

**AN EXPLORATORY STUDY OF THE RELATIONS
BETWEEN ASPECTS OF AUTONOMY AND CONCRETE OPERATIONAL ABILITIES**

BEVERLEY MOSS-MORRIS, B.A. (Honours) (Cape Town)

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ABSTRACT

The study attempted an exploration of the relation between aspects of autonomy and cognitive development, at the concrete operational stage. This was intended as a contribution to extending Piagetian theory in order to encompass an understanding of variations in cognitive development. Thirty Sub A boys and girls were individually tested on a modified Piagetian inventory, and a modified sentence completion test of autonomy. The Vineland Scale was administered to their parents, and teachers completed a teacher rating scale of autonomy, developed for this study. Through regression analyses, it was found, in line with previous research, that autonomy was situationally specific. Linkages between some aspects of autonomy and specific areas of concrete operational thinking were also evident. A number of preliminary interpretations were offered for the findings. It was concluded that the linkage between aspects of autonomy and areas of concrete operational thinking could be understood within a Piagetian framework, with implications for a revision of Piagetian theory.

* Measures, scoring systems, and additional tables are available on request from the author.

SECTION ONE: INTRODUCTION

The present study represents an exploratory investigation of the link between cognitive development and aspects of autonomy, within a Piagetian framework. From a broader perspective, this involves the issue of variations in cognitive development.

Piaget's theory of intellectual development has been the most influential in the field over several decades. The main focus of this theory is on the progressive and sequential development of knowledge. Piaget considered this progressive sequence to be universal, and his theory is therefore concerned with the invariants of cognitive development. However, Piaget argues only that the sequence of the stages and the qualitative nature of the structures are invariant, and makes no claims about the ages at which transitions occur. Though Piaget (1970) did briefly consider possible contributions to variations in the rate of cognitive development, such as socio-cultural factors, he did not conduct any comprehensive systematic examination of this issue, either empirically or theoretically.

Many authors have criticised the lack of cognizance of the issue of variations in Piaget's theory (Feldman, 1980; Lautrey et al, 1987). Furthermore, there exists a body of research within a Piagetian framework, which indicates cross-cultural differences in the rates of cognitive development (Cole & Scribner, 1970; Dasen, 1984; Goodnow, 1969; Greenfield, 1969). There is also ample evidence of individual differences in cognitive development within single cultures, in research using psychometric measures of intelligence, development, and scholastic achievement.

A satisfactory theory of development must be able to account for both the variance and the invariance in development. The issue of variations in cognitive levels also has important implications for both education and

clinical practice, since intellect is associated with adaptation to the environment. It is therefore important to examine whether Piagetian theory can be extended to provide an understanding of possible mechanisms leading to variation. The main purpose of the present study is to investigate the role of autonomy as one possible source of individual variation in cognitive development. This is attempted by establishing the linkage between this notion and cognitive development, firstly, through a consideration of relevant aspects of Piagetian metatheory, and secondly, by an empirical investigation of this link.

1.1 Piagetian metatheory

One of the most fundamental concepts of Piaget's theory is that of the construction of knowledge (Piaget 1970). Piaget views knowledge construction as the outcome of a process of interaction between the organism or child, and the object world. In the course of this interaction the child constructs progressively more complex cognitive structures in order to adapt more effectively to the world. Piaget therefore attributes an active role to the child in cognitive development.

This conceptualization of the child as an active agent has become increasingly prevalent in research and theory in a number of areas of developmental psychology. For example, social cognitive theory views the child as an "intuitive scientist" who actively applies cognitive strategies to interpret social situations (Ross, 1981). Recent theories of socialization also emphasize the reciprocal role played by the child in parent-child interaction (Maccoby, 1984; Rutter & Hersov, 1985).

Another fundamental concept of Piagetian theory is that of the role of action (Piaget, 1970). Action can either involve physical acts in the environment, or intellectual operations, which Piaget viewed as interiorised actions. In order to gain knowledge about the physical world, the individual

needs to act on objects so as to transform them; eg., displacing, connecting, combining, taking apart and reassembling objects. These actions then become integrated and internalized through a long period of development to form mental operations. Mental operations consist of internalized actions which are reversible, and also involve transformations, such as joining together, placing in order etc. Operations are therefore constructed on the basis of sensorimotor actions, and relations between these actions.

It is important here to distinguish conceptually between the active role of the child, and action, though the two are closely interrelated. The active role of the child refers to the notion of the child constructing his own cognitive structures; action is the means by which the child comes to know the world and develop the structures to understand it.

These two fundamental concepts are embedded in Piaget's understanding of the sources of intellectual development, which he referred to as the "classical factors of development" (Piaget, 1970, p.719). He claimed that there were four of these - maturation, experience, social transmission and equilibration. The latter factor integrates the effects of the other three factors.

(a) **Maturation.** This refers to the development of the central nervous system, which provides the possibility for certain cognitive structures to emerge, but does not automatically lead to this. "Biological maturation does nothing more than open the way to possible constructions." (Piaget, 1970, p.712).

(b) **Experience.** This refers to experience acquired through contact with objects, which provides the means by which these cognitive structures are constructed. According to Piaget there are three types of experience:

(i) **Exercise** merely involves the exertion of effort on objects,

without necessarily leading to the acquisition of knowledge about them. However, it often leads to the consolidation of various actions or operations.

- (ii) **Physical experience** involves the direct interaction with the physical properties of objects in the material world. This experience leads the child to abstract generalizations about the properties of objects in the physical world, and the regularities which may exist in these, ie., physical knowledge.

- (iii) **Logico-mathematical experience** involves the abstraction of rules from actions which are performed on objects. This leads to knowledge derived from reflection on the actions themselves, rather than on the physical attributes of the physical objects, ie., logico-mathematical knowledge. The action of counting can be used to illustrate this. The child may repeatedly count different arrays of objects, arranged in various ways. Through reflection on these actions, the child will be led to the realisation that the number of objects will remain constant, irrespective of their specific properties, or transformations in display. Though this type of knowledge is independent of the physical properties of objects, it is nevertheless derived from actions exerted on objects.

In practice these three types of experience are generally interrelated, and are often difficult to distinguish. Piaget claimed that physical knowledge was dependent on the prior acquisition of the logico-mathematical structures (Piaget, 1970). Recent studies however, indicate that physical experience is prerequisite to the development of logical operations (Clements, 1984; Slone, 1987). This suggests that the individual's contacts with objects in the physical world are of even greater importance than claimed by Piaget.

(c) **Social transmission.** Piaget acknowledged that cultural and educational factors, such as parental explanation, discussion with peers, and classroom instruction, as well as the availability of possible experiences in different environments, play a role in accelerating or retarding the rate of transition from stage to stage (Ginsburg & Opper, 1969). However, he assigned less importance to these factors than to the role of experience. He also claimed that real learning was not possible without the necessary cognitive structures - for this reason it is not possible to accelerate learning through didactic means beyond a certain point.

(d) **Equilibration.** This factor is a process which coordinates the effects of the other three factors. Piaget considered one of the basic processes of the organism to be the striving for equilibrium. There are two ways in which the organism strives for equilibrium. The first is organisation, which entails the internal coordination of one's own cognitive structures. The second is adaptation, which involves the striving for equilibrium between the organism and the environment. This is made up of two complementary functions - assimilation and accommodation. Assimilation involves the incorporation of information about the world to already existing structures. Accommodation occurs when information is incompatible with existing structures, which are therefore modified in order to incorporate the information. In this way a state of equilibrium is progressively attained. It is this process also which leads to the sequential nature of development, due to the progressive replacement of old by new structures.

The preceding discussion of the classical factors of development illustrates the constructive role which Piaget assigned to the individual in cognitive development. Though maturation makes certain developments possible, and the social environment may influence the rate at which these occur, it requires activity on the part of the individual to actualize them. This construction

takes place through experience, which is made up of actions. Actions are the means by which knowledge is extracted from the environment. "... there can be no experience without action at its source, whether real or imagined." (Piaget, 1970: 721) The process of equilibration, which integrates all these factors, also assumes activity, in that it requires active organisation and adaptation on the part of the child.

Piaget considered his theory of the nature of knowledge development to apply universally. The source of this universality is located in the organism's interaction with the world, which he saw as the basis of cognitive development. Since all individuals share basically the same biological make-up, and the physical world is the same for all, he assumed that cognitive development would be invariant.

Though Piaget has been little concerned with the issue of variations in cognitive development, there is a large body of empirical evidence which has found such variations. Two sources of such evidence will be considered here. These are cross-cultural research within a Piagetian framework, and research from other frameworks on individual variations in cognitive performance, as measured by assessments such as I.Q. and scholastic achievement. This evidence, and the theories advanced by these researchers to account for it, will be briefly presented. The author claims that Piagetian metatheory is sufficiently broad to encompass an understanding of these findings of variations in cognitive development. They will therefore be interpreted within a Piagetian framework, and the factor of autonomy will be advanced as a potential source of variation which is particularly consistent with this framework.

1.2 Variations in cognitive development

1.2.1 Cross-cultural research

Cross-cultural research into Piagetian theory has demonstrated significant

variations in the cognitive development of individuals in different cultures. In particular, it has found marked differences in the rate of development, and in the relative timing of development for different concepts (Cole & Scribner, 1970; Dasen, 1984; Goodnow, 1969; Greenfield, 1969). Most theorists have attempted to account for this in terms of the different experiences available in the social environment. Dasen (1984) has incorporated a notion of differential experiences into an eco-cultural interpretation of cross-cultural results. This interpretation argues that societies encourage the development of skills and ideas that are appropriate for the activities specific to that eco-cultural setting. Therefore, differences in the rate of development of particular concepts reflect those conceptual areas which are, or are not, valued by a particular culture. This theory is consistent with other recent neo-Piagetian research. Slone's (1987) study indicates that different domains of physical knowledge may be separately constructed on the basis of physical experience with each particular content, as opposed to one single set of operations being applied to a number of domains.

This focus on socially determined experiences has been most fully developed by Buck-Morss (1975), who has used materialist theory to account for the findings of cross-cultural research, and has based a critique of Piagetian theory on this. She argues that the Piagetian stages are particular to capitalist society, developing out of, and underpinning, the structures of such a society. Piaget's stage theory, which makes a claim for universality, is seen as itself ethnocentric, particularly in the notion of the formal operational stage, which involves a separation of form from content. This separation is seen as reflecting the structure of a money exchange, which involves an abstract form of mediation of social relations and production.

However, the overall chronology of the stages of development for particular concepts, from the sensorimotor to the concrete operational levels, has in fact been generally confirmed (Dasen, 1984). It also seems likely that there would be some commonality to cognitive development, as many aspects of the

physical world are equally available to all individuals.

1.2.2 Research within cultures

The research into individual differences in performance within cultures has been concerned mainly with the influence of social environmental variables and heredity. Over recent years, social environmental variables, such as family and social class, have received particular attention.

The research into family and school variables has been comprehensively reviewed by Rutter (1985), who concluded that the nature of these experiences during childhood has important effects on cognitive performance. Variations are greatest in extreme social conditions, such as very adverse circumstances. A number of researchers have been particularly concerned with the variables of social class, or parental educational level (Laosa, 1982; McGowan & Johnson, 1984; Valencia & Henderson, 1985), and the processes by which these are translated into differences in cognitive development. These researchers consider that the influence of these factors is mediated through their effects on aspects of the home environment, or parent-child interaction. However, much of the other research in this area is purely descriptive, and Rutter (1985) criticises it for failing to explain the precise mechanisms by which differences in the environment are translated into cognitive development.

The influence of heredity and biological variables on individual performance has received considerable attention, especially earlier this century, according to Maloney & Ward (1976). It is generally accepted at present that these variables make some contribution to variations in intelligence, but that their effects are mediated by the influence of environment (Anastasi, 1976). The role of such factors is most important in circumstances such as genetic abnormalities or neurological damage.

In sum, the research into cross-cultural and individual differences in cognitive development indicates that social and biological variables have a

significant influence on the rate of cognitive development. Since variations in performance between individuals seem to be mainly quantitative rather than qualitative, this suggests that they also represent differences in rate of development. An adequate theory of cognitive development needs to account for and explain the role of these variables.

1.2.3 A Piagetian framework for variations in cognitive development

It is argued that Piagetian metatheory can account for the mechanisms by which variations in the social environment affect cognitive development. Piaget himself claimed that social factors influence the nature of objects available to the child. Since actions on objects are the means by which cognitive development is actualized, this will influence the overall rate of cognitive development, and the timing of development of particular concepts. However, he assumed that the capacity of social factors to influence the objects available in the world was minimal. In contrast, the above findings indicate that social factors play a significant role in cognitive development. It seems that this issue can be resolved by Dasen's (1984) eco-cultural theory. This theory emphasizes the extent to which a particular eco-cultural system influences the nature of the individual's experiences, by the provision of differential opportunity and encouragement for experiences. In this way, social differences can exercise a major influence on the world with which the individual interacts. It is argued that this framework can be extended to social environmental differences within cultures. Families or social classes are likely to make different types and amounts of experiences available to the individual, and to emphasize different skills and abilities.

Piaget's theory is also able to encompass an understanding of the role of heredity, or biological variables, on cognitive development. Cognitive development is seen as the outcome of the organism's interaction with the world. Therefore, differences in the organism, attributable to heredity or biological factors, could influence the effectiveness with which the organism interacts with the world, or its capacity to integrate the

experiences arising from this.

Thus both cross-cultural and individual differences in cognitive development can be interpreted within the central framework of Piagetian theory - that of the construction of knowledge through experience gained in interactions between the organism and the world. Since the concepts of construction and experience are central to Piaget's theory, an exploration of factors which influence experience and actions, will be especially relevant to an understanding of individual differences within a Piagetian framework.

1.2.4 Autonomy as an influence on cognitive development

In the present study, the author hypothesizes that aspects of autonomy, such as self-reliance, initiative and self-determination, are possible factors in the child which would be related to actions in the world. It is likely that the child who does more activities on his/her own, and who shows initiative in seeking out different experiences, or different ways of coping with problems, will be involved in a greater number and variety of actions in the physical world. Furthermore, children who are self-determining, are in a position to make their own decisions and plans, which would again provide more opportunities for a range of actions in the world.

Since actions are necessary for the development of both physical and logico-mathematical knowledge, it is likely that greater amounts of autonomous behaviours will facilitate the rate of cognitive development by leading to earlier stage transitions. However, it seems probable that the relation between autonomy and cognitive development will be interactive rather than unidirectional, in that higher levels of cognitive development will also facilitate greater self-reliance and initiative in the child. Autonomy and cognitive development will thus be mutually enhancing or retarding.

Therefore, it appears that there are theoretical grounds for considering that autonomy might be one of the factors which accounts for individual differences in cognitive development. There is no direct support for this

linkage in Piagetian theory and research. However, there is a body of work which provides indirect evidence for a relation between these two areas. This work will now be briefly reviewed.

1.3 Evidence for a linkage between autonomy and cognitive development

A number of authors, working within a Piagetian framework, have speculated about the role of autonomy in cognitive development. Greenfield (1969), in a cross-cultural study of the development of conservation amongst the Tiv in North Africa, alludes to the possible influence of such a factor. She suggests that child-rearing practices emphasizing conformity to the group as opposed to individual achievement, may have been one factor leading to cognitive differences.

In addition, Kamii and DeVries (1980), in addressing objectives for early education based on Piagetian principles, argue that the child's initiative, alertness and curiosity are essential factors for true learning. These qualities not only lead children to develop their own solutions to problems, but also to pose interesting questions for investigation. Furthermore, they lead children to put things into relationships, which is seen as essential for the construction of knowledge. Kamii and DeVries (1980) also consider autonomy crucial to learning in another sense. They advocate an autonomous relation to adults, which implies that the child is given the freedom to make his/her own judgements and decisions, within the constraints of mutual regulation of their own and others' desires. This appears to correspond to the notion of self-determination. Autonomy, in this sense, encourages the child to think problems through, rather than to rely on certain "givens". It also encourages the development of logical thinking, decentration, and language, through the processes of negotiation which it involves. Piaget himself was concerned with this latter notion of autonomy in his investigations of moral development (in Kamii & DeVries, 1980).

There are other indications of a possible linkage in a large number of studies concerned with non-Piagetian notions of cognitive development. There is a considerable body of research into the relation between parental or school practices associated with the development of independence, and cognitive performance (Baumrind, 1967; Datta & Parloff, 1967; Frodi et al, 1985; McClelland et al, 1958; Mussen, 1979; Teevan et al, 1979; Wickern & Nowicki, 1976). The conclusion which can be drawn from this body of research is that autonomy-enhancing child-rearing practices lead to more autonomy in children, which in turn facilitates cognitive development. In addition, there are a number of studies in the literature which examine constructs related to autonomy eg., mastery-motivation, curiosity, and task-oriented behavioural style (Yarrow et al, 1981; Kreidler et al, 1984; Mevarech, 1985). These studies generally show that cognitive performance is enhanced by higher levels of these characteristics. Indirectly, this provides further supporting evidence for the linkage of autonomy to cognitive development.

It can be concluded, therefore, that there is both theoretical and indirect empirical support for a linkage between autonomy and cognitive development. Having established a rationale for this linkage, the next purpose of the present study is an empirical investigation of such a linkage. However, before developing specific hypotheses about this linkage, it is necessary to carefully examine the nature of the concept of autonomy.

1.4 Nature of autonomy

The concept of autonomy/independence falls into the area of personality or psychosocial development. This concept has been defined in a number of different ways in the literature, and has been considered from a variety of different theoretical perspectives. The terms autonomy, and independence (which is often used in the same sense as autonomy), have been seen to cover a range of behaviours or characteristics (Maccoby & Masters, 1970; Steinberg

& Silverberg, 1984). A review and evaluation of these definitions and perspectives falls outside the scope of this discussion. Instead, a useful framework provided by Shouval (1975, 1977, 1984) will be adopted for this study.

Shouval's (1977) concern was to explore the conceptualisation of independence and dependence as single, bipolar, unidimensional and molar traits. He argued that molar concepts of personality have been found to be invalid, as shown by Endler & Hunt's (in Shouval, 1977) work on anxiety. He therefore suggested, on the basis of a review of the literature, and a series of studies which he conducted, that independence was a multidimensional concept. He first differentiated this concept into two major dimensions, which appear to be qualitatively distinct. He termed these attachment and autonomy. These will now be briefly discussed, with some elaboration on Shouval's (1977) definitions.

Attachment refers to the bond, or emotional relationship to significant others, which expresses itself in the seeking of proximity and contact (Bowlby, 1970; Ainsworth et al, 1977). The concept of attachment as used by attachment theorists concerns specifically the bond with the primary attachment figure - often the mother. This is in contrast to the concept of dependency, as used by social learning theorists, which refers rather to the general propensity to seek closeness, affection and approval from all others, with no reference to particular figures.

Autonomy is used by Shouval (1977) primarily in the sense of self-reliance. His use of this term is very broad, and seems to cover a number of other aspects of autonomy considered important by other authors, such as initiative (Steinberg & Silverberg, 1984; Maccoby & Masters, 1970), subjective sense of self-reliance (Steinberg & Silverberg, 1984) and self-determination, or resistance to pressures to conform (Steinberg & Silverberg, 1984). In general, then, this aspect of independence refers to the individual's relationship to the object world, in contrast to

attachment, which concerns the relationship to significant others. It is therefore this aspect of independence with which the present study is concerned.

Shouval (1977) argues that the above two categories (attachment and autonomy) are separate dimensions of behaviour, rather than two ends of a bipolar scale. This indicates that the seeking of contact or proximity with others does not imply a lack of self-reliance in instrumental situations. Similarly, detachment from significant others does not necessarily result in high levels of autonomy, in the sense of initiative and persistence in solving problems alone.

Autonomy, which is the focus of this paper, appears itself to be multidimensional. Shouval (1977) isolated four separate factors of autonomy through an exhaustive series of factor analyses of a sentence-completion test of autonomy. These were - autonomy in problem-solving situations (an aspect of self-reliance), autonomy in traumatic situations (which appeared to elicit attachment-type behaviours), independence from parental pressure (a form of self-determination), and independence of peer pressure (another form of self-determination). He concludes that autonomy is therefore differentiated in terms of agent and situation, and that it is probable that it can be even more finely differentiated across situations and agents than attempted in his study.

Furthermore, there appear to be developmental changes in autonomous behaviours, which do not involve a simple increase over time, but rather transfers of autonomous and dependent behaviours from one area to another. eg., the decrease in conformity to parents in adolescence coincides with an increase in reliance on peers (Steinberg & Silverberg, 1984).

Therefore, autonomy appears to be a multidimensional and developmentally specific variable. Consequently, Shouval (1977) considers that it can best be understood as a general term covering a number of behaviours, which may

have a conceptual core. A particular child establishes a different position on each type of autonomy. Individual differences between children in autonomy will therefore not involve variations in the amount of a trait "autonomy", but will rather be in the form of different profiles or patterns of autonomous behaviours. This multidimensionality of autonomy indicates that hypotheses about the relation between autonomy and cognitive development need to consider a number of different aspects of autonomy.

1.5 Hypotheses

In the present study two hypotheses have been advanced, one about the nature of autonomy, and one about the linkage between autonomy and cognitive development.

Hypothesis 1

In line with research findings, it is hypothesized that autonomy is a multidimensional variable, consisting of a number of separate, situationally specific aspects.

Hypothesis 2

A theoretical basis for a linkage between autonomy and cognitive development has been established. Since autonomy appears to be a multidimensional variable, this implies that some aspects of autonomy may be more important for cognitive development than others, in that certain actions may be more productive of the construction of knowledge than others. This linkage will be investigated at the level of concrete operational abilities in this study. Therefore, hypothesis 2 states that some aspects of autonomy will be related to the construction of areas of concrete operational thinking.

The present study involves a preliminary investigation of a number of types of autonomy across different situations and agents, and their relations to areas of cognitive development, both overall and individually, in order to explore such links.

SECTION TWO: METHOD

2.1 Subjects

The sample consisted of 30 Sub A children, evenly divided by gender. The children were drawn from two classes in a coeducational primary school, in the predominantly middle-class central area of Cape Town. The ages of the children ranged from 6.1 - 7.8, with the mean age being 6.10. This age range was selected as one in which children were most likely to be in transition from the preoperational to the concrete operational stage of thinking.

In the selection of subjects, an attempt was made to keep the parental educational level as homogenous as possible, in order to limit other sources of variance on cognitive development. Parental educational level has been shown to be more salient than other measures of SES or ethnic group status in influencing the nature of home environment, with particular impact on scholastic performance (Laosa, 1982; McGowan & Johnson, 1984; Valencia & Henderson, 1985). Parental educational level also provides a very rough and imperfect, but cost-effective indication of parental intellectual level. The majority of the sample (17 children) had at least one parent whose highest qualification was a Std. 9 - 10 education. The remainder of the sample consisted of 7 children whose parents both had a post-matric qualification, and 6 children whose parents both had a Std. 6 -8 qualification.

2.2 Measures and scoring

Three measures of autonomy were used in this study, in order to tap as many different aspects of autonomy as possible. The data was obtained from three

different sources viz., parent, teacher, and child, so that a wide range of situations and points of view could be covered. These measures form the independent variables of the study. An inventory of Piaget's developmental tasks was used to assess the degree to which the child has attained concrete operational thought. This forms the dependent variable of this study.

2.2.1 Sentence Completion Test of Autonomy

This test was used as a measure of the child's self-perceptions of three types of autonomy viz., self-reliance in problem situations, self-reliance in traumatic situations, and self-determination with respect to peers. It was modified from a multiple-choice sentence completion test of autonomy developed by Shouval (1977), for use with 8 - 16 year old children. Shouval's test consisted of four scales, termed obstacle-press, trauma-press, peer-press, and parental-press; the first three corresponding to the above three types of autonomy respectively, and the last scale assessing self-determination in regard to parents. These scales were developed on the basis of factors which emerged from Shouval's original construction of a unitary test of autonomy. The test then went through four successive revisions based on item and factor analyses, in order to strengthen these four factors.

The final version of Shouval's test presents the child with 28 conflict scenarios (7 for each scale), and three possible ways of resolving these, each reflecting different degrees of autonomy. The child is then required to select one of these responses, which is given a score of 1 - 3, depending on the degree of autonomy. This yields four scores, one for each of the factors. Shouval (1977) reports that the test has satisfactory reliability and validity.

However, an initial analysis of the data collected in the present study, indicated that for the age group used in this study, the items comprising the parental press scale tended to elicit responses reflecting compliance or

non-compliance, or perhaps style of home discipline, rather than autonomous decision-making. It appears that the parent-child power balance at this age level is such that children do not have freedom of choice in the particular situations presented by these scenarios. For this reason, the items comprising this scale were excluded in this study. Two other items, both making up the trauma-press scale, were also excluded, since the initial analysis of the data revealed them to be age or culturally inappropriate. In addition, the administration of the test was modified, by using an open-response rather than multiple-choice format, partly because a number of the response choices were also culturally inappropriate, and partly due to the limited reading-ability of the subjects. The wording of a number of items was simplified to adapt the test for the younger age-group.

The modified version of this test then consists of 19 incomplete conflict scenarios, 7 comprising the obstacle-press scale, 5 comprising the trauma-press scale, and 7 the peer-press scale. These were presented verbally to the child in an individual interview, in the form of a game. The children were asked to complete the experimenter's sentences as quickly as they could, as if they referred to the child him/herself. Responses were recorded verbatim by the experimenter.

A content analysis of all the responses was then undertaken. A scoring system was developed for each of the three scales, reflecting increasing degrees of self-reliance, or self-determination. These responses were assigned a numerical score, with higher scores representing greater degrees of self-reliance or self-determination. In this way, each child was assigned a separate score for each of the different scales.

The tests were then scored independently by two raters. Inter-rater reliabilities, as determined by Pearson's correlation coefficients, were .89, .90, and .97, for the obstacle-press, trauma-press, and peer-press scales respectively. This is seen to indicate a highly satisfactory level of objectivity in the scoring systems.

2.2.2 Vineland Social Maturity Scale

This scale, which is widely used clinically, was employed as a measure of autonomy in the sense of self-reliance and initiative, as shown by the child's ability to attend to, and take responsibility for, his/her personal needs. The scale was originally developed by Doll in 1947, and later revised in 1953 and 1965, to assess levels of social competence from birth to 25 years (Anastasi, 1976, Mittler, 1970). The scale consists of 117 items arranged in average order of difficulty and separated into year groups according to the mean scores obtained for each item. The items are divided into eight categories: general self-help, self-help in eating, self-help in dressing (these three categories appear to be assessing self-reliance in a number of areas of self-care), occupation (this category assesses daily activities, perhaps reflecting initiative), socialization (this category assesses level of play, and seems less related to autonomy), communication (this category assesses competence in conveying verbal or written information, and also seems less related to autonomy), locomotion (self-reliance and initiative in travelling to different places) and self-direction (initiative in planning and directing activities).

The test is administered as an interview, either with the examinee, or, (especially at the younger age-levels), with an informant who is familiar with the person. Items are scored by the interviewer as either passed or failed on the basis of actual examples of behaviours reported by the informant. There are also procedures for scoring items for which the child has had no opportunity, or for which no information is available. Social age and social quotient scores can be computed for the individual from the raw scores. A retest reliability of .92 has been established for this test (Anastasi, 1976).

A number of minor modifications were made in the use of the scale for this study. The raw scores obtained on the scale, rather than social age scores,

were used. There were a number of reasons for this. Firstly, the norms are rather outdated and culturally inappropriate for non-American children (Anastasi, 1976). Secondly, the numbers of items at the different age levels vary somewhat randomly. As a result, the scores obtained for passing different numbers of items are unequally weighted (eg., passing an additional item at the 6 - year level, gives a credit of 3 extra months, whereas passing an additional item at the 7 - year level gives a credit of 4 extra months). The focus of this study was on the extent and range of situations in which the child shows autonomous behaviour, rather than on comparisons with other populations. Therefore, the raw scores provided the best measure of the amount of autonomous behaviours for a particular child. To enable a more detailed analysis of autonomy across different situations, the raw scores of items for each category were also computed for each child. In addition, two items which seemed to be assessing functions other than self-reliance or initiative (ie., disavows literal Santa Claus, and tells time to the quarter hour) were omitted in this study.

2.2.3 Teacher Rating Scale of Autonomy (TRS of Autonomy)

This measure was developed for the present study to assess autonomy in the school situation. A pool of 15 items was generated by the experimenter, in consultation with a Sub A teacher and other colleagues. These items involved descriptions of types of behaviours displayed by children of this age-group, which were seen to reflect self-reliance or initiative in activities and tasks. The development of items followed two criteria. Firstly, items should reflect concrete behaviours rather than descriptions of qualitative attributes or characteristics, to reduce subjectivity in assessment. Secondly, items should refer to the ways in which a child approaches tasks or activities, rather than actual competence in these, in order to separate autonomy from ability.

The 15 items were then distributed to three other Sub A teachers, who were asked to evaluate them in terms of their clarity, applicability to Sub A children, ease of scoring, and possible association with other variables. On

the basis of these evaluations a number of items were excluded or modified, resulting in a final scale of 8 items.

The final scale consists of 4 items which tap self-reliance, and 4 items which assess initiative. Half of the self-reliance and half of the initiative items are phrased positively (i.e., implying self-reliance or initiative), and the other half are phrased negatively (i.e., implying a lack of these qualities). Positive and negative items are alternated in the rating scale, to prevent the development of response sets.

In the study, the teachers were asked to rate each child on a 5 point Likert-type scale, in terms of how often each type of behaviour was shown by the child in comparison to class-mates. Comparative rather than absolute frequencies were used, because opportunities for each type of behaviour are variable. In order to reduce the halo effect, the teacher was not informed that the purpose of the scale was to assess autonomy. Each child was assigned a score of 1 - 5 for each item on the basis of the ratings, with higher scores reflecting increasing levels of autonomy. (The scores on the negative items were reversed, as higher scores here reflected greater amounts of non-autonomous behaviours). The range of possible scores for this test is therefore 8 - 40. A split-half reliability of .94 was obtained for this measure, using a Spearman's Brown formula to correct for the change from an 8 item test to a 4 item test. This is interpreted as indicating highly satisfactory internal consistency.

2.2.4 Inventory of Piaget's Developmental Tasks

A modified version of this assessment procedure was used as a measure of the child's attainment of concrete operational thinking in a number of areas. The inventory was developed by the Centre for Research in Thinking and Language (Department of Psychology, Catholic University, copyright Hans Furth, 1970) as a research instrument, for use with children and adolescents who have attained some concrete operations. It consists of 18 problem areas derived from Piaget's developmental research into concrete and formal

operational thinking.

The Inventory uses a paper-and-pencil format, with a printed booklet containing the problems in pictorial form, and a minimum of linguistic instructions. In the original version of the test, the problem areas were assessed through a multiple choice format, after presentation of an example. A pass/fail score could be assigned to each item, making a numerical score for the whole test possible.

The adapted version of this measure retained the content of the questions in each problem area, but wherever possible the problems were presented in concrete rather than pictorial form. The purpose of this was to make the measure more consistent with Piaget's clinical method of assessment, which uses concrete objects and a flexible question and answer procedure. An additional advantage of this modification was that it eliminated the added requirement that the child interpret often confusing pictorial material.

However, the questions were still presented in such a way that the child was required to give one solution to the problem. This was achieved in a number of different ways, depending on the problem. The child was either asked to choose the correct solution from the original pictorial presentation of possible answers, or from concrete examples of these choices. Alternatively, the child was simply asked for a solution. These solutions were then matched with the multiple choice selection in the booklet. The scoring system of the original version was therefore retained, so that a numerical score could be derived for ease of statistical analysis. The Inventory was administered individually to each child, so that no written instructions were required. This had the advantage of further increasing the similarity to the Piagetian clinical method.

Seven of the 18 problem areas were used for this study. A preliminary analysis of the data indicated that an individualised cut-off criterion (eg., to stop after all items in one problem area had been failed) was not

useful. Though the problems are presented in approximate order of difficulty, it was found that there was no clear consistency across children in the areas in which they would fail or pass questions. However, it appeared that after the eighth problem area children tended to rely on random guesses rather than attempting to solve the problems on the basis of judgement. (The ninth problem area was concerned with the conservation of volume, which is a fairly advanced concrete operational concept). As a result, when the child was incapable of the necessary operations, there was a greater likelihood of a correct answer being given if a guess was made, simply on the basis of chance, than if an answer was ventured on the basis of an incorrect judgement. Therefore, only the first eight problem areas (except for the sixth problem area, which was omitted as it used algebraic mathematical conventions) were utilised for this study.

The modified version of this test involved the following problem areas:

- (a) **Quantity.** Understanding of continuous and discontinuous quantity - these questions require the use of the operation of compensation.
- (b) **Horizontal levels.** Understanding of the effect of gravity on liquid levels, which requires the notion of the horizontal.
- (c) **Sequence.** Ability to internally spatially manipulate, and maintain the order of a hidden sequence, through a series of changes in orientation.
- (d) **Weight.** Understanding of the conservation of weight through a number of transformations of shape.
- (e) **Matrix.** Ability to classify using a matrix, which requires the simultaneous coordination of two variables.
- (f) **Perspective.** Ability to visualize a 3-dimensional scene from other perspectives, which requires decentration and internal spatial manipulations.
- (g) **Movement.** Ability to visualize a sequence of movements of a 2-dimensional object, which requires an understanding of the invariant characteristics of an object, despite spatial transformations.

2.3 Procedure

The children were interviewed individually by one experimenter during school hours, over two sessions, in an isolated room at the school. The Piagetian inventory was administered in the first session, and the Sentence Completion test in the second session. This order of administration was preferred as it enabled the development of rapport prior to the presentation of the potentially more threatening Sentence Completion test.

The parents were then contacted telephonically to arrange interviews at their homes or work-places. They were informed that the study involved an exploration of links between childrens' knowledge about the physical world and their home activities. All parents had given written permission for the study prior to this. During the interview, the Vineland scale was administered to the parent/s. The interviews were conducted primarily with the mothers of the children, for reasons of convenience, but the fathers or father-figures participated in a number of the sessions. All parents were interviewed within two weeks of the sessions with the children.

During the same period the class teachers were asked to complete the Teacher Rating Scale of Autonomy for each pupil participating in the study.

SECTION THREE: RESULTS

3.1 Overview of analyses

The analyses of the present study were conducted over four stages:

- (a) Simple correlations were computed to investigate the relations between aspects of autonomy, to determine whether the first hypothesis of the multidimensionality of autonomy was supported.
- (b) The effects of other factors such as gender, age and parental

educational level were inspected through t-tests and simple correlations, to establish whether these warranted consideration in later analyses.

- (c) Simple correlations were computed between aspects of autonomy and scores on the Piagetian Inventory, to test the second hypothesis of a linkage between autonomy and areas of concrete operational thinking, and also to provide indications of which aspects of autonomy appeared most important.
- (d) Stepwise multiple regressions were then performed to further investigate the hypothesis of the linkage, by determining the magnitude of the contribution of aspects of autonomy to the scores. This also established the significance of the unique contributions of the different aspects of autonomy to performance on the Piagetian Inventory.

Stages (c) and (d) were undertaken separately for the overall scores on the Piagetian Inventory, and then for the scores on each of the components of this Inventory. This was done in order to obtain an overall idea of the linkage between aspects of autonomy and concrete operational thinking, and then to explore the specific relations between aspects of autonomy and different areas of concrete operational thinking.

3.2 Relations between aspects of autonomy

The links between the different aspects of autonomy were examined to determine to what degree they were separate and situationally specific. A second purpose of this was to investigate whether it would be more useful to consider the categories of the Vineland Scale separately, or together in the overall score. The results of the intercorrelations between all the aspects of autonomy are presented in Table 1.

TABLE 1

Intercorrelations among measures of Autonomy

Measure	1	2	3	4	5	6	7	8	9	10	11	12
1.Obstacle Press	-											
2.Trauma	.50 **	-										
3.Peer Press	.25	-.17	-									
4.TRS Autonomy	-.03	.11	.05	-								
5.Vineland	-.06	.11	.15	.25	-							
6.Self-Help Eating	-.16	-.39 *	.36 *	.16	a	-						
7.Self-Help Dressing	.04	-.03	.16	.14	a	.28	-					
8.Occupation	-.49 **	-.49 **	-.09	.02	a	.43 *	.43	-				
9.Locomotion	.20	.23	-.11	-.10	a	.14	.05	.05	-			
10.Communication	.28	.31	.30	.41 *	a	.32	.37 *	.08	-.02	-		
11.Socialisation	.07	.08	.06	.25	a	.35	.02	.22	-.02	.01	-	
12.Self-Determination	.02	.10	-.18	.14	a	.18	.17	.28	.02	.10	.03	-

Note. N = 30.

a Spurious part-whole correlation is not reported.

* p < .05. ** p < .01.

3.2.1 Relations between overall measures of autonomy

As expected, most of the intercorrelations between the different overall measures of autonomy were non-significant. The only significant associations were between the obstacle press and trauma press scales of the Sentence Completion test ($r = .50$, $p < .01$). This suggests that for this sample, the responses in terms of self-reliance in problem situations, and self-reliance in distress-provoking situations, were less differentiated than those found by Shouval (1977).

3.2.2 Relations between categories of the Vineland Scale and other measures of autonomy

When these categories were considered, some significant correlations with the other aspects of autonomy did emerge. Surprisingly, strong negative correlations between the occupation category and each of the obstacle press and trauma press scales ($r = -.49$ for both, $p < .01$) were evident. A negative correlation was also found between the self-help eating category and the trauma press scale ($r = -.39$, $p < .05$). The meaning of these results is difficult to interpret. Though the expectation was that aspects of autonomy would be fairly independent of each other, it seems unlikely that they would be negatively related, since this implies that autonomous behaviour in one situation is associated with a lack of autonomy in another situation. These results raise doubts about the validity of the obstacle press and trauma press scales, suggesting that these may not have been measuring the actual incidence of autonomous behaviours, but rather certain response tendencies, on the part of children of this age-group, to this type

of item. This might also account for the unexpected correlation between the two scales.

This interpretation is confirmed by inspection of some of the actual responses given. In a number of these, the child stated that he/she would behave in a particular way, whereas there was evidence from the interview with the parents that this was not the case; eg., one child's response to the item: "When I was on the bus I suddenly got a bad tummy-ache, so I...", was that she would buy something to eat from a shop, because she only got a tummy-ache when she was hungry. Her mother reported, however, that this child had never yet entered a shop on her own, always losing confidence at the last minute. It seems, therefore, that children responded to items on the basis of social judgement, ie., an evaluation of what should be done under the circumstances, rather than a reporting of their own likely responses.

There were two other associations with categories of the Vineland Scale. These were between self-help in eating and the peer press scale ($r = .36$, $p < .05$), and the communication category and the TRS of Autonomy ($r = .41$, $p < .05$). The former result is difficult to interpret. The latter result can be accounted for on the basis that the particular communication items which discriminated between children at this level, involved the spontaneous exercise of reading and writing skills at home. This association therefore seems to reflect positive attitudes and initiative regarding academic skills, both at home and at school.

3.2.3 Interrelations between categories of the Vineland Scale

On the whole these categories appeared to be fairly independent of each other. The only significant correlations were between self-help eating and occupation, and self-help dressing and communication ($r = .43$ & $.37$ respectively, $p < .05$). This indicates that in general the different categories were tapping different aspects of autonomy or areas of functioning, and that it would be most useful to look at these separately,

rather than clumped together in a single Vineland score.

3.2.4 Summary

- (a) It appeared that the different aspects of autonomy measured here were in general independent of each other, which confirms the hypothesis of the multi-dimensionality of autonomy.
- (b) It appeared that the obstacle press and trauma scales of the Sentence Completion test were not measuring actual autonomy in the present study, but rather particular response tendencies on the part of children of this age-group. These two scales will therefore be omitted from later analyses. There was no clear evidence of similar problems with the peer press scale, which may reflect real resistance to peer conformity. This scale will therefore be retained.
- (c) It seems most useful to consider the Vineland categories separately, rather than using a composite Vineland score.
- (d) The following aspects of autonomy were therefore retained for later analyses: peer press, TRS of Autonomy, self-help eating, self-help dressing, occupation, locomotion, communication, socialisation, self-determination.

3.3 Effects of gender, age and parental education variables

The contribution of these factors to the Piagetian scores was considered, in order to determine whether they accounted for some of the variance. If these were found to contribute, this would confuse the relations between these scores and aspects of autonomy.

3.3.1 Gender

This factor is commonly inspected in research, since it contributes to differences on a number of psychological variables. Differences between the mean scores for boys and girls, on both the overall and component scores of the Piagetian Inventory, were therefore analysed using t-tests. None of the

differences between mean scores reached significance.

3.3.2 Age

Age is clearly related to cognitive development, due to the sequential nature of the stages. Since there was a reasonable age range in the sample (6.1 - 7.8 years), it was necessary to examine whether this was contributing significantly to the variance in the scores on the Piagetian Inventory. Single correlations were therefore performed between the variable of age and the overall and component scores of the Piagetian Inventory.

On the whole these correlations were very low, except for an anomalous significant negative correlation with the matrix component of the Piagetian Inventory ($r = -.38$, $p < .05$). This result seems difficult to interpret, until the correlations of the components with the overall Piagetian scores are inspected.

All except one of the components of the Piagetian scale correlated highly with the overall Piagetian score (p ranging from $< .05$ to $p < .001$). This is to be expected, since all the tasks require the operations of reversibility and compensation, which are aspects of thinking characteristic of the concrete operational stage. However, there was a very low intercorrelation with the matrix component ($r = .08$). This suggests that the scores on this test were affected by variables other than the ability to use concrete operations. This could be attributed to random variation, caused by a tendency for some of the children to rely on guessing. Since the test uses a multiple choice format, these children would then have a 25% chance of choosing the correct response. However, children who attempted to solve the problems on the basis of judgement, but were incapable of the necessary operations, would select an incorrect answer. It may be that more of the younger children relied on a guessing strategy than did older children. This component of the Piagetian Inventory will therefore not be analysed separately.

3.3.3 Parental educational level

Parental educational level has been shown to exercise an important effect on the child's I.Q. and scholastic performance. This effect has been hypothesized to be either the result of differences in the home environment (Laosa, 1982; McGowan, 1985), or due to hereditary differences (Rutter, 1985). Simple correlations were therefore computed to explore the possible influence of this factor. For this purpose, children were given scores reflecting parental educational level, by assigning a score of 1 for each parent who had a Std. 9 - 10 education, and a score of 2 for each parent who had a post-matric education. In this way, a range of scores from 0 (both parents < Std.9 - 10) to 4 (both parents > Std. 9 - 10), was derived. This was considered to be a satisfactory ranking of data for a correlational analysis.

Only the correlation between the overall scores and parent education reached statistical significance ($r = .42$, $p < .05$). This result, however, implies that level of parental education does have a significant influence on the child's overall attainment of concrete operational thinking. This variable therefore needs to be considered for the stepwise multiple regressions.

The correlations between this variable and aspects of autonomy were next inspected, in order to explore the possibility that the effect of this factor was mediated through its influence on aspects of autonomy. A significant correlation with the TRS of Autonomy was evident ($r = .50$, $p < .01$), but no associations were found with other aspects.

3.3.4 Summary

- (a) It appeared that only the factor of parental educational level had any real influence on the Piagetian tasks. This variable will therefore be analysed in the stepwise multiple regressions.
- (b) Parental educational level was also associated with the TRS of Autonomy.
- (c) The analysis of the effects of age on the scores highlighted the problems with the matrix component. This component will therefore not be

analysed separately.

3.4 Relations between aspects of autonomy and overall Piagetian scores:

Stage 1

The linkages between aspects of autonomy and overall Piagetian scores, which are the main focus of this study, were first explored through simple correlations, in order to provide a preliminary understanding of these relations. The results are presented in Table 2.

TABLE 2

Correlations between overall Piagetian scores
and aspects of autonomy

Aspects of autonomy	r
TRS of Autonomy	.39*
Peer Press	.16
Self-help eating	.39*
Self-help dressing	.49**
Occupation	.05
Locomotion	.28
Communication	.38*
Socialisation	.26
Self-determination	.06

Note. N = 30.

* p < .05. ** p < .01

Four aspects of autonomy correlated significantly with the overall Piagetian scores. These were: TRS of autonomy ($r = .39$, $p < .05$), self-help eating ($r = .39$, $p < .05$), self-help dressing ($r = .49$, $p < .01$), and communication ($r = .38$, $p < .05$). This indicates that, when considered separately, (a) autonomy in learning situations in the classroom, (b) self-reliance in caring for needs as regards eating, (c) self-reliance in dressing or bathing, and (d) interest and initiative shown in exercising the skills of reading and writing, are associated with areas of concrete operational thinking.

3.4.1 Summary

There is support for the hypothesis of a linkage between aspects of autonomy and concrete operational thinking.

3.5 Relations between aspects of autonomy and overall Piagetian scores: Stage 2

These linkages were then examined through a stepwise multiple regression. This analysis served to provide some idea of the overall contribution of different aspects of autonomy, and possibly parental educational level, to the Piagetian scores. The analysis also enabled an evaluation of the significance of the unique contribution of each of these factors to the scores; or, in other words, an assessment of which of these different factors helped to additionally explain the variance of the scores. The criterion level for retaining variables in the regression was set at the $p < .10$ level. These results are presented in Table 3.

TABLE 3
Stepwise multiple regression with overall
Piagetian Inventory scores

Aspects of autonomy			
	Self-help dressing	TRS of Autonomy	Locomotion
R ²	.24	.35	.43
F(Change to R ²) ~	8.88**	4.35*	3.91+
F(Regression) =	8.88**	7.14**	6.58**

Note. N = 30.

+ $p < .10$. * $p < .05$. ** $p < .01$.

~ F score to determine significance of the addition of the new variable to the regression.

= F score to determine significance of the overall regression equation.

It can be seen from this, that the three variables which were entered into the regression, together accounted for 43% of the variance, which is significant at $p < .01$. This indicates that a number of aspects of autonomy were significantly associated with areas of concrete operational abilities.

The aspects of autonomy which made a unique contribution to the variance, were self-help in dressing and bathing ($p < .01$), and the child's autonomy in the classroom ($p < .05$). There was also a tendency for a contribution from the locomotion category of the Vineland Scale, which is concerned, at this level, with travel outside the home ($p < .10$). These results indicate that

the first two variables, and possibly the third, are associated with areas of concrete operational thinking.

It is noteworthy that the locomotion variable did not have a significant single correlation with these scores. Furthermore, in this analysis, neither the self-help eating, nor the communication category, made a significant contribution to the variance in the Piagetian scores, which was not already explained by the above three variables. Similarly, the parent education variable no longer added a significant unique contribution to the variance of the scores.

However, caution must be exercised in generalising these results to the population. The reason for this is the tendency of a multiple regression to inflate the "real" relations of variables, because of the contributions of error variance specific to the sample in the computation.

3.5.1 Summary

- (a) The hypothesis that aspects of autonomy are linked with areas of concrete operational thinking, was again supported.
- (b) The aspects which were most important for concrete operational abilities overall, appeared to be self-help in dressing and classroom autonomy. There was also a trend-level contribution from travel outside the home.

3.6 Relations between aspects of autonomy and the components of the Piagetian Inventory: Stage 1

The linkages between aspects of autonomy and each of the components of the Piagetian Inventory were investigated, in order to explore the specific relations between aspects of autonomy and areas of concrete operational thinking. Simple correlations were computed in order to provide preliminary indications of the nature of these relations. These results are presented in Table 4.

TABLE 4
Correlations between components of Piagetian Inventory
and aspects of autonomy

Components	Autonomy Variables								
	Peer Press	TRIS of Autonomy	Self-Help Eating	Self-Help Dressing	Occupation	Locomotion	Communi- cation	Social- isation	Self- Direction
Quantity	.02	.29	.33 +	.46 **	.14	.19	.36 *	.19	.20
Levels	.37 *	.23	.19	.24	-.25	-.05	.25	.05	-.39 *
Sequence	.03	.19	.06	.39 *	-.15	-.13	.26	-.10	.23
Height	.04	.17	.11	.29	-.14	.19	.23	.22	-.05
Perspective	.00	.21	.24	.23	.18	.31 +	.26	.04	.16
Movement	.20	.39 *	.23	.36 *	.11	.07	.07	.29	.03

Note. N = 30.

+ $p < .10$ * $p < .05$ ** $p < .01$

3.6.1 Quantity

Scores on continuous and discontinuous quantity problems were significantly related to self-help in dressing and bathing ($r = .46$, $p < .01$), and to the communication category ($r = .36$, $p < .05$), which taps initiative in reading and writing skills. There was also a trend towards a relation with self-help in eating ($r = .33$, $p < .10$).

3.6.2 Horizontal levels

Scores on the understanding of the horizontal in liquid levels were significantly associated with the peer press scale ($r = .37$, $p < .05$), which assesses resistance to peer conformity. There was also a surprising negative correlation with the self-determination category ($r = -.39$, $p < .05$), which would imply that a decrease in this aspect of autonomy was associated with an increase in understanding of horizontal levels. The discriminating items in this category involve buying goods from a shop without parental assistance (in many cases in this sample the parent would wait outside the shop). This result however, is obscure.

3.6.3 Sequence

The only significant correlation with scores on this component was the self-help in dressing category ($r = .39$, $p < .05$). This indicates that the child's self-reliance in dressing and bathing is linked to the ability to retain a sequence through a series of changes in spatial orientation.

3.6.4 Weight

There were no significant correlations between aspects of autonomy and this component of the Piagetian Inventory. This suggests that the areas important for the development of the notion of the conservation of weight were not tapped by this study.

3.6.5 Perspective

There was a trend towards an association between the scores on the ability to visualize a scene from different perspectives, and the locomotion category, ($r = .31$, $p < .10$), which is concerned with the degree to which the child moves about independently outside the home.

3.6.6 Movement

Scores on the capacity to work out the positions of a shape through a series of spatial transformations, were significantly correlated with the TRS of Autonomy ($r = .39$, $p < .05$), and with self-help in dressing ($r = .36$, $p < .05$).

3.6.7 Summary

- (a) There were indications that different aspects of autonomy were important for different areas of knowledge.
- (b) A few of these associations, however, are obscure, and it appears that not all relevant areas were assessed in this study.

3.7 Relations between aspects of autonomy and components of the Piagetian Inventory: Stage 2

The linkage of aspects of autonomy and parent education, with the component Piagetian scores, were next investigated through stepwise multiple regressions, in order to evaluate the unique contributions of the I.V.s to these components. The criterion level for retaining factors was again set at

the $p < .10$ level. The stepwise multiple regression conducted for the weight component, which had previously showed no significant single correlations, did not reveal any other significant relations. The same finding applied to the sequence and perspective components, each of which had shown only one notable association, at the significant and trend levels, respectively. These analyses were therefore omitted. The results of the analyses which were retained are presented in Tables 5 - 7.

TABLE 5

Stepwise multiple regression
with Quantity scores

Statistics	Autonomy Variables
	Self-Help Dressing
R^2	.21
F(Change to R^2) =	7.58 *
F(Regression) =	7.58 *

TABLE 6

Stepwise multiple regression
with Levels scores

Autonomy Variables		
Peer Press	Parental Education	Self-Direction
.14	.28	.35
4.39 *	5.18 *	3.10 +
4.39 *	5.11 *	4.71 **

TABLE 7

Stepwise multiple regression
with Movement scores

Autonomy Variables	
TRS of Autonomy	Self-Help Dressing
0.16	0.25
5.13 *	3.56 +
5.13 *	4.58 *

Note. N = 30.

+ $p < .10$ * $p < .05$ ** $p < .01$

- F score to determine significance of the addition of the new variable to the regression.

= F score to determine significance of the overall regression equation.

3.7.1 Quantity

in this analysis, only self-help dressing emerged as contributing a significant proportion to the variance of the scores obtained on this test of continuous and discontinuous quantities ($R^2 = .21$, $p < .01$). This result indicates that the previous contribution of the communication and self-help eating variables can largely be explained by this factor.

3.7.2 Horizontal levels

The peer press scale accounted for a significant 14% ($p < .05$) of the variance of the scores on this test of the understanding of the horizontal in liquid levels. The parent education variable also showed a significant unique contribution to the variance in these scores, though its single correlation with this component had been non-significant. The unique contribution of the self-determination category, which was previously negatively correlated with these scores, dropped to the level of a trend, indicating that some of its contribution was already explained by the other two factors. Nevertheless, this result remains obscure.

3.7.3 Movement

The TRS of Autonomy emerged as the most significant association with these scores ($R^2 = .15$, $p < .05$). The unique contribution of self-help in dressing was diminished to the level of a trend. This reveals that the previous contribution of this variable is partially explained by the TRS of Autonomy. The implication of these results is that autonomy in the classroom is significantly associated with scores on the understanding of spatial transformations of shape, and that self-help in dressing and bathing shows a tendency to a linkage with performance on this component.

The results of the above analyses must again be interpreted with caution, as they probably reflect inflated estimates of the "real" relations in the population.

3.7.4 Summary

- (a) There were again indications of specific linkages between aspects of autonomy and areas of concrete operational thinking.
- (b) Though the relative importance of each of the variables was clarified, a few of the associations remain obscure.

SECTION FOUR: DISCUSSION

The purpose of this study was to examine the relations between aspects of autonomy and concrete operational thinking, as a contribution to an understanding of variations in cognitive development within a Piagetian framework. The results of the exploratory investigation pertain both to the nature of autonomy itself, and to its linkage with concrete operations. These findings have implications for Piagetian theory.

4.1 Autonomy as a multidimensional variable

Hypothesis 1 stated that autonomy consisted of a number of separate, situationally specific aspects. This was supported by the results of this study, which showed that different aspects of autonomy were generally unrelated to each other. Even similar types of autonomy seemed to be differentiated according to different situations, as shown by the finding that self-help in dressing and bathing was unrelated to self-help in eating. This provides support for Shouval's (1977) suggestion that his different categories of autonomy (obstacle press, trauma press, peer press, parent press) could be even more finely differentiated across different situations and agents.

Autonomy, therefore, seems to be made up of a number of separate dimensions, which are contextually bound. It cannot be viewed as a single trait, but rather as a set of tendencies to behave in different situations with particular degrees of self-reliance or initiative. The possibility exists, however, that certain of these tendencies may habitually occur together, and form distinctive patterns of autonomous behaviours. The fact that some intercorrelations between aspects of autonomy were found, provides tentative support for this.

4.2 Relation between aspects of autonomy and concrete operational thinking

Hypothesis 2 stated that there would be a linkage between some aspects of autonomy and the construction of areas of concrete operational thinking. The results provide empirical support for the existence of linkages between these two areas. The aspects of autonomy which appeared most important in this study for concrete operational thinking overall, were those of self-help in dressing and bathing, and autonomy in learning situations in the classroom. There was also a tendency to a relation with travel outside the home.

An investigation of the different areas of concrete operational thinking provided some clarification of the nature of these relations. Self-help in dressing and bathing was specifically related to knowledge of continuous and discontinuous quantities (quantity), and to the ability to retain a sequence through transformations in spatial orientation (sequence). There was also a tendency to an association between this aspect and the ability to understand spatial transformations of a 2-dimensional shape (movement). Classroom autonomy was related to the movement component, and there was a tendency to an association between travel and the ability to visualize a scene from different perspectives (perspective).

Other aspects of autonomy were found to be specifically related to the horizontal levels component of the Piagetian test. These particular findings are rather obscure. The strongest association with this component was the resistance to peer pressure aspect of autonomy. Whilst it seems that the ability to form independent decisions has important implications for cognitive development, as argued by Kamii and DeVries (1980), it is unclear why the only relation found with this aspect was the understanding of horizontal levels. There was also an inexplicable negative relation with independence in buying goods from a shop. Therefore, explanations of the findings of the present study will be confined to the self-help dressing, classroom autonomy, and travel aspects of autonomy, which show clearer evidence of linkages with concrete operational thinking.

A number of tentative explanations can be offered in an attempt to interpret these findings. There are two main groups of explanations, viz., those in terms of the influence of a third factor, and those in terms of direct relations between these two areas.

4.2.1 Explanations in terms of a third factor

As in all correlational studies, it may be that a third variable is

responsible for the finding of both higher levels of aspects of autonomy, and the construction of areas of concrete operational thinking. One possible variable underlying the correlational evidence could be that of parental education. Parental educational level was assessed in the present study as a rough measure of heredity and social class, since these variables are frequently advanced as potential influences on development.

For this factor to act as a third variable, it would need to show an association with these aspects of autonomy, and to make a unique contribution to the areas of concrete operational thinking with which these aspects are related. This was not the case with this data, which indicates that parent education does not form a third variable mediating between these aspects of autonomy and concrete operational abilities. However, it is possible that another home environment factor, unrelated to the measure or range of social class assessed here, does play such a role, or that a more sensitive measure of heredity or maturation would find such a relation.

Though parent education does not appear to play a mediating role in this study, there is evidence of a relation between this factor and classroom autonomy. It is possible to explain this on the basis that parental educational level influences the development of certain attitudes and strategies towards learning, especially in an academic context. This is consistent with Laosa's (1982) hypothesis that the influence of parental educational level on the scholastic achievement of children, is through the transmission of an approach to learning, which had been acquired by the parents in their own school experiences. Therefore, parent education appears to influence some aspects of autonomy, which in turn are linked with concrete operational abilities.

There was also a relation between parent education and one specific component of the Piagetian test, viz., horizontal levels, which was not associated with these aspects of autonomy. It is possible that this relation is through other factors not tapped in the present study.

4.2.2 Explanation in terms of direct relations

An alternative explanation for the findings of linkages between aspects of autonomy and cognitive development, is that they indicate a direct relation between the actions involved in the autonomous activities, and concrete operational thinking. This hypothesis is not unidirectional. Therefore, either a) actions encouraged by aspects of autonomy influence cognitive development; or, b) cognitive development influences levels of autonomy, and thus actions.

(a) There are two possible explanations for the direction - autonomous activities lead to concrete operational thinking:

(i) Firstly, there may be a relation between the specific actions involved in the activities themselves, and the development of areas of knowledge. This implies that dressing and bathing, classroom autonomy, and travel outside the home may themselves provide opportunities for actions from which knowledge can be derived. A number of tentative suggestions as to these actions can be made for some of these aspects.

The acts of dressing and bathing require the coordination of a number of actions around the body, requiring the ability to correctly orient movements or other objects (eg. clothes) to the space represented by the body. These abilities are likely to be important for the sequence and movement components of the Piagetian test. Furthermore, bathing provides the opportunity for the child to experiment with the properties of water, which is a continuous quantity. This experience might be useful for an understanding of the properties of continuous quantity. The tendency of most children of this age-group to play in the bath indicates that such exploration does occur. It is likely that children who bath on their own have a freer rein for such experimentation. This

interpretation is in line with Slone's (1987) research, which indicated that the construction of logical knowledge for a particular area was dependent on physical experience acquired with the content in that domain.

This interpretation seems less applicable to classroom autonomy. It is unlikely that experiences in the classroom themselves have provided the opportunities for the actions on which concrete operations are based, due to the limited school exposure of this sample of children. In addition, Piaget viewed formal education as peripheral to genuine cognitive development, which was conceived of as the progressive construction of cognitive structures through actions, rather than the acquisition of facts and academic skills (Ginsburg & Opper, 1969).

The specific action interpretation can, however, be applied to travel outside the home. The freedom to move around the neighbourhood provides experiences of viewing spatial features from different aspects. In order to find their way children would also need to understand that these features remain constant even when seen from different perspectives, as well as developing the ability to form internal spatial maps of the area. This may account for the tendency to a relation between this aspect of autonomy and the perspective component of the Piagetian test, which requires the ability to visualize a scene from different angles.

- (ii) A second explanation of the direction - autonomous activities lead to cognitive development - is that these activities form part of a group or pattern of autonomous tendencies, which are productive of actions with a strong potential for the construction of knowledge. Self-reliance in dressing and bathing may represent a pattern of autonomies in the home, characterised by an acceptance of challenge. Dressing and bathing could be seen as the major area in

the home in which there are requirements for self-sufficiency, for this age-group, and may thus represent the frontier of challenge to the child's self-reliance and mastery. In this way, self-reliance in bathing and dressing is linked to actions in the world, as a representative of a group of autonomous tendencies in challenging situations in the home.

In the case of autonomy in academic situations, it seems likely that this aspect forms part of a pattern of autonomies involving self-reliance and initiative in learning situations in general, perhaps reflecting a general curiosity about events, and confidence in attempting to understand or master them. The particular association between this aspect of autonomy and the movement component of the Piagetian test, may simply reflect the general importance of autonomy in learning situations for cognitive development, since this component of the test was highly correlated with the overall Piagetian score. Travel outside the home may reflect another group of autonomies, perhaps characterised by initiative and curiosity in the exploration of the environment.

- (b) The linkage can also be explained in terms of the other direction - cognitive development leads to autonomy. It is likely that concrete operational abilities influence the capacity for autonomous behaviours. It is most probable, however, that the relations between aspects of autonomy and concrete operational thinking are interactional, rather than unidirectional. Autonomy is likely to influence cognitive development by encouraging the construction of knowledge, but simultaneously cognitive development makes new forms of autonomy possible. On the basis of the present exploratory study no decision can be made about the direction of development, or the applicability of particular explanations.

In sum, it can be concluded that there is a link between autonomy and

cognitive development, but that these relations do not allow of clear interpretation. Nonetheless, each explanation offered above, except perhaps for the third factor interpretation, is consistent with Piagetian notions of action and construction. Even the effect of a third factor can be encompassed within this framework if it is viewed as playing a role in the development of autonomy, which in turn influences cognitive development. Moreover, the findings of specific linkages between aspects of autonomy and areas of concrete operational thinking, provide further evidence for the multidimensionality of autonomy, and support Slone's (1987) findings referred to earlier, that the development of operational knowledge about an area depends upon specific experience with that content. It appears that autonomy, being situationally specific, influences different areas of experience, which in turn influence the construction of knowledge about the physical contents of that area.

4.3 Limitations of the study and suggestions for further research

The small size of the sample, and statistical considerations, necessitate caution in generalising the specific results to the population. Therefore, the particular relations found, and interpretations offered for them, should not be viewed as definitive, but rather as suggesting areas for future research. The aspects of autonomy covered in the present study were also by no means exhaustive; this was demonstrated in the failure to find significant relations with the weight component of the Piagetian Inventory, which indicates that not all aspects of autonomy potentially important for different areas of knowledge, were tapped. Therefore further research would need to explore a greater breadth of autonomy.

It would be interesting in particular to investigate autonomy in informal learning situations such as exploration and play. Though the child's daily activities and play with peers were considered in the occupation and socialisation categories of the Vineland test, these were concerned only

with the extent of children's participation in certain activities, rather than with their approach to these activities (as was done in the Teacher Rating Scale of Autonomy). The category also consisted of a number of disparate items, eg., drawing, using skateboard/skates/bicycle, household tasks. The findings of the present study, however, indicate that autonomy varies situationally; therefore it would seem most appropriate to differentiate finely between activities in further investigations. This suggests that aspects of autonomy need to be explored in greater depth, in terms both of analysing the subtleties of the child's approach to situations, and of considering more differentiated aspects of autonomy.

Another aspect of autonomy which seems to warrant further attention is that of the child's autonomy when faced with obstacles. Though this aspect was assessed in the present study using a sentence completion test, methodological problems discussed in the previous section led to its omission. The disappointing relations found with the resistance to peer pressure factor, which is part of the same test, may also be partly attributable to similar methodological problems. It would therefore be interesting to further investigate this aspect as well.

The methodological problems encountered in the present study, raise a number of issues regarding an appropriate methodology for investigating aspects of autonomy. The previous discussion indicates that future research needs to have both greater breadth and greater depth. Though cost-effective, the problems with a self-report methodology, as well as the limitations of quantitative methods such as rating or interview scales, suggest that more qualitative methods of investigation would help to address this need. This suggestion is supported by research from other areas (Lea, 1986), where it was found that qualitative analyses complemented quantitative measures.

It is suggested that a potentially fruitful approach for all future research into the relations between aspects of autonomy and cognitive development, would be to explore the possibility of patterns of autonomies. This approach

resembles that of attachment theorists (Ainsworth et al, 1978), who are concerned with categorical differences in attachment, rather than quantitative "amounts" of attachment.

The findings of the present study cannot necessarily be generalised to other age-groups, since developmental trends in autonomy have been demonstrated (Steinberg & Silverberg, 1984). A number of the findings are probably specific to this development level. It is unlikely, for instance, that autonomy in dressing and bathing will be of importance for the cognitive development of older children. Future research could therefore attempt to establish the particular aspects of autonomy important for cognitive development, at different developmental levels.

4.4 Implications for theory and practice

Despite the limitations of the present study, it does demonstrate the existence of relations between aspects of autonomy and areas of knowledge, which can be justified and interpreted within a Piagetian framework. From a broader perspective, the study indicates that it is possible to formulate an understanding of individual differences in cognitive development which is consistent with concepts central to this theory - that of the construction of knowledge through experiences in the form of actions. It also suggests that a focus on factors influencing this construction is a potentially most useful approach to explaining variations in the rate of cognitive development. These factors can be integrated into a revision of Piagetian theory, which remains consistent with its central concepts. This has important implications for an evaluation of Piagetian theory, since it is necessary for a theory of development to account for both variations and universals.

These conclusions are in line with recent neo-Piagetian research, which has increasingly focussed on the study of non-universal features of cognitive

development. Lautrey et al (1987) were concerned with the phenomenon of vertical *décalages*, demonstrating the existence of individual differences in these. They argued that these differences can be attributed to an interaction between situational variations (which would seem to correspond to eco-cultural factors), and individual characteristics. Aspects of autonomy would seem to correspond to the latter category.

Autonomy can also add to an understanding of the influence of social factors on cognitive development. Autonomy can be viewed as forming a mediating variable between the social environment and cognitive development. Certain characteristics of the social environment may influence the child's levels of autonomy in different situations, which would in turn affect their action in the world, and thus cognitive development. An understanding of the role of social influences on the development of autonomy could be incorporated into an eco-cultural framework. This type of model may apply to the factor of parental educational level, as discussed earlier. Though the present study does not provide clear confirmation of such a relation, it seems that this would form another fruitful area for further investigation.

These findings have clinical and pedagogical implications as well. They emphasize the importance of enhancing the child's autonomy in a wide number of situations, for optimal cognitive development. This point has been made by others with regard to education (Ginsburg & Opper, 1969, Kamii & DeVries, 1980). However, it can also be applied to clinical situations, in terms of adding to an understanding of developmental delays, and as offering a potential area for intervention.

- Ainsworth, M.D.S., Blehar, M.C., & Waters, E. (1978). **Patterns of attachment**. New Jersey: Lawrence Erlbaum.
- Anastasi, A. (1976). **Psychological testing**. (fourth edition). New York: MacMillan.
- Baumrind, D. (1967). Child care practices anteceding three patterns of preschool behaviour. **Genetic Psychology Monographs**, 75, 43-88.
- Bowlby, J. (1974). **Attachment and loss**. Vol. I. London: Hogarth Press.
- Buck-Morss, S. (1975). Socioeconomic bias in Piaget's theory and its implications for cross-cultural studies. **Human Development**, 18, 35-49.
- Clements, D.H. (1984). Training effects on the development and generalisation of Piagetian logical operations and knowledge of number. **Journal of Educational Psychology**, 76, 766-776.
- Cole, M. & Scribner, S. (1974). **Culture and thought**. New York: Wiley.
- Dasen, P.R. (1984). The cross-cultural study of intelligence: Piaget and the Baoule. **International Journal of Psychology**, 19, 407-434.
- Datta, L. & Parloff, M.B. (1967). On the relevance of autonomy: Parent-child relationships and early scientific creativity. **Proceedings of the 75th Annual Convention of the APA**, 2, 149-150.
- Feldman, D. (1980). **Beyond universals in cognitive development**. New Jersey: Ablex Publishing Corp.
- Frodl, A., Bridges, L. & Groinick, W. (1985). Correlates of mastery-related behaviour: A short-term longitudinal study of infants in their second year. **Child Development**, 56, 1291-1298.
- Ginsburg, H. & Opper, S. (1969). **Piaget's theory of intellectual development. An introduction**. New Jersey: Prentice-Hall.
- Goodnow, J.J. (1969). Cultural variations in cognitive skills. In D.R. Price-Williams (Ed.), **Cross-cultural studies**. Harmondsworth: Penguin.
- Greenfield, P.M. (1969). On culture and conservation. In D.R. Price-Williams (Ed.), **Cross-cultural studies**. Harmondsworth: Penguin.
- Kamii, C. & DeVries, R. (1980). **Group games in early education. Implications of Piaget's theory**. Washington: The National Association for the Education of Young Children.
- Kreitler, S., Zigler, E. & Kreitler, H. (1984). Curiosity and demographic factors as determinants of childrens' probability-learning strategies. **The Journal of Genetic Psychology**, 145, 61-75.
- Laosa, L.M. (1982). School, occupation, culture and family: The impact of parental schooling on the parent-child relationship. **Journal of Educational Psychology**, 74, 791-827.

- Lautrey, J., de Ribaupierre, A. & Rieber, L. (1987). Operational development and individual differences. In E. De Corta, H. Lodewijks, R. Parmentier & P. Span (Eds.), **Learning and Instruction: European research in an international context**. Vol. 1. Oxford: Pergamon Press.
- Lea, S. (1986). **The impact of the mentally handicapped child upon the parents: A comparative study**. Unpublished Masters thesis. University of Cape Town.
- Maccoby, E.E. & Masters, J.C. (1970). Attachment and dependency. In P.H. Mussen (Ed.) **Carmichaels Manual of Child Psychology Vol. II**. New York: Wiley.
- Maccoby, E.E. (1984). Socialization and developmental change. **Child Development**, 55, 317-328.
- Maloney, M.P., & Ward, M.P. (1976). **Psychological assessment. A conceptual approach**. New York: Oxford University Press.
- McGowan, R.J. & Johnson, D.L. (1984). The mother-child relationship and other antecedents of childhood intelligence. **Child Development**, 55, 810-820.
- Mevarech, Z.R. (1985). The relationships between temperament characteristics, intelligence, task-engagement and mathematics achievement. **British Journal of Educational Psychology**, 55, 156-183.
- Piaget, J. (1970). Piaget's theory. In P.H. Mussen (Ed.), **Carmichael's manual of child psychology**. New York: Wiley.
- Ross, L. (1981). The "Intuitive scientist" formulation and its developmental implications. In J.H. Flavell & L. Ross (Eds.), **Social cognitive development**. Cambridge: University Press.
- Rutter, M. (1985). Family and school influences on cognitive development. **Journal of Child Psychology and Psychiatry**, 26, 683-704.
- Rutter, M. & Cox, A. (1985). Other family influences. In M. Rutter & L. Hersov (Eds.), **Child and adolescent psychiatry (2nd edition)**. Oxford: Blackwell.
- Slone, M. (1987). **Developmental relations between physical and logico-mathematical knowledge**. Paper presented at the Biennial Meeting of the Society for Research into Child Development, Baltimore, April 23 -26.
- Shakespeare, R. (1970). Severely subnormal children. In P. Mittler (Ed.), **The psychological assessment of mental and physical handicaps**. London: Tavistock.
- Shouval, R., Duek, E. & Ginton, A. (1975). A multiple-choice version of the sentence completion method. **Journal of Personality Assessment**, 39, 41-49.
- Shouval, R., Zakay, D. & Halfon, Y. (1977). Autonomy or the autonomies? Trait consistency or situation specificity. **Multivariate Behavioural Research**, 12, 143-157.
- Shouval, R., Shouval, E., Kav-Venaki, S., Sharabani, R. (1984). Ethnic and cultural variations in children's independence by ordinal position and gender. **Individual Psychology**, 40, 3-21.

- Steinberg, L. & Silverberg, S.B. (1986). The vicissitudes of autonomy in early adolescence. **Child Development**, 57, 841-851.
- Strodbeck, F.L. (1958). Family, interaction, values, and achievement. In D.C. McClelland, Baldwin, U. Bronfenbrenner & F.L. Strodbeck, **Talent and society**. New Jersey: Van Nostrand.
- Teevan, R.C. & McGhee, P.E. (1972). Childhood development of fear of failure motivation. **Journal of Personality and Social Psychology**, 21, 345-348.
- Valencia, R.R. & Henderson, R.W. (1985). Family status, family constellation, and home environmental variables as predictors of cognitive performance of Mexican American children. **Journal of Educational Psychology**, 77, 323-331.
- Wichern, F. & Nowicki, S. (1976). Independence training practices and locus of control orientation in children and adolescents. **Developmental Psychology**, 12, 77.
- Yarrow, L.J., McQuiston, S., MacTurk, R.H., McCarthy, M.E., Klein, R.P. & Vletze, P.M. (1981). Assessment of mastery motivation during the first year of life: Contemporaneous and cross-age relationships. **Developmental Psychology**, 19, 159-171.