding decrease in the use of constructs classified as appearance, role or behavioural.

The general direction of this result is consistent with the hypothesis. There is a developmental trend towards the use of increasingly abstract constructs. This general trend is consistent with that found in other research into the development, both in the context of PCT and in other theoretical frameworks (see Chapter V). However, in detail, the results of the present study are not consistent with previous studies of children's personal constructs. These studies
suggest that the predominant use of abstract, psychological construct is a relatively late development. Brierley's (1967) study revealed that even in early adolescence behavioural constructs formed the largest category. The results of the present study, however, suggest that the child's ability to make distinctions between other people in psychological terms develops earlier. Even at 7 years of age psychological constructs form the largest category. The predominance of psychological constructs is even greater when implicit psychological constructs, constructs initially assigned to other categories but with psychological implications are included. The finding concurs more closely with the result of free description studies of the content of children's interpersonal perceptions. It was suggested that the results of previous repertory grid studies may reflect performance problems due to the complex and demanding triadic elicitation procedure.

There are, however, age changes in the nature of the psychological constructs used. Younger children employed a higher proportion of implicit psychological constructs, than older children. Most frequently these were expressions of psychological characteristics in behavioural terms, for example, the construct 'fights a lot' rather than 'aggressive'. Previous studies would not have classified the construct 'fights a lot' as 'psychological' but it is not clear whether the use of such a construct represents a fundamental difference between descriptions in solely behavioural terms and the ability to attribute behavioural constancies to underlying psychological dispositions of the person, or merely a lack of verbal fluency.
While psychological constructs are the predominant category at all ages, are there any developmental changes in the detailed nature of the psychological constructs used? An examination of the constructs elicited suggests that one dimension along which psychological construing might develop is a concern with social or interactional characteristics.

Constructs that are produced very frequently by older children but not by younger children are concerned with the quality of interactions and social relationships, e.g. 'easy to get on with', 'easy to talk to', 'difficult to get to know'. Such a development may reflect an increasing concern with social relationships, a consequence of the decreasing egocentrism predicted by Piagetian theory. Decreasing egocentrism implies the development of the ability to recognise the alternative views of other people and presumably the ability to discriminate between those people with whom one shares a degree of commonality of construing and those who have a different basis for understanding the world. It suggests that as the child gets older he develops the capacity to construe the constructions of others which, according to the sociality corollary, is a prerequisite for entering into a social process involving the other person. This suggestion is consonant with studies of the development of friendship (e.g. Bigelow and La Gaipa, 1974) which show that as children grow older they shift from basing friendship on situational factor to adopting psychological criteria.

A more systematic, detailed analysis of the nature of children's psychological constructs may confirm this hypothesis and reveal other developmental changes in psychological construing.
The present study shows a high proportion of psychological constructs at all ages together with a developmental increase in the proportion of psychological constructs. However, an analysis solely in terms of the frequency of different types of constructs reveals little of their relative importance in construing others. The number of concrete constructs decreases with age but do the distinctions that they embody also decrease in importance for the child's understanding of other people? One approach to this question might be to consider the relationships between concrete and abstract constructs. In a study subsidiary to the main investigation, the importance of differences in age between the elements was considered. We will not report the results of this study in full but when the psychological construct grids were analysed by INGRID and cluster analysis, it was found that for young children the elements were sharply divided into two groups, children and adults. For older children no such strong distinction based on age emerged. The conclusion from this difference is, that for young children, the construct 'old-young' occupies a superordinate position in their construct system. Age subsumes a range of psychological constructs and is a highly constellationary or stereotypic construct. If an element is construed as young or old this defines their position on a number of psychological constructs. For older children, however, the construct, 'young-old' does not have such a strong superordinate and constellationary role. A cursory examination suggests that the same age differences exist with respect to the construct 'male-female'.

Thus, while psychological constructs form the largest category in
all age groups, the extent to which construing is actually on a psychological basis varies. For young children, although they can generate psychological constructs, their use is tightly defined by superordinate concrete constructs.

**STRUCTURE**

From the discussion of Piagetian theory in Chapter II, it was hypothesised that there should be developmental changes in the structural and organisational characteristics of construct systems as well as in their content. The dimensions along which Piaget sees the states of equilibrium that characterise stages of development changing suggest that construct systems develop in the direction of increasing complexity of structure.

The notion of cognitive structure was discussed in greater detail in Chapter III. Much previous research into the structure of personal construct systems has considered their structural characteristics in terms of Cognitive Complexity. Bieri (1955) defined Cognitive Complexity as the number of independent dimensions of meaning in a system and the tendency to construe social behaviour in a multidimensional fashion. However, research has found little correlation between different measures of Cognitive Complexity. Contradictory hypotheses have been generated and inconsistent findings have emerged, even in studies which have employed similar measures. It was suggested that an approach to cognitive structure solely in terms of Cognitive Complexity or the number of dimensions in the system, is inadequate.
The conceptual system theory of Harvey, Hunt and Schroder (1961) and Shroder, Driver and Streufert (1967) was proposed as a more fruitful alternative, offering, as it does, a multidimensional model of structure. Schroder et al distinguish three independent aspects of structure, the first in discrimination, the capacity of a particular dimension or construct to discriminate between stimuli or elements. The second is differentiation, essentially the same dimension as Bieri's cognitive complexity, i.e. the number of independent dimensions or constructs in the system. The third is integration, which Schroder et al. see as central in determining the overall structural complexity of the system. It is concerned with the complexity of the rules which combine different dimensions or constructs into organised systems. According to Shroder et al., it is the degree of integration between constructs which determines the capacity to construe the world in a multi-dimensional fashion rather than just the number of independent dimensions as proposed by Bieri. It was hypothesised that there would be a developmental increase in the level of each of these structural characteristics.

**Discrimination**

The results for discrimination were according to hypotheses although only limited conclusions could be drawn concerning the effect of age as the element rating procedure for 13 year olds was different from that for 7 and 10 year olds. This made comparisons between 13 year olds and others impossible.

Nevertheless, between the ages of 7 and 10 years there was a
significant increase in the degree of fineness with which constructs could be applied in making judgments. This finding is consistent with the results of previous studies and with Piaget's description of a change from the categorical 'black and white' thinking of the pre-operational child to the more discriminating ability of the concrete operational child to think relatively and distinguish between 'shades of grey'.

**Differentiation**

Five measures, assumed to reflect differentiation or the number of independent construct dimensions were used in this study. Three had been used in previous studies and were based on correlations between constructs. Two were derived from a principal components analysis and the third from a cluster analysis, being the number of construct clusters at a particular level of correlation. The other two measures were developed for this study. The first was also derived from the cluster analysis but employed a more stringent criterion for construct clusters. The second was based on the variance of 'self-other' distances.

The first finding of note was that these five measures, purporting to measure the same structural characteristic of differentiation, fell into two negatively correlated groups. It was concluded that these five measures in fact reflect two different structural characteristics. The latter two may reflect the degree of differentiation, the number of independent constructs in the child's construct system. It was suggested, however, that the first three measures might be more appropriately interpreted as reflecting the degree of organisation, the number of
implicative links between differentiated constructs.

The rationales for these different interpretations is most clear if we consider the two measures derived from the cluster analysis. The difference between these measures points out the importance of discriminating between the levels of relationships between individual constructs. Strong relationships between constructs should indicate synonymity or functional equivalence and a lack of differentiation between constructs. Weaker, yet still significant relationships between constructs should indicate that constructs, which are differentiated, having identifiably different meanings, have organisational links between them. They are built into a system with implicative or predictive relationships between the parts. Thus the cluster analysis measure based on a strict criterion for association between constructs should reflect the degree of differentiation while the measure based on a less stringent criterion should reflect the degree of organisation.

This distinction points out the inadequacy of structural measures which consider the overall degree of relationship between constructs in the grid, such as the principal components measures or Bieri's or Bannister's measures, without discriminating between strong and weak relationships between individual constructs. Thus a high percentage of variance accounted for by the first component in a principal components analysis may reflect a lack of differentiation, a high degree of organisation or moderate levels of both.

The conclusion is that measures of differentiation or organisation should take into account the strength of individual inter-construct relationships.
The distinction between two sets of measures may account for the failure of other studies of children's construct systems, to find a developmental increase in the level of differentiation, and in some cases (e.g. Applebee, 1976) for the finding of decreases in differentiation with increasing age. These studies have used inappropriate measures, because they have failed to discriminate between differing levels of construct inter-relationships they have confounded differentiation and organisation.

Given this interpretation of the measures, the results of the present study, confirm the hypotheses of developmental increases in the degree of differentiation and organisation.

The degree of differentiation increases significantly with age, particularly between the ages of 7 and 10 years. Thus, as children get older they have an increasing number of independent psychological dimensions available for the construing of other people. The earlier discussion of the relationships between concrete and abstract and of age changes in the extent to which psychological characteristics are defined by concrete constructs, such as age or sex, suggest that, in part, this increasing differentiation of psychological constructs may be a consequence of the freeing of psychological implications from constellatory construing based on concrete characteristics.

The results for the measure based on self-other distances also suggest that, as children develop, they distinguish more clearly between other individuals, a consequence of both increasing discrimination within single constructs and differentiation between constructs.
Specifically, the results show that older children are better able to discriminate between others in terms of their similarity to themselves. This result offers some support for the suggestion offered in the discussion of content, that older children are more aware of the degree of commonality and sociality they have with others. It has implications for Piaget's notion of decreasing egocentrism but suggests that decreasing egocentrism is reflected not just by an increasing awareness of differences between 'self' and 'other' but by a more developed, more sophisticated notion of 'self' which allows the recognition of differences in the degree to which others are similar or different to 'self'. To express it in PCT terms, it appears that the construct 'self-not self' becomes increasingly discriminating.

Organisation

If the first three differentiation measures are, in fact, more appropriately interpreted as measures of organisation, the results for them also support the hypothesis of increasing organisation with age, particularly between the ages of 10 and 13 years.

Piagetian theory proposes that one major developmental change is in the ability of the child to conceive of the world in a multi-dimensional fashion. The young child, in the preoperational phase, has a strong tendency to 'centre'. That is, he takes into account only one attribute of a situation when making judgements and predictions. This tendency is illustrated in Piaget's studies of conservation in which, for example, young children 'centre' on the attribute of 'height'
when making judgements of the volume of a liquid, and ignore other attributes such as the diameter of the container. While the child may be aware of a range of different attributes, he is unaware of the relationships between them. It is only as he develops that he is able to organise and integrate these different attributes in order to make multidimensional judgements.

The results in this study suggest a similar development in the understanding of the social world. As the child develops he constructs organisational relationships between constructs, building them into a system which permits anticipation and prediction and a multidimensional view of the world. Thus the ability to construe multidimensionally is a consequence of the degree of organisation within the system rather than the degree of differentiation as proposed by Bieri (1955).

Taken together, the results for differentiation and organisation show two stages in the structural development of psychological construing. Firstly, between the ages of 7 and 10 years psychological construing emerges in its own right as psychological constructs break free of constellationary concrete constructs. They become increasingly differentiated into independent dimensions for judging others. The years 10 to 13, however, see a reintegration of these differentiated constructs into an organised system embracing predictive and implicative links between them.

The point does need to be made, however, about the limited view of construct organisation reflected by the measures used in this study and, indeed, most other investigation of the structure of construct systems. All of these measures, whether based on matching scores
between constructs as in Bieri's measure, or on correlations between constructs, as in the principal components and cluster analysis measures, only reveal linear relationships between constructs, i.e. where one pole of one construct maps on to one pole of another construct. Such measures do not recognise the possibility of curvilinearly related constructs where, perhaps, both poles of one construct imply the same pole of another. To take a simple example, the two constructs: 'left-wing - right-wing' and 'extreme - moderate' might be related but in a curvilinear fashion. Both poles of the first imply one pole of the second while the middle range of the first implies the other pole. Despite the strong implicative links between these two constructs, none of the current methods for revealing the structural characteristics of construct systems from repertory grids would reveal this relationship.

The conclusions of this and other studies must be treated with caution, bearing this weakness in mind.

The degree of organisation reflects the number of links between independent constructs, but integration, as defined by Harvey et al. (1961) and Schroder et al. (1967) has a wider meaning. For them, integrative complexity has to do with the complexity of the organisational rules relating dimensions or constructs. Therefore, one must consider the quality as well as the quantity of construct relationships.

The results discussed in Chapter XI referred to two aspects of the quality of organisational links between constructs, balance and openness.

**Balance**

Balance refers to the degree to which all dimensions in a system
are interrelated in such a way that each contributes to the functioning of the system. A highly balanced system would be one in which all dimensions were of approximately equal centrality. A less balanced system would contain a few constructs of high centrality and a number of peripheral constructs of less importance.

The results for Smith and Leach's hierarchical measure of cognitive complexity show an increase with age in the importance of the finer details of a construct system for the judgement and perception of other people, particularly between 10 and 13 years of age. This was interpreted as reflecting a developmental trend towards increasing balance. This progression is consistent with Piaget's predicted trend away from the tendency to 'centre' or concentrate on a limited number of attributes when making judgements of a situation. In the case of judging the volume of a liquid, for example; as the child develops he becomes increasingly able to recognise the different attributes in the situation, consider them simultaneously and give them equal status in making his judgement. The results for balance and for organisation suggest a similar developmental trend in the construing of people.

Openness

The measure of 'openness' was derived from Landfield's distinction between assuming and hypothesising man (Landfield, 1977), and was interpreted as reflecting the dimension Harvey et al. (1961) term as 'openness-closedness'. This refers to the degree of certainty or commitment in construct relationships and the number of alternative interpretations they are open to. Again the results supported the hypothesis and openness increased with age, particularly between the ages of 10 and 13 years.
In PCT terms this suggests that young children have a predominantly constellatory mode of construing, functioning at the level of assumption with rigid implicative or predictive links between constructs. As children develop, they shift towards a more propositional mode of construing. The older child functions more at the level of hypothesis and accepts suggestions to the relationships he construes between constructs. As was suggested in the discussion of developmental changes in the relationships between concrete and psychological constructs, as children develop the relationships between constructs become less rigid and more capable of considering alternatives.

This development is predicted by Piagetian theory. According to Piaget it is only when he attains the stage of formal operations, that the child develops a hypothesising mode of thought and the potential for an experimental approach. The formal operational child can spontaneously generate alternative interpretations and predictions which reflect possibilities and hypotheses. The formal operational child's world is one of possibilities rather than one of rigid certainties.

Summary

This study of developmental changes in the structural characteristics of construct systems shows that the general course of development is as predicted by Piagetian theory. The complexity of structure increases with age in terms of discrimination, differentiation and integration. Structural development occurs in two stages between the ages of 7 and 10 years, the major developmental trend is the increasing differentiation between psychological constructs. The years 10 to 13 see the reintegration
of these differentiated constructs into an organised system. As well as an increase in the number of organisational links between constructs in this period, construct systems increase in integrative complexity as reflected by qualitative changes in construct relationships. Construct systems become increasingly balanced as the contribution that organised dimensions make to judgements becomes more equal. They also become more propositional as rigid definite relationships between constructs give way to the recognition of possibility and alternatives.

PERSONAL AND SUPPLIED CONSTRUCTS

The separate structural analysis of personal and supplied constructs showed a differential rate of development. From 7 to 10 years of age, personal constructs showed more rapid development, from 10 to 13 years of age, supplied constructs showed more rapid development.

It was suggested that the later structuring of supplied constructs reflects the decreasing egocentrism of the child. According to Piagetian theory it is only in late childhood that the child accepts the validity of alternative viewpoints or constructions of the world and becomes able to use them in a structured and meaningful way.

The results for supplied constructs also show a developmental increase in the degree of commonality or shared ways of construing the world between children. The pattern of construct relationships for older children shows greater similarity than that for younger children. This provides further evidence for the development of a less egocentric mode of construing and is presumably a consequence of a social learning process involving interaction with others, through which the child is
assimilated into a culture and assumes that culture's values. Kelly construes 'culture' as similarities in what members of the group expect of each other. This assumes, as the results of the present study show, the development of construct systems with common predictive or implicative relationships between constructs.

This has implications too, for the development of sociality; the extent to which one person can construe the construction processes of another. It was suggested in the discussion of developmental changes in the content of construct systems and of the result for the differentiation measure based on the variance of distances between 'self' and other elements that, as children develop, they become increasingly capable of construing the construct system of others. They are increasingly able to discriminate between those with whom they can engage in a satisfactory social relationship and those with whom they can't. They also discriminate between those who are similar to themselves and those who are different.

Sociality and the ability to play a constructive role in a social process with another person require the ability to construe the other person's outlook. It is only when the child can recognise alternative perspectives, a consequence of decreasing egocentrism, that he can have a role in relation to the other. The possibility of such effective interactions is increased by a degree of commonality. Duck (1977) points out that the probability that one person will understand the construction processes of another increases with the degree of similarity. Kelly (1955, p. 99) suggests that 'commonality between construct systems may make it more likely that one construction system
can subsume part of another.

The conclusion from this is that children become increasingly capable of adopting a social role with respect to other people and forming truly social relationships. This conclusion is supported by work on friendship in childhood. Bigelow and La Gaipa (1974), for example, found that while young children account for friendship in situational terms, older children are aware of a psychological basis to friendship.

DYNAMIC ASPECTS OF CONSTRUING

Personal Construct Theory emphasises the dynamic and changing nature of the individual. Construing is seen as a process in which the anticipations and predictions generated by one's system of constructs are continually being put to the test of experience. Experience continually subjects a person's construct system to a process of validation or invalidation. As a result, hypotheses and predictions are revised as the construct system itself changes and adapts.

It was pointed out in Chapter I that, despite this theoretical emphasis on construing as a dynamic process, little empirical research, and none in the developmental field, has examined the nature of this dynamic process. It was argued in Chapter I that any comprehensive study of developmental changes in construing must consider these dynamic properties of construct systems as well as their static characteristics such as content and structure.

The empirical study reported in Part Three is an attempt to investigate construing as a process and to examine how the nature
of this process might vary with age. The study considered the stability and response to invalidatory feedback of two particular aspects of construct systems; the pattern of construct interrelationships, and the overall structural characteristics of the system in terms of differentiation, organisation, balance and openness.

STABILITY

Bannister and Mair (1968) argue that changes in construing must be examined in the context of a known baseline level of variation in construct systems; the 'noise' level of variation or fluctuation in the characteristics of construct systems which do not indicate 'real' psychological change. Such a baseline might be provided by an investigation of the stability of various characteristics of construct systems. What is the variation, or conversely, consistency of these characteristics under conditions which are not intended to induce 'real' change.

Given this argument, the investigation of the stability of children's construct systems was a necessary precursor to examining the process of change in construing. In addition to this the stability of children's construct systems is of interest in its own right.

Stability of Construct Relationships

Results for the stability of the pattern of construct relationships were presented in Chapters XV and XVI. They reveal a number of interesting findings.

Firstly; the number and amount of changes in the pattern of con-
struct relationships decreases with age. The conclusion from this was that the stability of the pattern of relationships increases with age, particularly between 7 and 10 years of age.

This finding is consistent with Piaget's account of cognitive development. As discussed in Chapters II and XIII, Piaget argues that, as the equilibrium between assimilation and accommodation develops with age, cognitive systems become more permanent. That is, the parts of the system retain their value or meaning when confronted with a new situation. This is what faced the subjects in the control groups in this study. They were asked to apply the same set of constructs to two different sets of elements without any explicit intervening feedback. The results are consistent with the notion of increasing permanence. We can conclude that young children show less stability in the meaning of their constructs, as defined by the pattern of construct relationships, than older children.

This age difference in the stability of construct relationships may be related to the age differences in the structural characteristics of construct systems revealed by the results in Part Two. It was concluded that the construct systems of younger children are less organised than those of older children. They include fewer implicative or predictive links between constructs. Taking that finding together with the age differences in stability we might conclude that the construing of young children is 'looser' than that of older children. In his work on thought disorder, Bannister (1960, 1962) argues that loosened construing was reflected by both low intensity scores and low consistency of construct
relationships.

If the systems of psychological constructs of young children are relatively loose it implies that they generate weak and varying predictions. This adds further support to the conclusion that, while young children may generate psychological constructs in a grid and be able to apply them to other people, they do not possess a coherent and stable 'psychological theory' of other people.

**Stability of Structural Characteristics**

The stability of differentiation, organisation and balance also varies with age. Young children showed more change in these characteristics between completing the two grids than older children. These findings call into question the validity of inferring structural characteristics from measurement on a single occasion.

When the direction of structural changes between the first and second grid were examined it was revealed that the direction of change was related to the individual's initial level of structure. For organisation, balance and openness, those who showed an initially high level of structure showed a decrease, while those with an initially low level showed an increase.

Two explanations can be offered for this differential directional change. Firstly, it may be due to regression to the mean. As no reliability coefficients for the measures are available it is not possible to adjust the scores to take account of this and regression to the mean must be recognised as a possible factor.
affecting the scores. Evidence that it is not the sole effect comes from the age differences in the strength of the directional tendencies.

The second explanation is that there is some effect on structure due simply to the process of completing the grid. Fransella and Bannister (1977) report that several studies with adult subjects show that intensity scores tend to increase between the completion of one grid and another, even though no intervening feedback is provided. Fransella and Bannister conclude that some sort of process is inherent in the actual completion of the grid. With respect to the increase in intensity, they suggest that the articulation of construing necessary to complete a grid initiates a tightening process.

The directional tendencies revealed by the present study also suggest that some process may be involved in completing the grid. However, in contrast to Fransella and Bannister, we would conclude that the direction of changes in structure is not the same for all individuals. The nature of the process, or at least its effects, varies with the existing structural characteristics of the individual.

THE EFFECTS OF INVALIDATION

The study also considered the effects of two types of invalidation, rating invalidation and pattern invalidation, on the pattern of construct relationships and the overall structural characteristics of the construct system.
It has already been pointed out in the previous section that an analysis of changes in construing must be set against the stability of construct systems as an index of the baseline or 'noise' level of variations in construing.

However, studies of the effects of invalidation have not always considered the stability of construct systems of a comparable group of subjects (Bennister, 1963; 1965). These studies simply took changes in construing shown by subjects who had received invalidatory feedback and assumed that these changes were due to the experimental manipulation. These studies did not, for example, compare the responses of experimental subjects with those of control subjects who had received no feedback on their construing. The failure to do this means that the validity of any conclusions as to the effect of invalidation must be questioned.

In the present study, the baseline of variation in construct systems was taken into account by transforming the raw scores of subjects in the experimental groups to express them in relation to the results for the subjects in the control groups. To take account of the age differences in the baseline, the scores for experimental subjects were transformed relative to the appropriately aged control group.

INVALIDATION AND CONSTRUCT RELATIONSHIPS

The first major conclusion with respect to the effects of invalidatory feedback on the pattern of construct relationships is that two distinct modes of response emerge. Subjects may respond
to invalidatory information by showing more change in the pattern of construct relationships than the control group, or by showing less change.

We therefore considered the effects of invalidatory feedback in terms of the extent of the response; how much the response differed from the control group irrespective of the direction of the difference, as well as the specific nature of the response.

**Extent of Response**

Considering first the extent of response of the pattern of construct relationships, two major findings emerged.

**Extent of Response, Discrepancy and the Experience of Invalidation**

Firstly, the results were interpreted as reflecting a curvilinear relationship between the extent of response and the degree of discrepancy between the individuals initial construction and the feedback. It was suggested that the extent of response of the pattern of construct relationships increases with increasing discrepancy of feedback up to a certain point. Beyond that point, as the degree of discrepancy increases still further, the extent of response diminishes.

While the response lies in the first part of this curve the individual presumably recognises that there is a mismatch between his anticipations or predictions and his experience as defined by the feedback. He experiences this as invalidatory and responds to this although, as we have seen, this response may take different
However, as the discrepancy between the individual's anticipations and the feedback becomes greater, it seems that there may be a change in the way that discrepancy is construed. It may be that at high levels of discrepancy the response demanded from the individual to accommodate to this novel situation is too great for him to contemplate. Given the commitment to his construction, that Kelly (1955) argues is a crucial element in the process of construing, he may conclude that the degree of discrepancy suggested by his experience is unrealistic. Rather than adjust his construct system he may choose to reconstrue the experience and question its validity.

For example, the individual may decide that the source of the discrepant information is not reliable. Some evidence that such a process might operate comes from a study by Harvey (1967). He found that when an individual was presented with counter-attitudinal information which was highly discrepant with his initial attitude, change in attitude only occurred when the source of the information was of high status and was presumably seen by the individual as reliable.

The implication of this conclusion is that, although the degree of discrepancy between the individual's anticipation of a situation and the outcome increases, the significance that the individual attributes to that outcome, and therefore the degree of invalidation experienced, diminishes.

This points out the distinction that must be made between the
degree of objective discrepancy between the individual's expectation and the outcome, and the subjective construed experience of invalidation.

Kelly (1955, p.158) emphasises that it is the construed outcomes of events that is significant. Thus in this study, for example, the degree of invalidation does not correspond to the degree of mismatch or discrepancy between the child's rating of elements and the ratings provided by the feedback, but depends on how that inconsistency is construed by the child.

Despite this emphasis, the distinction between objective discrepancy and construed invalidation is one which has been ignored by most studies of the effects of invalidation. The studies by both Bannister and Cochran look for relationships between changes in construing and feedback without considering how that feedback is construed. Therefore their studies cannot be considered as dealing with invalidation per se.

One conclusion to be drawn from the relationship between discrepancy, response and the experience of invalidation inferred from this study is that if we wish to understand the effects of invalidation we must pay closer attention to how the individual construes the situation.

Age Differences in the Experience of Invalidation

The second major conclusion to emerge from the analysis of the extent of response of the pattern of construct relationships to discrepant feedback is that the relationship between discrepancy and
extent of response varies with age. The results were interpreted as showing a shift, with age, in the position of the curvilinear relationship between discrepancy and response. The maximum response and decrease in response occur at a higher level of discrepancy for older children than for younger children.

The conclusion to be drawn from this interpretation is that, at low to moderate levels of discrepancy, younger children experience greater invalidation than older children. However, the level of discrepancy at which younger children begin to question the validity of the discrepant experience is lower than for older children. Younger children have a lower threshold for reconstruing the discrepant information or its source and, therefore, for ignoring or warding off inconsistent feedback. We would conclude that at higher levels of discrepancy younger children experience less invalidation than older children.

These age differences are consistent with the developmental trends hypothesised in Chapter XIII. It was suggested that the lack of equilibrium between assimilation and accommodation in young children should be reflected in a tendency to respond to discrepant information either by disruptive change or by ignoring the inconsistency. In the preceding discussion it has been suggested that at low to moderate levels of discrepancy young children experience greater invalidation and show more response, although not necessarily more change, than older children. At higher levels of discrepancy they are more likely to ignore the feedback and show no response.

In the cognitive systems of older children assimilation and accommodation are more equilibrated. Older children show greater 'stability'; the ability to compensate for or cancel out perturbations which tend to alter the existing state of equilibrium.
This suggests that the construct systems of older children are better able to integrate inconsistencies between anticipation and experience. This is supported by the findings of the studies of impression formation in children discussed in Chapters V and XIII. It also suggests that older children should be able to tolerate more discrepancy before reconstruing the information and ignoring it.

It is suggested that the mechanism underlying these age differences is change in the structural characteristics of children's construct systems. As we have seen, the construing of children becomes progressively more differentiated, organised, balanced and open as they get older.

The relationship between structure and the dynamic properties of construct systems have already been discussed (see Chapter XIII). Research suggests that systems of greater structural complexity are more tolerant of ambiguity and discrepancy between expectation and outcome (Harvey, 1966; Reich, 1966). Research also shows that, the higher the degree of structural complexity, the higher the threshold for warding off or ignoring discrepant information (Harvey, 1967; Sandilands, 1974), and the less the cognitive conflict and negative arousal caused by such information (Harvey and Klein, 1965; Harvey and Ware, 1966).

Given the greater structural complexity of older children, they should indeed experience less invalidation at low to moderate levels of discrepancy than younger children and be prepared to accept greater inconsistency before rejecting such information.
The Nature of Response

As discussed earlier, the results of the present study revealed two modes of response to discrepant information. One mode involves changing the pattern of construct relationships in response to discrepant feedback. This is the sole mode of response to have been considered in previous studies of the effects of invalidation. However, the results of the present study suggest that some individuals responded to the discrepant feedback in a different way. They showed less change in the pattern of construct relationships than subjects in the control groups.

This response was interpreted as reflecting a rigidification of the construct system. This was seen as analogous to the finding in studies of attitude change that some people hold an attitude even more strongly after counter-attitudinal information.

In terms of Personal Construct Theory it suggests that the individual recognises the mismatch between his anticipations and his experience and experiences this as invalidatory. However, rather than changing his construct system, he focusses on and defines the existing predictive links between constructs and reapplies them to retest them.

Nature of Response, Discrepancy and the Experience of Invalidation

In Chapter XIX it was suggested that the nature of the response of the pattern of construct relationships to invalidation varies, with the degree of invalidation experienced. At low and moderate levels of invalidation the response is one of changing the pattern
of relationships. At higher levels of invalidation the individual responds by rigidifying his system. This suggestion is consistent with Sherif and Hovland's (1961) assimilation contrast theory of attitude change. They argue that while counter-attitudinal information lies within the 'latitude of acceptance' a change in attitude occurs. As the degree of discrepancy between the information and the individual's initial position increases it enters the 'latitude of rejection' and the individual shows a contrast response by holding his initial attitude even more strongly.

If we combine these suggestions for the nature of the response with those for the extent of the response offered in the previous section, it seems that the response of the pattern of construct relationships to discrepant information may pass through three phases.

In the first phase the individual recognises the inconsistency between his expectations and the outcome. He accepts the validity of the experience and construes it as invalidating. He responds to this invalidation by changing the pattern of construct relationships in his system.

As the degree of discrepancy increases, the individual experiences greater invalidation. However, the nature of the response changes. During this phase the individual responds to invalidation not by changing the pattern of construct relationships but by rigidifying them.

As the degree of discrepancy increases still further, the individual begins to question the validity of the feedback and eventually
reaches the point where he reconstrues the experience and rejects the information. He therefore no longer experiences invalidation and there is a lack of response of any kind.

Age Differences in the Nature of Response

The results for the relationship between age and the nature of the response seem to suggest that for younger children the shift from a response of change to one of rigidification occurs at a lower level of discrepancy than it does for older children. It is suggested that this is due to the greater degree of invalidation experienced by younger children at low to moderate levels of discrepancy which, in turn, is due to structural characteristics of the systems of younger children rendering them less tolerant of inconsistency and less able to integrate discrepant experience into the existing structure.

INVALIDATION AND STRUCTURAL CHARACTERISTICS

In considering the effects of discrepant feedback on the structural characteristics of construct systems it is necessary to distinguish three aspects of the response: the extent of response, the nature of the response in terms of whether it represents more or less change than the control group, and the direction of changes in structure that occur.

Extent and Nature of Response

The general conclusion from the results for the extent and nature of response of structural characteristics is that there is
a similar relationship between response and degree of discrepancy to that for the pattern of construct relationships. It is suggested that, as the degree of discrepancy increases, the response shifts from one of changing the structural characteristics of the system to one of maintaining or rigidifying structural characteristics and then to one of ignoring the discrepant information. It is also suggested that, as the child gets older, the shift from one form of response to another occurs at higher levels of discrepancy as the degree of invalidation experienced varies.

Moreover, different patterns of results for different structural characteristics suggest that they may be differentially affected by a particular level of discrepancy. Within the range of discrepancy provided by this study the extent of response of differentiation varies with age but not the nature of the response. This suggests that within this range of discrepancy the response shifts from one of rigidification to one of ignoring the feedback. For balance and openness, however, the nature of the response varies with age, but not the extent of response. This suggests that for these characteristics the response changes from one of change to one of rigidification. Alternatively, the response of all structural characteristics may not follow the pattern of changes we have outlined.

**Direction of Change**

The general conclusion regarding the direction of structural change in response to invalidation is that the direction of change is dependent on the individual's initial level of structure. Those
with a low score on each structural measure initially show an increase after discrepant feedback. Those with a high score initially show a decrease.

This conclusion is not consistent with Bannister's hypothesis (Bannister, 1963, 1965) that invalidation leads to a weakening of construct relationships which should be reflected by an increase in differentiation and a decrease in organisation.

The nature of the invalidatory feedback provided in the present study was rather different from that provided by Bannister. He gave his subjects only very general feedback on the overall accuracy of their construing. Also Bannister provided serial invalidation over a number of occasions with different sets of elements. In contrast, in the present study feedback was provided on a single occasion and related to a single set of elements.

Given this difference, the present results do not necessarily disconfirm Bannister's hypothesis that serial invalidation induces a decrease in the strength of construct relationships. However, as pointed out in Chapter XIII, the results of Bannister's studies do not offer unequivocal support for his hypothesis. In particular, the results suggest that there are wide individual differences in the way people respond to invalidation. The results of the present study reveal similar individual differences which appear to be related to the structural characteristics of the individual.

This conclusion is consistent with the findings of Cochran's studies of peoples responses to inconsistent information (Cochran,
Like the present study, Cochran found that those initially high in construct relatedness showed a decrease after receiving inconsistent information, while those who were initially low showed an increase. Cochran argued that this differential response was due to people's need to maintain some degree of structure and order among their constructs. Only those who could weaken the relationships between their constructs and still maintain some structure could afford to do so.

Cochran (1977) suggests that there are two modes of response to inconsistent information. Subjects high in construct relatedness respond by weakening the relationships between constructs. Subjects low in relational strength respond by changing the pattern of construct relationships. This is not supported by the results of the present study. Initial level of structure has no effect on the degree of change in the pattern of construct relationships.

SUMMARY

In the opening chapter to this thesis it was argued that, while Personal Construct Theory emphasises processes of change, it offers no account of the ways in which construing might develop with age. The question was asked as to how the construct systems of children of different ages differ and what are the major parameters of change as the child grows up.

In an attempt to suggest answers to these questions the relationship between Personal Construct Theory and Piaget's theory of cognitive development was discussed and similarities in the under-
lying bases of the two theories were pointed out. It was suggested that Piagetian theory might offer a useful framework for considering the development of personal construct systems.

The implications of Piaget's theory for the parameters of development in construct systems were discussed and it was hypothesised that there should be developmental changes in the content, structure and dynamic properties of construct systems.

In general these hypotheses were confirmed by the empirical studies. The course of development of children's construct systems does indeed follow that predicted by Piaget's theory of cognitive development. To this extent Piaget's theory does offer a useful context within which to consider the interpersonal construing of the child. It may provide a fruitful base for the generation of further hypotheses for future test.

Not only does it appear fruitful to conceptualise the development of construct systems in Piagetian terms, but also it seems that Piaget's theory is of relevance to the way the child understands his social world as well as to his understanding of physical phenomena.

Content

The empirical study supported the hypothesis, derived from Piagetian theory, that there is a developmental trend towards the increased use of abstract psychological constructs. While psychological constructs formed the largest category for all age groups,
the proportion increased significantly with age.

There also appear to be developmental changes in the nature of the psychological constructs used. Young children are more likely to express psychological discriminations in behavioural terms than older children. Also, older children show greater concern with social and interactional characteristics. This was interpreted as a manifestation of decreasing egocentrism and increasing sociality, the ability to construe the construction processes of others.

It was suggested that, despite the large proportion of psychological constructs elicited from young children, concrete constructs occupy superordinate positions in their systems and have constellatory relationships with psychological constructs. It was concluded that young children might rely more on concrete discriminations between people, even though they may be expressed in psychological terms.

Structure

The results of the empirical study also supported the hypothesis that there is a developmental progression towards increasing complexity of cognitive structure.

Initially, structure was conceptualised in terms of three dimensions; discrimination, differentiation and integration. However, it was suggested that some measures, based on the overall degree of relationship between constructs and previously assumed to reflect differentiation, might be more appropriately interpreted as reflecting the degree of organisation between differentiated constructs.
Given this, the results are consistent with the predictions of Piagetian theory. From 7 to 10 years of age there is an increase in the number of independent constructs that children employ in their judgments. Between 10 and 13 years of age the major developmental trend is towards increased integration of these differentiated constructs. Three aspects of integration were identified: organisation, balance and openness.

The construct systems of older children embrace more organisational links between constructs, enhancing their ability to make multidimensional judgements and reducing their tendency to 'centre' on particular aspects of a situation. There are also qualitative changes in the nature of the organisational links between constructs. Children become increasingly balanced; the significance of dimensions becomes more evenly distributed. The relationships between construct also become more propositional. Implicative relationships between constructs become less rigid and more capable of accepting alternatives. The child's construing becomes more hypothetical.

While all three aspects of integration increase with age, they are not highly correlated. This suggests that integration itself should be considered as a multidimensional structural characteristic.

Examination of the structural characteristics of personal and supplied constructs revealed a differential rate of development. It was concluded that the structural development of supplied constructs was delayed due to the egocentrism of younger children making it difficult for them to accept the validity of alternative
constructs for viewing the world and therefore to be able to apply them in a structured way.

There is also a developmental trend towards increased commonality as reflected by greater consensus in the pattern of relationships between supplied constructs. It was suggested that this was a reflection of decreasing egocentrism and a social learning process. The implications of this development for sociality and social relationships was discussed.

**Stability**

As predicted the stability of the pattern of construct relationships and structural characteristics increases with age. This is consistent with Piaget's suggestion that the cognitive systems of older children are more 'permanent'.

The possibility of an effect on structure due to the process of completing a grid was discussed. It was suggested that the direction of any effect varies with the structural characteristics of the individual. The possible confounding effect of regression to the mean was also considered.

**Invalidation**

The findings with respect to the effects of discrepant feedback and invalidation have general implications for the nature of the construing process as well as specific developmental implications.
To deal with general implications first. The findings reveal that one must distinguish between the objective amount of discrepancy or inconsistency implied by the feedback and the actual experience of invalidation. It was suggested that discrepancy and invalidation are curvilinearly related with low invalidation experienced at low and high discrepancy. While Kelly emphasises that it is the construed outcomes of events which are significant, research into the effects of invalidatory feedback has tended to ignore how it is construed and experienced by the individual.

The effects of discrepancy and invalidation must be considered in the context of fluctuations in construing shown by a control group who have had no such experience. When this was done in the present study, it was revealed that the response to invalidation is not necessarily one of change as assumed by previous studies. It appears that some individuals respond to invalidation, not by changing the pattern of construct relationships or structural characteristics, but by rigidifying them; by changing them less than a comparable control group.

The nature and extent of response varies with the degree of invalidation experienced. At low to moderate levels of invalidation the individual responds by changing his construct system. At higher levels of invalidation he responds by maintaining or rigidifying his system. At high levels of discrepancy the information itself is reconstrued and the individual discounts or ignores it. He experiences less invalidation and shows less response of any kind.
Finally, with respect to the direction of structural change in response to invalidation, it appears that there is not a simple unidirectional effect as proposed by some investigators. The direction of change varies with the structural characteristics of the individual.

Turning to the developmental implications of the findings, it was suggested that the major developmental difference lies in the degree of invalidation experienced at particular levels of discrepancy which, in turn, affects the nature and extent of the response shown. It was concluded that older children experience less invalidation at low to moderate levels of discrepancy and have a higher threshold for discrepant information before reconstruing and ignoring it.

This is consistent with Piaget's suggestion that the cognitive systems of older children are more 'stable, that is they are more able to cancel out or compensate for inconsistent experiences. It was suggested that this is due to the greater structural complexity of older children which enhances their ability to integrate discrepancy and accept varying predictions.

It must be emphasised that this account of the effects of discrepant feedback and invalidation, and of developmental changes in these effects can only be offered very tentatively on the basis of the limited range and results of the present study. It must be regarded as a hypothesis for test rather than as a definitive conclusion, and as generating more questions than answers.
A test of this hypothesis should consider a wider age range of subjects, provide a wider range of discrepant feedback and control it more closely, and examine the subject's account of how he construes that discrepancy.

The present study poses many questions. Are there differences due to age and structural characteristics, in the form of particular modes of response as well as where they occur on the dimension of discrepancy? How does the nature of the constructs invalidated, for example their superordinacy, centrality, and the nature and extent of relationships with other constructs, affect the response to invalidation?

These and other questions can only be answered through further research into construing as a process. Given the emphasis of Personal Construct Theory on the dynamic and changing nature of construct systems, the full potential of the theory can only be realised through greater research effort into this aspect of construing.
REFERENCES


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