

**Bangor University**

## **DOCTOR OF PHILOSOPHY**

**Developmental changes in effort and ability understanding, young children's perceptions of their competence and their risk taking behaviour.**

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*Award date:*  
1994

*Awarding institution:*  
Bangor University

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**DEVELOPMENTAL CHANGES IN  
EFFORT AND ABILITY  
UNDERSTANDING, YOUNG CHILDREN'S  
PERCEPTIONS OF THEIR  
COMPETENCE AND THEIR RISK  
TAKING BEHAVIOUR.**

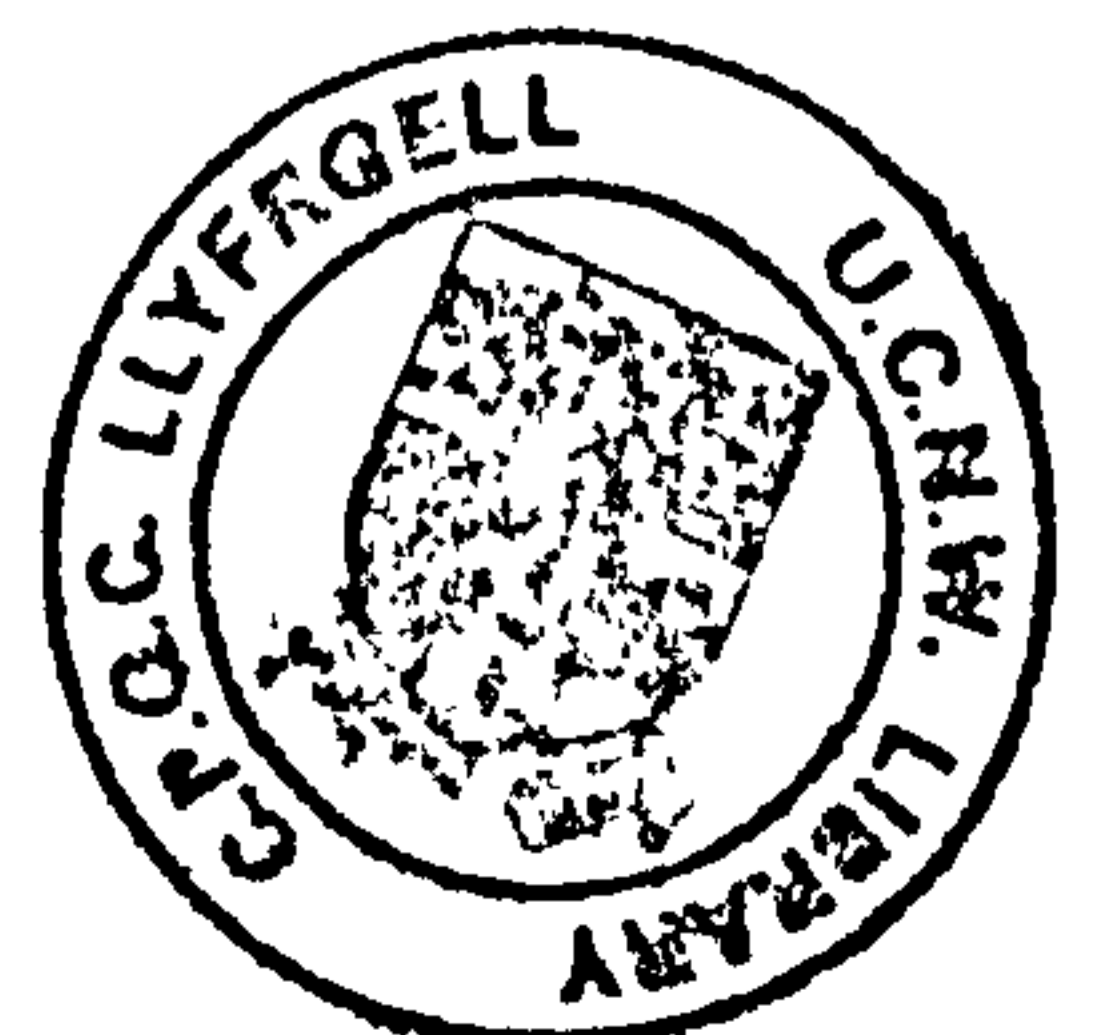
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Thesis submitted to the University of Wales in fulfilment of the requirements  
of the Degree of Doctor of Philosophy at the University of Wales, Bangor.

(September, 1994.)

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*For my Dad.*

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## Acknowledgements

Many thanks are extended to the children who acted as subjects in this thesis, their parents and the staff at their schools. The individuals and organisations who I would like to thank for taking part are as follows: Saturday Morning Movement Group and Pre-school Gym Group (Bangor); Ysgol Cae Top; Ysgol Glannadda; Bethel Primary School; Beaumaris Primary School; Simeon Fawcett, Eleanor Tanner, Beth McAvoy, Simon Rogers and their parents; Y Felinheli Primary School; Deganwy Primary School; Bodfford Primary School; Glan Conwy Primary School; Oldershaw Secondary School; Llandrillo-yn-Rhos Junior and Infants Schools, and members of Menai Bridge Scout Troop. Other subjects whom I would like to thank are various members of the UCNW student population. The input of Terry Williams, Jane Holdsworth and Katherine Salter was also greatly appreciated. For both their practical and moral support, the following people have earned my sincere gratitude and respect: Romy Lawson; Helen Butterworth; Rebecca Denning; Mum, and Karine Jasper. Most of all, I would like to thank Della and John Fazey for their unerring faith in me when my own waned and for helping me not only to work my way through academia but also through life. To prevent this from falling prey to the slushy sentimentality reminiscent of Oscar winners' speeches, suffice to say that I am grateful for all their hard work, humour, individuality and much more.

## Summary

It has widely been presumed that children between the ages of 4 and 6 years do not possess the cognitive capacity and experience to understand constructs such as ability and personal competence. Identifying the aetiology of such understanding is a primary objective of achievement motivation research considering the behavioural implications of these constructs, in relation, for example, to participation level (Roberts, Kleiber & Duda, 1981). Evidence was produced by the present research which challenged some assumptions which have been made about the limitations of children's conceptual understanding and behaviour in the physical domain. Previous research by Nicholls (1978) has indicated that in the academic domain, young children (4-7 years) do not differentiate between effort and ability as causes of outcome. He suggests that children only gradually differentiate between these two constructs to employ ability in their verbal explanations at a later age. When Nicholls' (1978) protocol for assessing this conceptual development was employed in the physical domain, using children aged between 4 and 13 years, current investigations revealed the same developmental trajectory. However, when effort cues were removed, children aged between 4 and 6 years used ability as a referent in relation to academic but not physical tasks. Contrary to previous assumptions, this suggests that young children may perceive effort and ability as discrete constructs and that some children are able to verbalise their beliefs about academic ability from an early age. Their beliefs, or their capacity to verbalise these beliefs, appears to be specific to the domain under consideration. This, and other findings which are described below, support current suggestions that behavioural indices are more appropriate than verbal, interview based methodologies for assessing young children's conceptual understanding. Behavioural measures do not require the child to verbalise their beliefs, a capacity which does appear to be limited, particularly in relation to physical tasks. Interpretational differences by individuals at different developmental levels may also be ameliorated by the use of behavioural measures. Both Fogel & Thelen (1987) and Piaget have suggested that behavioural measures can be used to identify change. In the present research a behavioural measure was used to indicate the stability of different levels of effort and ability understanding. Attempts were made to relate stability of conceptual developmental stage to behavioural stability on a motor task, based on the theoretical proposals of, for example, Fogel & Thelen (1987). These authors suggest that developmental phenomena exhibit alternate periods of stability and instability which is mirrored in, and can be measured by, stability of the individual's behaviour during different developmental stages. Perhaps due to factors such as insufficient sensitivity of the method employed to detect these feasibly small shifts in stability, only limited evidence was produced to support the proposal that effort and ability understanding demonstrates alternate periods of stability and instability. However, this experiment did lead to further investigations of the behaviour of children between 4 and 6 years of age when they were offered rewards for successful performance attempts on a motor task. Findings contradicted previous assumptions made about the maturity of young children's achievement related behaviour. When fixed payoff rewards were used to increase the saliency of young children's performance outcomes their behaviour suggested an increased awareness of, and capacity



to, assess their own competence level. Subsequent investigations which examined young children's task related behaviour when they were offered variable payoffs as rewards also revealed more advanced behaviour than would be suggested by previous research. In this context, young children could provide behavioural estimates of their perceived competence which were accurate and could select levels of task difficulty which offered them realistic levels of challenge. This behaviour suggested an understanding of the competence required to achieve success on tasks of varying degrees of difficulty and whether or not their own competence matched these required levels. These children also seemed to understand the incentive value, and their probability, of succeeding on different levels of task difficulty. It appears that, given certain circumstances, young children can: employ ability related explanations for performance outcomes; accurately assess their own competence, and appropriately use task related information to adopt personal levels of challenge which are compatible with their own level of task competence.

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## **Introduction**

The main issues which are investigated in this thesis are the developmental changes involved in effort and ability conceptualisation and methodological concerns about the measurement of young children's perceptions of their competence.

Chapter One discusses previous research by Nicholls (1978) which has examined the nature of this conceptual development when children are asked to apply their reasoning to academic tasks. Also discussed in Chapter One are features of development such as multidimensionality (for example, Baltes, 1987) and domain specificity (for example, Fischer & Canfield, 1986) which do not allow direct extrapolation of findings from one domain to other domains (for example, from the academic to the physical domain). The present research is concerned with children's application of this conceptual understanding to physical settings. However, the multidimensional and domain specific nature of development does not permit Nicholls' (1978) findings in the academic domain to be used directly to explain how children apply their knowledge of these concepts to performance outcomes on physical tasks. Empirical assessment was required to determine the developmental changes involved when children were asked to apply their conceptual understanding to physical tasks. Chapter Two describes an experiment which investigated the nature of this conceptual development when children were asked to discuss these concepts in the context of physical tasks. The methodology employed was based on Nicholls' (1978) protocol (which is described in more detail in Chapters One and Two) but adapted to use physical tasks. To explore the developmental changes in this conceptual understanding, children from a range of chronological ages were interviewed and the results from this study were compared with those from Nicholls' (1978) original study. This comparison revealed that effort and ability understanding demonstrates similar developmental trajectories when reasoning is applied to academic and physical tasks. Although the same general trends were evident, results of this experiment indicated that Nicholls' (1978) finding that very young children equate effort with ability may not be the only available explanation for their beliefs about these concepts. Their equation of effort and ability may instead be an artefact of the explicit effort cues with which young children are presented during this method of assessment, coupled with the emphasis which is placed on effort in their day to day environment. Furthermore, some young children's interview responses indicated that they may not interpret questions about ability in the same way as do adults. Reported in Chapter Two are experiments in which children aged

between 4 and 6 years were asked to explain performance differences on academic or physical tasks when effort cues were removed and interview questions did not explicitly refer to ability. Subjects were able to cite ability related factors as explanations for performance differences on academic but not physical tasks. However, in neither context did children cite effort as an explanation for different performance outcomes. Results of these studies indicated that in relation to academic and physical tasks, young children's apparent equation of effort and ability may not accurately reflect their beliefs about these concepts. Their equation of effort and ability may be a response to the cues presented to them by the methodology employed to assess effort and ability understanding. Where physical tasks are concerned, young children appear to possess a limited capacity to verbalise ability and possibly to conceptualise this construct. These limitations of both methodologies and children's verbalisation are investigated towards the end of the thesis and will be discussed in more detail further on in this introduction. Results from this study provided direct evidence concerning children's use of effort and ability as outcome explanations. Using these findings, suggestions were then made about how young children perceive the meaning of ability.

Prior to the investigation of these methodological and verbalisation issues, the thesis maintains its focus on effort and ability conceptualisation but examines this understanding from a somewhat different perspective. Having established the developmental pattern of effort and ability understanding which is exhibited when children apply their knowledge to physical tasks, this continuum of understanding was examined from a number of theoretical perspectives. In Chapter Three, various developmental theories are discussed, which, although demonstrating different aetiologies, present similar approaches to the nature of developmental change. These theories share one common feature which is most pertinent to the present research. They describe development as a series of alternating periods of stability and instability, proposing that the development of novel, more advanced states occurs as a result of experienced periods of instability.

Thelen (1989) suggests a method of addressing this issue in general and it is this method which was employed in the current thesis. She suggests that the stability of individuals' behavioural responses to experimentally induced perturbations from the norm provide an

indication of the stability of their developmental stage. A stable developmental phase is indicated by stable responses within the individual and within the group. During unstable phases, behavioural responses demonstrate less stability and mean responses deviate from those exhibited during stable phases. Chapter Four describes an experiment which utilises this hypothesis to explore whether or not this approach can be employed to measure the development of effort and ability understanding using behaviour as an index of stability. The experimental disruption administered was in the form of manipulated performance information on a perceptual motor task which children representing all levels of this conceptual development played. Their behavioural responses to the disruption were indicated by their choices of task difficulty level following this disrupted performance information.

*A priori* proposals were made about the stability of different developmental stages of effort and ability conceptualisation by considering the stability of the child's schema throughout different levels of this conceptual understanding. As a result, it was proposed that levels one and four represent stable stages of this continuum whereas levels two and three represent an unstable stage. How these proposals were determined is described in detail in Chapter Three. As Chapter Four discusses, only limited support was provided for these proposals. Although not conclusively demonstrated, children from levels one and four did exhibit greater stability of behavioural response than those from levels two and three. Some incongruencies between actual and expected results were revealed which are discussed in more detail in Chapter Four and later in the thesis in relation to other findings.

One incongruence which was investigated further was the behaviour of children who had reached only level one of effort and ability understanding. Although their behaviour exhibited the pattern which was predicted, its intensity did not result in statistical analyses reaching traditional levels of significance. It was suggested that this result reflects young children's inconsistent regard for the outcomes of their previous performance attempts when making decisions about their future courses of action. Therefore an investigation was carried out to examine the effects on approximately 5 year old children's behaviour of increasing the salience of their previous performance attempts. The experimental disruptions used in the previous experiment were administered but children were also



offered sweets as a reward for successful performance attempts. This reward was expected to increase the children's awareness of their previous performance attempts and subsequently make the relative success and failure of previous performance outcomes salient to them. Results of this experiment indicated that children's behavioural response to experimentally disrupted performance information does demonstrate change when performance outcomes are made salient, compared with when they are not. Of greatest interest was the finding that even when performance information indicated that success could be easily achieved, these children appeared unwilling to select challenging levels of the task (as a similar group had done previously when performance outcomes were not made salient) if there was a risk of losing the reward which was offered. The children's behaviour also suggested that they possessed fairly accurate perceptions of the competence required for successful completion of different levels of task difficulty. Such knowledge seems likely to be accompanied by an understanding of personal level of competence. As a result, it was then decided to further explore young children's risk taking behaviour whilst simultaneously examining the methodological and verbalisation issues discussed previously. These latter issues were examined in relation to the accuracy of young children's perceptions of their own competence. Irrespective of its inherent interest, this phenomenon appears to provide an ideal vehicle by which to address problems associated with methodology and young children's capacity to verbalise ability related constructs. Chapter Five presents a review of literature and research which discusses various issues concerning the nature of young children's perceptions of their own competence. Theoretical approaches to risk taking behaviour and research which has examined this behaviour are then considered in Chapter Six.

Subsequent to this discussion, the following proposals were made concerning these phenomena. It was firstly hypothesised that when young children are offered variable payoffs for successful task performances they will exhibit more realistic risk taking behaviour on a perceptual motor task compared with children who are not. A variable payoff system is one which provides increasing amounts of reward as the difficulty level of the task increases. Realistic risk taking behaviour is indicated by the selection of tasks which are appropriate for the individual's ability level and which present them with an optimal level of challenge. Variable payoffs increase the individual's awareness of the incentive value of success and provide opportunities to assess competence in relation to task difficulty. By offering this system of reward, it was expected that young children

would employ the information provided about personal competence, task difficulty, and incentive value of success to select tasks which presented optimal levels of challenge and which indicated realistic levels of risk taking.

Two factors were expected to lead to greater accuracy of competence estimates in the reward than the non reward group. Behavioural indices of perceived competence were expected to eradicate the problems of construct verbalisation and interpretation which are encountered when verbal measures are used with young children. A variable payoff system provides the children with an incentive to accurately assess their competence. They must choose levels which match their own competence in order to maximise the amount of reward they receive. Empirical work which examined these hypotheses is described in Chapter Seven. According to expectations, but counter to many previous findings about young children's capacity to be realistic about their competence, when offered variable payoffs, young children demonstrated realistic risk taking. Furthermore, the variable payoff system, combined with a behavioural index of perceived competence, revealed that children are able to accurately assess personal competence in this situation.

The main findings from this final experiment were as follows: young children will select optimal levels of personal challenge and demonstrate realistic risk taking behaviour when they are offered variable payoffs for successful task performances, and when behavioural measures are combined with an incentive to accurately assess competence, young children will provide accurate estimates of their own competence on a perceptual motor task. This last finding addresses the methodological concerns mentioned previously. It appears that methodologies which require young children to verbalise their beliefs may not be wholly appropriate. Due to their limited capacity to verbalise their beliefs, behavioural measures may be more suitable when assessing young children's understanding of the construct of ability and their personal competence level.

The final chapter, Chapter Eight, provides an overview of the areas with which this thesis is concerned and empirical investigations which addressed these concerns. Following this,

the findings of these experimental endeavours are briefly presented, as are the theoretical premises on which they were based. A suggestion is made in this discussion that young children's understanding of issues such as task difficulty, ability and personal competence are more advanced than previous work has indicated. Possible implications of these empirical findings are then discussed. For instance, these findings indicate that the suitability of methodologies which are used to assess young children's conceptual understanding should be examined. The present findings also support the statements of authors (such as Baltes, 1987) that the domain specificity of methodologies is an imperative consideration. Such comments are made pertinent when the findings from experiments two and three are considered. These studies indicated that young children's understanding of ability in relation to outcome and effort expenditure demonstrates domain specificity.

Finally, Chapter Eight suggests possible avenues of future research which have emanated from these findings. Such directions include: a more thorough examination of the domain specificity of young children's beliefs about ability; an examination of whether or not stages of effort and ability understanding exist further to those identified by previous research as current findings indicate may be the case; an assessment of the efficacy of employing behavioural measures to explore young children's conceptual understanding, and, using a different approach from that adopted in the present thesis to investigate whether or not different stages of effort and ability understanding demonstrate differential degrees of stability as the present thesis suggested.

**CHAPTER ONE.**

***DEVELOPING CONCEPTUALISATIONS  
OF EFFORT AND ABILITY.***

### **1.1.1. Introduction**

Effort and ability are seen as influential causes of success and failure by both Heider (1958) and Weiner (1972; 1974). Although an individual's concepts of effort and ability remain the same regardless of whether reasoning is applied to the self or to others (Nicholls & Miller, 1984), developmental changes in the meaning and implication of ability have been observed. Nicholls (1989) sees these changes in conceptions of competence as the crux of understanding achievement motivation. Changing conceptions of ability, difficulty and associated concepts should subsequently result in changes in achievement affect and behaviour (Nicholls, 1978). Ability has been defined by Nicholls (1978) as a reference to someone's current capacity but we can only use observed task performance to assess ability if optimal effort has been exerted. Hence, effort and ability are logically interdependent concepts (Nicholls, 1978) and cannot be studied in isolation from each other. Before 11/12 years of age, children are unable to conceptualise ability as a capacity, a phenomenon which will receive further consideration in the following section. Nevertheless, children as young as 2 are able to understand that individuals possess the means to produce successful or unsuccessful outcomes (Nicholls, 1989). Moreover, by 5 years of age, most children recognise that in a competitive context, only one person can win.

### **1.2.1. Developing conceptualisations of effort and ability in the academic domain**

Investigations which have examined the development of children's understanding about effort and ability concepts have mainly focused on children's applications of their knowledge to academic tasks. Initial research by Kun (1977) revealed indications of the developmental changes which are involved in the child's understanding of effort and ability concepts. She demonstrated that first grade children infer higher effort input when ability levels are presented as high, and *vice versa*. Third graders on the other hand infer less effort expenditure when outcomes are said to be the result of high rather than low ability. However, as Nicholls (1989) suggests, such research findings may indicate whether children generally associate effort with ability and not how they perceive the meanings of these constructs. Nicholls (1978) extended Kun's (1977) investigation by

systematically examining changes in children's conceptualisations of effort and ability over a cross-section of chronological ages. Within a causal framework, Nicholls (1978) examined the development of this reasoning, revealing that this conceptual development involves movement through four hierarchical levels. A description of his method of investigation follows.

Subjects between 5 and 13 years of age were shown three films, each depicting two children in a classroom working on an academic task. One of these children worked continuously throughout, whereas the other child, although not displaying disruptive behaviour, worked intermittently. They were both said to score 10 out of 10 in the first film and 2 out of 10 in the second. However, in the third film, the child working continuously and the child working intermittently were said to score 2 and 8 out of 10, respectively. After each of the films, the following set of questions was asked about the models, which, although standardised, was amended in response to the subjects' answers.

- (1) Was one working harder or were they working the same?
- (2) Is one cleverer or are they the same?
- (3) How come they got the same when one worked hard and one didn't? [For film three: How come this child scored more but didn't work as hard?]
- (4) If they both worked really hard, would one get more than the other or not?

Duda (1987) and Nicholls (1978; 1989) summarised the levels of reasoning which the children's answers to the above questions revealed. These levels are presented below.

**Level 1 (4-6 years):**

During this period, children are unable to differentiate between the concepts of effort, ability and outcome. Focusing on either effort or outcome, the young child believes the focus of their attention to be synonymous with ability. Explanations

for outcomes are tautological. Regardless of outcome, higher ability is inferred from a higher effort input and similarly, irrespective of observed effort expenditure, more effort input is inferred when success level is high. An enduring belief in the capacity to succeed and exert personal control over outcomes ensures a period of psychological security for these children. Evidence of this is seen in the optimistically exaggerated perceptions of competence found in young children (for example, Harter & Pike, 1984), a finding which is questioned in Chapters Five and Seven of this thesis. Nicholls (1989) suggests that these competence perceptions are maintained in part by the child's inability to conceptualise ability as a capacity.

This description of the young child's beliefs about effort and ability mirrors Lewis' (1994) comments that the young child's construals are widely recognised as illogical, constrained by content and context, idiosyncratic, and subjectively determined. Similarly, Kagan (1984) suggests that the child's interpretation of the meanings of constructs are always subjective and unconventional. However, Freyd (1983) claims that when children construct a verbal response relating to their beliefs, the meanings of concepts are altered to make "objective sense".

### **Level 2 (7-9 years):**

Effort and outcome are now linked as cause and effect, a feature which distinguishes level two from level one reasoning. Moreover, effort is believed to be the major cause of outcomes. As such, if the effort expenditure of two individuals is equal, resulting levels of success are also expected to be equal. Differences in achievement gained through equal amounts of effort input are commonly attributed to compensatory or misapplied effort. Although not yet employed as a causal referent, individual differences in ability are acknowledged at this level. For example, children are able to recognise that, in comparison to another, the harder working, lower achiever is the less able of the two. Although he asserts that children at level two do not perceive ability as a current capacity, Nicholls (1978; 1989) lacks clarity on the issue of how these children do perceive ability. It is apparent that they do acknowledge individual differences in ability as they are able to correctly classify individuals in relation to their effort expenditure and level of success.

Although they recognise

..the reality of the situation.. (Nicholls, 1978, p. 812),

these children do not use the concept of ability *per se* to explain equal outcomes gained through unequal effort input. However when Nicholls writes about this issue in later works, for example, 1989, he pays little attention to the question of how the child at this level of understanding conceptualises ability. His sole focus is on the way in which the child perceives the relationship between effort and outcome. It appears that Nicholls' (1978) earlier writing provided some indication that these children recognise the existence of ability and individual differences in ability but in his later writing (1989) he affords this question scant consideration. This is therefore an issue of contention, the only firm evidence which can be presented is that these children do not conceptualise ability as a current capacity in the same way that older children do.

### **Level 3 (9-10 years):**

Children no longer believe that effort expenditure is solely responsible for performance outcomes, and they now intermittently attribute performance outcomes to ability. As a result, these children are able to partially differentiate between effort and ability as outcome determinants. At this level, Nicholls (1989) believes that, unlike in previous levels, the child now sees ability as a current capacity, for example, being faster or smarter. This understanding is characterised by the knowledge that high ability can compensate for lack of effort whilst low ability limits the effects of effort expenditure on the level of a performance outcome. However, such principles are not yet systematically applied, for instance, the child may still assert that equal effort input will result in equal outcomes although previously they used ability related statements. It appears that Nicholls (1978; 1989) proposes that a huge cognitive change takes place in the transition from level two to three. In Nicholls' (1978; 1989) terms, the individual advances from possessing a limited understanding of the existence of ability and its influence on the outcome of a performance attempt, to the belief that ability is a current capacity, although this reasoning is, as yet, not consistently applied.



**Level 4 (11/12 years onwards):**

Individuals can now completely differentiate between effort and ability as outcome determinants and recognise that ability is a capacity. Such comprehensive understanding of how the interactional relationship between effort and ability influences performance outcomes allows systematic application of these principles. Children at this stage of reasoning realise that if high, ability enhances the effects of effort on performance, and if low, limits this effect. When success is gained through little effort, an inference of superior ability is made.

Werner (1957) has proposed a principle of development known as the orthogenetic principle. This principle describes development as a progression from relatively global and undifferentiated states to states which display increasing differentiation, articulation and hierarchic integration. The developmental progression of effort and ability understanding which Nicholls (1978) describes appears to follow this principle. The reasoning exhibited throughout this continuum also demonstrates the pattern of cognitive development described by Piaget. According to Crain (1992), Piaget defined four stages of general cognitive development: sensorimotor; preoperational; concrete operational and formal operational. All individuals do not necessarily experience these stages at exactly the same chronological age but they do progress through them in a universal, invariant sequence. Each stage represents a general pattern of thought which is qualitatively different from that displayed in the remaining stages. To a certain extent, knowledge of the child's present developmental stage allows us to predict their behaviour on a variety of tasks. These predictions are limited however by the fact that individuals can reach different developmental stages in different areas at the same time, a phenomenon which Piaget referred to as *décalage* (see section 1.3.1. on multidimensionality-page 15- for further comments on this and related concepts).

Before approximately 7 years of age, children's thinking is described by Piaget as preoperational. They are able to use symbols, for example, words and gestures, and internal mental images but cannot think logically or systematically. Centration

and egocentrism are characteristic of preoperational thought. The former occurs when an individual focuses on one salient feature of an event or object whilst ignoring its other features. For instance, the individual focuses their attention on only one dimension of an object such as its height but does not consider its other features such as depth. Egocentrism is an inability to see events and objects from the perspective of others, or even to realise that others may have a perspective which differs from one's own. During this stage, children will concentrate on what appears to be reality rather than what actually constitutes reality. For instance, when a stick is placed in water, the young child believes it is bent although it was clearly straight before entering the water (Miller, 1993). Evidence of preoperational thought is seen in children's reasoning at level one, in the centration, tautology and egocentricity of their responses to interview questions.

Concrete operational thinking is manifest from around 7 until 11 years of age. Reasoning is now systematic but can still only be applied to concrete, tangible entities. This is exemplified in the ability to comprehend the notion of conservation of matter. Such a focus on concrete entities is seen concerning effort and ability concepts. During Nicholls' (1978) levels two and three, in particular level two, the main feature of the child's schema is effort and other concrete, visible factors such as speed of task completion.

From approximately 11 years of age children enter the formal operations stage. Now they are capable of extending their thinking to the realms of the abstract. They are able to formulate hypotheses, make deductions and reason beyond what exists before them in the present to what is probable and possible. Reasoning of this nature is apparent at level four when the individual is able to comprehend, and cope with, the abstract concept of ability. They can now make ability inferences which follow logical and systematic patterns and take all relevant factors into account.

In general terms, throughout both Piaget's general cognitive developmental stages and Nicholl's continuum of effort and ability understanding, the emphasis moves from the concrete and tangible to that which is abstract and hypothetical.

Children's self-understanding displays the same changing pattern of emphasis, from the concrete to the abstract. Initially, their self-descriptive statements are based on physical attributes and activities in which they participate. With advancing age and cognitive development, these statements refer more to the child's inner, psychological attributes such as personality than to their more observable attributes (Broughton, 1978; Guardo & Bohan, 1971; Keller, Ford & Meacham, 1978; Secord & Peevers, 1974; Selman, 1980).

The child's early focus on concrete events and objects is reflected in the absence of a measurable self-worth construct before 8 years of age (Harter, 1986). During this period children are able to make self evaluations of their cognitive and physical competence. However this takes the form of a general competence factor as the children are unable to differentiate between their competence in the two domains (Harter, 1986). It is possible that the more tangible nature of cognitive and physical competence, in comparison with self-worth, enables them to evaluate this but not general self-worth. Alternatively, the lack of a general self-worth measure could simply be attributed to the young child's inability to verbalise this construct. Further investigation is required into this issue as Marsh, Craven & Debus (1991) claim that self-worth can be measured before eight years of age and that young children are able to differentiate between their cognitive and physical competence.

Although maturational forces, such as the child's general cognitive development, influence the development of effort and ability understanding, the influence of contextual factors cannot be overlooked. A number of theorists emphasise that to understand child development the child must not be considered as a decontextualised organism. For instance, Thelen (1989, p. 92) claims that,

...we cannot define the system removed from the context.

In other words, the child's environment, comprising of varied influences, contributes towards their development. This proposal is encompassed in one of Baltes' (1987) family of perspectives which he refers to as, "Contextualism as paradigm". This perspective suggests that development does not depend only on the individual themselves but on dynamic interaction between the individual, age-graded influences, history graded influences and non-normative influences. No one of these factors takes precedence over the others. Hence, just as the life-span approach to development which is adopted by Baltes (1987) sees plurality and complexity in the nature of development, plurality and complexity in the forces which influence developmental change is evident. Age-graded influences include, for example, cognitive developmental stages, the temporal sequence of which is relatively fixed across all individuals, and age-graded socialisation processes. Within their culture individuals experience these influences at approximately the same chronological age (Hetherington & Baltes, 1988).

Developmental changes in social comparison methods and the type and amount of self-evaluations made by children have been observed. With increasing age, social comparison and self evaluation increase (Butler, 1989; Dweck & Elliott, 1983; Frey & Ruble, 1987) as does the emphasis placed on normative evaluation (for example, Stipek & Tannatt, 1984). Throughout school, the emphasis changes from personal mastery and trying one's best to achieving in comparison with others, for example, Blumenfeld, Pintrich, Meece & Wessels (1982). Such messages conveyed by significant others could affect the child's notions of the role of effort and ability in determining outcomes of performance attempts. Subsequently, the changes in self-evaluation and social comparison use which have been documented may reflect this socialisation process. It is possible that these changes parallel and influence the child's developing conceptualisations of effort and ability. Hetherington & Baltes (1988) refer to this phenomenon as organismic contextualism whereby development arises as a result of interaction between the active, organised individual and its equally active and organised environment (for example, Overton, 1985). This interaction occurs at different contextual levels, for example, the individual themselves, their family and their wider community. Within these different contextual levels, children encounter socialisation processes and individuals which effect these processes. For instance,

the teacher at school and the child's parents and grandparents. Fogel & Thelen (1987) suggest that the information which individuals receive is internally organised so that it can be understood and to maintain an equilibrium between existing knowledge and externally received information. Children are therefore likely to organise effort and ability related information which they receive from significant others to strengthen their present schema about these concepts. Kelly (1955) has discussed the mechanism by which an individual's construction system of events and concepts develops. He proposes that individuals constantly experience both different events and variations of the same event and that the emphasis on different factors within these contexts changes throughout development. Subsequently, the way in which we construe these events and concepts which they involve is continually altered. Therefore the experience of developmentally related events, such as the emphasis placed on normative evaluation and effort could influence the individual's interpretation of these issues and their beliefs about effort and ability.

It is evident therefore that maturational change such as the child's movement through general stages of cognitive development is unlikely to be the only factor which influences children's developing conceptualisations of effort and ability. A likely explanation is that contextual factors, such as the child's social environment and the socialisation processes embodied by their particular culture, influence the developmental changes observed by Nicholls (1978).

### **1.2.2. The importance of effort**

It is evident from Nicholls' (1978) results that effort is the focal point of the young child's schema, representing an indicator of ability level and an influential outcome determinant (Whitehead, Anderson & Mitchell, 1987). Alongside material incentives, effort is a salient factor to the young child (O'Sullivan, 1993) and plays a primary role in their understanding of both self and others' behaviour (Stipek & MacIver, 1989). Previous research has demonstrated this saliency of effort to the young child. Pre-schoolers, from 2.5 years upwards did not accept help when faced with difficulties, instead they chose to increase their own effort input (Heckhausen, 1984). 5 and 6/7 year olds believe that increased effort expenditure can facilitate memory and recall, respectively (Wellman, Collins & Gliberman,

1981; Howe, O'Sullivan & March, 1992). The young child's focus on effort has been attributed to both parental treatment (Kurtz, Schneider, Carr, Borkowski & Rellinger, 1990) and pre-school experiences (Stipek & MacIver, 1989). Parents often convey the impression to their children that effort breeds success and pre-school work is frequently judged by the effort which has gone into producing it rather than by its quality.

Having been revealed as such an influential variable to young children, O'Sullivan (1993) investigated the nature of children's beliefs about effort in the context of metamemory. She showed 25 subjects (mean age of 54 months) drawings of children performing a recall task. These children were portrayed as trying either a little or a lot, or, with facial expressions omitted (to remove effort cues), as working towards either a low or a high incentive prize. The subjects believed that higher incentive and effort expenditure would result in greater recall and that a higher incentive would produce greater effort input. O'Sullivan (1993) then examined whether these beliefs would be reflected in actual behaviour. 34 subjects (mean age of 53.6 months) performed a recall task and were offered either a low or a high incentive prize for successful task completion. More attentional behaviour was observed in the high incentive condition confirming the children's belief that a greater incentive would result in increased effort expenditure. However, their belief that greater effort input would facilitate superior recall did not correspond to actual performance scores on the task. These results demonstrate the young child's firm beliefs about effort, which, due to their naiveté, may not represent reality (O'Sullivan, 1993).

The importance of effort to the developing child has been made apparent by Erikson in stage four of his life-span theory. During this stage, children experience a conflict between industry and inferiority. They begin to learn the skills which their culture values and develop a desire to gain competence in these skills. At the same time, the child discovers that they can derive pleasure from being industrious and working hard towards gaining these competencies. This enjoyment takes the form of satisfaction in the learning of a new skill and the approval and recognition received from significant others. If a sense of industry and competence is not the

result of these efforts, the child is, however, likely to develop a feeling of inferiority and inadequacy.

The emphasis which young children place on effort provides them with a means of protecting levels of perceived competence, a phenomenon succinctly described by Heckhausen (1984, p. 16) as the:

...effort-dependent elasticity of perceived competence.

It is also likely that young children's exaggerated competence perceptions (for example, Harter & Pike, 1984) are maintained by their belief that present effort expenditure can always be increased (O'Sullivan & Joy, 1990).

Following this euphoric period of optimism, children's competence perceptions tend towards a general decline. A logical, though yet to be established, relationship is apparent between developmental changes in perceptions of competence, self evaluation and concepts of effort and ability. Previous research has revealed conflicting results concerning the developmental changes exhibited in children's self-evaluations of their academic competence. Butler (1989); Dweck & Elliott (1983); Frey & Ruble (1987) & Ruble, Boggiano, Flett & Frey (1983) have suggested that this number of self-evaluations made increases with age, as does their positive content (Frey & Ruble, 1987). Moreover, parallels have been proposed between the increase in self evaluative instances and the demonstrated decrease in children's positive self regard (Dweck & Elliott, 1983). In contrast, a developmental decrease in the amount of self evaluations children make has been revealed, as demonstrated by older children's increasing reluctance to engage in verbalised self evaluation (Asher & Renshaw, 1981; Frey & Ruble, 1985). Darley & Goethals (1980) attribute this to feelings of anxiety which emanate from self evaluation as it becomes a more sensitive topic with increasing age.

As the individual's conceptions of effort and ability develop, the individual gradually increases their understanding that ability limits the effects of effort on

the success of performance outcomes. Unlike in previous levels, when level four reasoning is achieved, individual differences in perceived competence are now likely to affect performance levels. Impaired performance is anticipated when perceived competence is low and the concept of ability as a capacity is understood (Nicholls & Miller, 1984). When this concept is fully understood, enhanced competence perceptions result from favourable comparisons with others. For example, by expending comparatively less effort than others yet achieving the same or greater levels of success. However, in appropriate contexts, for example, task involving environments (where the aim is to achieve personal mastery rather than demonstrate superior competence over others), individuals are still able to apply the less differentiated concept of ability (Nicholls, 1984). Although Nicholls (1984) discusses the adult's use of the "less differentiated" concept of ability, no evidence exists to suggest that individuals regress to previous levels of understanding. The Piagetian approach to developmental change proposes that individuals do not regress to previously experienced stages. Nicholls (1978) appears to adopt this approach in his apparent belief that the development of effort and ability understanding ceases once the notion of ability as a current capacity is understood during early adolescence. However, life-span theorists such as Baltes (1987) would propose that development occurs long after the chronological age boundaries which are suggested by many child developmentalists. It is therefore possible that the adult's ability to apply the more or less differentiated concept of ability, depending on the context in which this concept is applied, is a manifestation of a further stage of reasoning about ability and effort concepts, rather than a regression to previously experienced developmental stages. Further investigation is therefore required to ascertain whether the individual's understanding of effort and ability concepts develops beyond the four levels which Nicholls (1978) proposes.

Empirical verification of the adult's use of the less differentiated concept of ability was provided by Jagacinski & Nicholls (1984). They asked undergraduate students to recall situations in which they employed either high or low effort under either task or ego involving conditions. (Task involving conditions emphasise personal mastery and improving on one's previous performance whereas ego involving environments emphasise demonstrating superior performance to others in a relevant normative comparison group.) In task involving conditions, the students judged their competence to be higher and



experienced greater positive affect when success was gained through the application of high rather than low effort. However, under ego involving conditions, the students judged their competence to be higher and experienced more positive affect when they perceived that they had succeeded through the input of little effort. Jagacinski & Nicholls (1984) concluded that, because these adults derived more positive affect and felt their competence was higher when more effort was expended in task involving conditions than in ego involving ones, they had employed the less differentiated concept of ability. It must be noted that under task involving conditions the subjects were not provided with information which allowed them to make comparisons of their own performance with those of others'. Additionally, the efficacy of studies which employ retrospective measures must be questioned as the degree of subjectivity which such studies rely on may be too great to result in conclusive findings.

Although they perceive ability as a capacity and understand that it limits the effects of effort on performance outcomes, adults as well as children attach great importance to effort, as demonstrated by Jagacinski & Nicholls (1990). Whereas children maximise effort input to maintain perceived competence, it was originally believed that adults maintain their perceived competence levels by reducing effort expenditure (e.g. Covington, 1984). Such effort reduction, when faced with failure, would then allow the individual to attribute poor outcomes to low effort rather than low ability. A lack of empirical support for the effort reduction paradigm led Jagacinski & Nicholls (1990) to conduct a series of experiments designed to determine the existence of such a phenomenon. Initial doubts concerning its existence were raised by a preliminary experiment in which adults were asked to imagine they were sitting an IQ test which became progressively more difficult. They were told that previous experience on the test meant they knew at which point they were unable to answer any more questions. Subjects were then asked if they would stop trying at this point in order to avoid appearing unintelligent to others. Even when appearing intelligent was stressed to the subjects, none reported that they would reduce their effort and were astounded at such suggestions made after the experiment.

In subsequent experiments subjects were asked to imagine either themselves or another sitting the test. In this hypothesised context, the individual was observed by either an instructor or peers. Alternatively, the hypothesised individual did or did not receive negative social comparison information (defined as knowledge that own performance will be worse than that of the normative peer group). These studies demonstrated an overwhelming lack of support for the effort reduction paradigm concerning the self, but some support where others are concerned. Subjects indicated that demonstrating effort was more important in the presence of an instructor, suggesting that effort employment is a means of obtaining social approval. However, social comparison did not affect the results and students' unwillingness to reduce effort was evidently not an attempt to appear hard working to others. Therefore no support was provided for this hypothesis.

A new hypothetical scenario was employed to assess whether subjects did not appreciate the implications associated with reducing effort. The advantages of effort reduction were stressed to the subjects: not appearing incompetent to others; being able to focus attention on a more achievable task instead; being able to attribute a poor outcome to low effort rather than low ability. Nevertheless, subjects still only saw effort reduction as a viable option for others and not for themselves.

Perceiving ability as a capacity, these subjects should realise the futility of continued effort if demonstrated ability level is low (see previous discussion of reasoning at level four of Nicholls' (1978) continuum). In spite of this, they chose to maintain effort, and did not demonstrate the behaviour expected from individuals at such a level of conceptual understanding.

A rudimentary flaw exists within the effort reduction paradigm as reducing effort requires the individual to acknowledge a lack of personal competence (Jagacinski & Nicholls, 1990). Protecting competence perceptions is one of the primary objectives of effort reduction. The need to recognise personal incompetence when deciding to reduce effort therefore effectively defeats the purpose of this process.

Jagacinski & Nicholls (1990) do suggest however, that effort is unlikely to be maintained when the individual has withdrawn their commitment to demonstrating competence at the task and when the withdrawal of effort is unconscious (Berglas & Jones, 1978). Support for the effort reduction paradigm would perhaps be revealed in two further contexts. If the investigation were conducted in a real life situation, compared with Jagacinski & Nicholls' (1990) hypothetical scenarios, subjects would have to face the consequences of their actions. The advantages of reducing effort may become more apparent and the subjects' willingness to do so would perhaps demonstrate an increase. In a physical or motor setting, effort and its impact on outcome are more immediately visible to others than in an academic context (See Duda, 1987). Hence, continuing effort when failure is experienced is more likely to result in damaged self-efficacy. It appears quite probable that in a physically oriented context, individuals will withdraw effort in response to failure as an attempt to protect self-efficacy levels. Whether or not children would subscribe to the effort reduction paradigm is still open to investigation as Jagacinski & Nicholls (1990) examined this phenomenon with adult subjects.

### **1.3.1. The multidimensionality of development and the concept of domain specificity**

To date, empirical evidence which pertains to the individual's developing conceptualisation of effort and ability has focused on children's reasoning about academic tasks. The present research is concerned with children's ability to apply this conceptual development within the physical domain. We cannot presume that reasoning about effort and ability concepts in this domain directly parallels that already revealed in academic contexts. Theoretical proposals concerning achievement motivation in these two domains may not demonstrate congruence when the observed differences in the nature of academic and sporting contexts are considered (for example, Duda & Nicholls, 1992). Possible developmental differences between the academic and physical domains need acknowledgement in order to provide individuals with beneficial learning environments.

Duda (1987, p. 136) warns against generalising across the physical and academic domains without sufficient empirical support:

...it would be limiting simply to extrapolate from the academic domain when attempting to understand how children engaged in sports tasks process their competence.

The following quotation from O'Sullivan (1993, p. 396) demonstrates the present specificity of Nicholls' (1978) continuum to the academic domain:

...young children do not differentiate between effort and *intellectual* ability in the same way that adults and older children do (my italics).

In fact, Nicholls (1978, p. 808) suggests that,

...it remains conceivable that a different set of levels might be found if different stimuli were used to elicit reasoning.

The rationale behind independent consideration of competency domains is demonstrated in the following discussion of the concepts of multidimensionality in development and domain specificity.

### **1.3.2. Multidimensionality**

Central to a number of theoretical perspectives (e.g. Baltes, 1987) is the multidimensional nature of development. Multidimensionality is one of the family of perspectives which Baltes (1987) describes as characteristic of his life-span approach to development. It refers to the variation in developmental trajectories which is evident in different domains of competence (Hetherington & Baltes, 1988). The concept of multidimensionality is reflected in Piaget's notion of horizontal *décalage* which proposes that highly and less highly developed structures exist simultaneously, and Erikson's claim that individuals can experience two of his eight life-cycle stages at any one time. Piaget's and Erikson's ideas on the course and mechanisms of development are examined in greater detail in Chapter Three.

Neo-Piagetians such as Flavell (1963), although maintaining Piaget's idea of the existence of general cognitive stages, have adapted some of his proposals so that this theoretical perspective can accommodate both general cognitive developmental stages and individual and domain specific differences. For instance,

Flavell (1963) suggests that general logical structures can be replaced by independently assembled domain specific structures. As a result, developmental changes may be acquired at different chronological ages in different domains, a situation which reflects Piaget's original proposal of horizontal décalage. Lewis (1994) also discusses proposals made by Case (1992), in which Case (1992) claims to reconcile the generality of stages with domain and task specificity. Case (1992) suggests that this issue can be resolved by the existence of individual structures which are designed to solve particular problems and are linked by central conceptual structures. These central control structures are assembled individually within each domain and are constrained only by maturational forces. They represent solutions to loosely related tasks, such as telling the time and reading music in six year old children, and share the same general content of semantics. Case (1992) believes that central conceptual structures are a common unit of analysis for knowledge domains and developmental stages and therefore offer a method of reconciling the notions of generality and specificity. Lewis (1994) however, contends that Case's (1992) proposals do not provide a solution to these issues but offer merely a compromise between two differing perspectives. Experiential, cultural and task factors all contribute towards the individual differences which can be observed in the construction of cognitive structures (Lewis, 1994). Carey (1985) believes that domain specific knowledge is based on the child's experiences with problems in the domain under consideration. As children's constructs of the world are guided by experience, content and goals, these constructs demonstrate considerable diversity. Regardless of this diversity however, the structures which underpin the conceptual content of different domains is universal across these domains (Case, 1992).

That developmental courses vary between domains of competence has already been mentioned, yet variation is also evident within competency domains. Even within developmental trajectories, individual differences are demonstrated. For instance, one experience may produce different outcomes for different individuals and alternatively, individuals may derive the same outcome through a number of different experiences. Hence, the concept of multidimensionality demonstrates the plurality of developmental change (Baltes, 1987). This proposal is mirrored in Kelly's (1955) "Individuality" corollary which also describes the individuality and plurality of developmental pathways. One person's perception of an event differs from other peoples' perceptions of the same event, therefore no two individuals

can ever experience exactly the same event. Consequently, an individual follows their own developmental course during which a unique personality is fostered. Evidence of organismic contextualism is apparent in Kelly's (1955) proposals. Kelly (1955) sees development as a process which involves active experiences with the environment and interpretation of this environment by the individual. The individual's present and previous environments shape their interpretation of their experiences and subsequently shape their individual course of development. Developmental changes also affect the way in which individuals interpret events. Therefore the same event may be interpreted differently by two individuals as a direct result of their developmental stage and the environmental influences they are exposed to by socialisation processes evident at this developmental stage. For example, high effort expenditure can be seen as a positive attribute by younger children but not by older ones, as a consequence of their beliefs about effort and ability and the emphasis which their current context places on these concepts.

Baltes (1987) cites the system of intellectual abilities found in adulthood as an example of multidimensionality. Intellect does not comprise only one structure but a whole subsystem of different structures. Of these, fluid and crystallised knowledge are the most important.

A multidimensional approach to motor and cognitive development is supported by Zelazo (1983). Traditionally, changes in cognitive and motor skills have been thought to occur simultaneously and few examples have been produced to suggest their independent development though Zelazo (1983) argues that cognitive and motor development may be asynchronous in some cases. Fagan (1977) for example has revealed that in some instances, infants may not have to rely on gross and fine motor skills to process visual and auditory information. A common approach to measuring the child's cognitive ability is by assessing their level of motor ability. Zelazo (1983) suggests that this may not be applicable in all cases and that in some, cognitive development may influence subsequent motor development. For instance, walking may be stimulated by the child's interest in a distance object. To satisfy their curiosity children must develop a means by which to gain access to this object, which may stimulate the development of unaided walking. During the preliminary developmental stages, motor development occurs

rapidly and independently of any cognitive change, providing further evidence for independent development between different competency domains.

### **1.3.3. Self esteem and domain specificity**

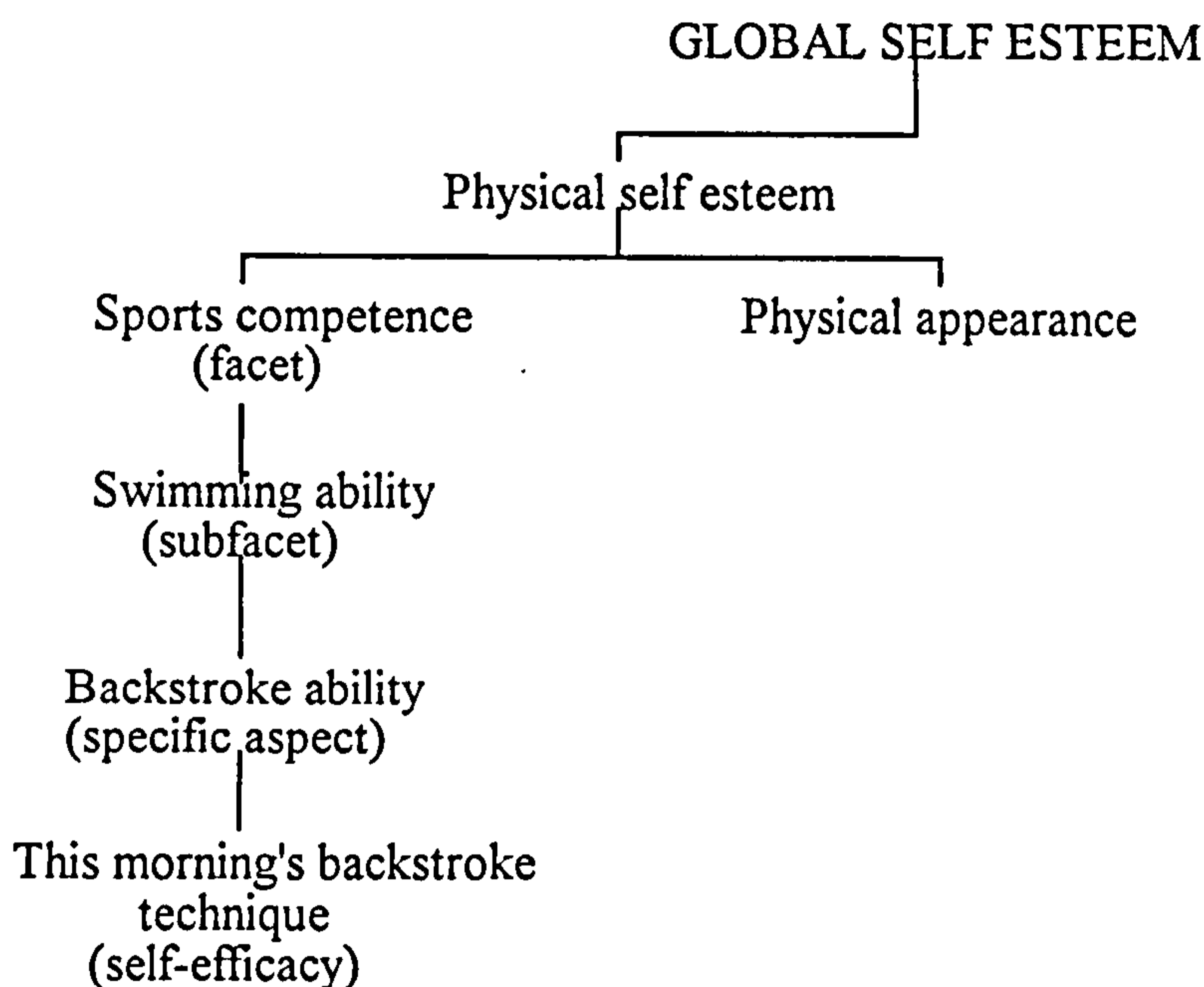
The constructs of self esteem and achievement motivation provide examples of the multidimensionality and domain specificity of development.

Multidimensionality is a common feature of self esteem theories (Weiss, 1987). Self esteem can only be understood if an individual's self evaluations within all domains of competence are considered (Fox: hierarchical model, 1988; Harter: multidimensional model, 1985a). These perceptions of competence vary from one domain to another (Harter, 1985a). For instance, an individual can judge their competence in the classroom to be high yet feel incompetent in sporting and social contexts.

This domain specificity allows researchers to employ distinct subscales to measure competence perceptions in different domains (Harter, 1985a), and individuals in general to personalise their self esteem. This personalisation is achieved through either self-serving or discounting. If in a given domain, an individual's perceived competence is high, they can self-serve by attaching greater importance to this domain than others in which their competence is low. Discounting is the converse of self-serving, helping to ameliorate the effects of low perceived competence on self esteem level. To discount, individuals reduce the importance of those domains in which their perceived competence is low. Subsequently, the demonstration of competence in domains which have been discounted is no longer of importance. As self esteem level is only influenced by domains which are important to the individual (Harter, 1985a), self-serving and discounting are effective ways of customising and maintaining self esteem.

However, the multidimensionality of self esteem extends beyond the observed domain specificity of competence perceptions. Multidimensionality is also apparent within domains of competence, exemplified in the physical domain by Fox (1988). Figure 1.1 (modified from Fox, 1988) demonstrates his hierarchical

arrangement of dimensions within the physical domain. Physical self esteem initially derives from an individual's self evaluations of sports competence and physical appearance. Self evaluative judgements become even more refined within each of these facets of physical self esteem. For instance, feelings of general sporting competence are built up by assessing competence in different sporting pursuits and the particular skills which they involve. Located at the base of the hierarchy are specific, state feelings of self-efficacy such as, "My backstroke technique was good today". If sufficiently reinforced, these perceptions can permeate up through the hierarchy to influence more stable feelings of physical and global self esteem.




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**Figure 1.1: A hierarchical arrangement of physical self esteem components (Fox, 1988)**

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#### **1.3.4. Multidimensionality and achievement motivation**

When achievement motivation theories are proposed, they are generally concerned with specific domains of competence and are believed to possess limited generality to other domains (for example, Weiner, 1990). Duda & Nicholls (1992) investigated the extent to which achievement motivation variables can be



generalised across the sporting and academic domains and demonstrated that multidimensionality is a feature of achievement motivation. They obtained measures in both domains of: goal orientations; beliefs about the causes of success; intrinsic satisfaction/enjoyment, and perceived ability, from 207 adolescents (mean age of 15.1 years). Whereas goal orientations and beliefs about the causes of success were found to generalise across the two domains, perceived ability demonstrated a greater association with intrinsic satisfaction/enjoyment and boredom in the sporting than the academic domain. Similarly, different predictors of satisfaction/enjoyment and boredom were revealed in the two domains. These were respectively task orientation and perceived ability in the sporting and the academic domains. Duda & Nicholls (1992) attribute these differences to the competitive and tangible nature of sport which makes sporting competence more visible to others than academic competence. Hence, we can see evidence of the domain specificity of achievement motivation variables. The degree of the generality across domains of competence depends on which variables are under consideration (Duda & Nicholls, 1992).

As mentioned previously, the present research is concerned with effort and ability understanding and its developmental trajectory in the physical domain. Multidimensionality and domain specificity prompt an exploration of similarities between this research focus and effort and ability development in the academic domain. In an examination of this issue, two factors require attention - the nature of this conceptual development and its temporal sequence. The developing concepts of effort and ability revealed by Nicholls (1978) reflect the different types of reasoning which Piaget describes in his general cognitive developmental stages (see section 1.2.1 for a full discussion). Reasoning changes from that characterised by preoperational thought to concrete then formal operational thought with movement through the continuum. This is exhibited by the child's initial focus on concrete entities such as effort and his/her increasing capacity to reason about abstract entities such as ability.

Considering the parallels between developing conceptualisations in the academic domain and general cognitive development, it is reasonable to hypothesise that a similar developmental trajectory will be exhibited in the physical domain. The

developmental advances in the reasoning displayed throughout the continuum require movement through general cognitive developmental stages. As the nature of effort and ability conceptual development displays characteristics of general cognitive developmental advances, it is unlikely to differ in the academic and physical domains.

Similarly, the developmental trajectories of effort and ability understanding in the academic domain and of general cognitive developmental stages appear to be temporally synchronous. At the onset of developments in this conceptual understanding, parallel advances in general cognitive capacity are exhibited. These changes in general reasoning capacity, from preoperational to formal operational thought, are manifest in the developing conceptualisations of effort and ability revealed in the academic domain. It seems safe to assume that effort and ability understanding in the physical domain will follow the same temporal pattern as general cognitive developmental stages and subsequently, as effort and ability understanding in the academic domain. Therefore we would expect temporal unity of the developmental trajectories of effort and ability understanding in the academic and physical domains. This proposal is supported by Lewis (1994) who claims that global reorganisation in one or more domains should stimulate reorganisation in other competency domains through coupling with and amplifying perturbations experienced in these domains. The notion of amplified perturbations in normal parameter values is described in more detail in Chapter Three.

Initially, Nicholls (1978) proposed that, if different stimuli were employed to elicit reasoning about effort and ability concepts, different levels of understanding could conceivably be revealed. By 1992, (p. 35) he claims that,

...there is no reason to expect any significant differences in the nature of the conception of ability-as-current-capacity or its development for the field of sport and games,

and that (p. 34):

...there is every reason to suppose that use of physical tasks would show comparable trends in conceptions...

Irrespective of Nicholls' (1992) comments and the expectations of the present research, that similar developmental trajectories of effort and ability understanding will be displayed in the academic and physical domains, multidimensionality and domain specificity necessitate empirical verification of these claims. Although Nicholls' (1978) findings have been applied to the physical domain, no empirical support has yet been provided for this application. Therefore Chapter Two describes an experiment which investigates whether effort and ability understanding is applied to physical tasks in a similar manner to which it is applied to academic tasks. Comments made by Duda (1987) (and by Nicholls, 1992, see reference note 1) support the need for such a study. She states that investigations should examine how physical ability is construed by children at different ages and that the information obtained will increase our understanding of children's sporting performance levels and persistence and aid attempts to maximise children's levels of sporting participation.

**CHAPTER TWO.**

***AN INVESTIGATION INTO EFFORT AND  
ABILITY UNDERSTANDING  
CONCERNING PHYSICALLY ORIENTED  
CONTEXTS.***

### **2.1.1. Introduction**

Chapter One presented previous research which has revealed the developmental changes involved in children's understanding of effort and ability concepts. This research has focused mainly on the child's application of their knowledge to academic tasks, although these findings have been widely employed to explain this conceptual development with respect to physical tasks. The domain specificity and multidimensionality of development indicate that existing knowledge about this conceptual development should not necessarily be applied across different competency domains. For instance, domain theory (Fischer & Canfield, 1986) suggests that knowledge acquisition does not occur simultaneously in different domains. Consequently, it appears that the individual's capacity to apply this acquired knowledge to different domains may not be comparable between domains. The multidimensional and domain specific nature of development therefore does not allow direct extrapolation of Nicholls' (1978) findings to the physical domain. These issues necessitate an empirical assessment of children's capacity to apply their knowledge of effort and ability concepts to physical tasks. As a result of this, Chapter Two describes an investigation which was carried out to compare developing conceptualisations of effort and ability in the academic and physical domains and across a range of chronological ages.

### **2.1.2. Subjects**

The subjects were taken from five primary schools in Gwynedd and Clwyd and a secondary school on Merseyside. Participants, who were predominantly Caucasian, were chosen at random by class teachers to represent a range of academic ability levels. Of the total sample of 137 subjects, 70 were boys and 67 were girls, aged between 4 and 13 years.

An explanation is offered to define randomisation in the current context when referred to in this and subsequent studies which are described in this thesis. This randomisation refers to the selection of schools, classes within these schools, children within these classes and the allocation of these children to different experimental groups. Local schools were approached and asked if they would participate in this research. As a result, these schools were not selected in a truly random manner, it was those who met the criteria (for instance, sufficient numbers

of children at the required age or developmental level) and who were willing to take part, from which subject samples were obtained. Children were then selected to participate if they met the requirements of the study under consideration, and, where appropriate, allocated as randomly as was feasible to different experimental groups.

Although this procedure results in a degree of randomisation in that the schools selected could have been any from a number in North Wales and the children who took part did so through this arbitrary selection procedure, the limitations of this randomisation are acknowledged. Although it would have been desirable to have employed truly random samples in this and subsequent experiments, the practical limitations incurred in this research placed limitations on the extent of randomisation which could be achieved. For instance: schools had to be within daily travelling distance of the University of Wales, Bangor; the children had to be able to speak English (a number of young children in rural schools in North Wales only speak Welsh); the schools and children had to be willing to take part in the research, and, only schools which accommodated children at the required ages or levels of conceptual development could be included in studies described in this thesis.

A comment is also warranted concerning the small samples employed in the current research as it must be acknowledged that small numbers increase the probability of incorporating deviant samples (Kerlinger, 1986). Practical considerations, some of which were listed previously, all contributed to the resultant small sample sizes used in this research. These include: the nature of the empirical investigations, that is, independent testing sessions for each individual; the time scale allowed to carry out doctorate research; the sizes of the schools in the locality; the limitations of bilingualism, and, the necessity to impose as little as possible on schools' time.

Although these are real and unavoidable concerns, it is necessary to highlight that the use of small samples can limit the efficacy of certain statistical analyses and,

coupled with the problems of achieving completely random samples, the extent to which findings using these samples can be generalised to their immediate population and to other populations. The caution required when using small samples and parametric statistics is considered further on in this thesis (see page 109), whilst the issue of generalisability is considered below.

When small samples are employed from a limited population, as was the case in the present research, this limits the extent to which findings can be generalised to wider populations. Consider, for instance, Kerlinger's (1986) suggestion, discussed previously, that small samples are more likely than larger ones to include deviant samples, that is, those which may not be representative of the whole population from which they are taken. It was hoped that the subjects who participated in the investigations carried out in this research were representative of all the children at the level of conceptual development which they themselves have achieved. However, the cautionary nature of such inferences must be acknowledged. The generalisability of the present findings extends only to the immediate population from which the subjects were taken and cannot be said with any certainty to extend beyond this population, that is, predominantly Caucasian, English speaking children from rural North Wales.

When the limitations imposed by small samples sizes on both randomisation and generalisability are considered, it seems that when drawing conclusions from current findings, some reservation is required. It is evident that future research is required which replicates the current investigations with larger sample sizes and with different samples to overcome the problems incurred here.

### **2.2.1. Experimental procedure**

The following experimental procedure was based on Nicholls' (1978) protocol, as described in Chapter One, page 1, and modified to incorporate a physically oriented setting. Normative conceptions of ability are concerned with performance in a given situation rather than skill development over relatively long periods of time (Nicholls, Pataschnick & Mettetal, 1986). Knowledge of ability as

a capacity requires the understanding that this present capacity determines the degree to which expended effort can influence performance outcomes (Nicholls, 1989). Subsequently, methodologies which assess children's understanding of effort and ability concepts must examine this in one-off performance situations and not in long term learning ones, as Nicholls (1989) advises. The present experiment therefore employs a performance situation involving physical tasks rather than one which implies long term physical skill development.

### **2.2.2. The films**

All subjects watched a sequence of three different films showing two children performing physical tasks. The order of presentation of these films did not vary between subjects. Two sets of films were used, one depicting boys and one depicting girls to remove the possibility of gender bias.

Each of the three films showed two children working side by side on a physical task which enabled the subjects to make direct comparisons between the models' behaviour. In each of the three films, one of the children applied continuous effort whilst the other child, although not displaying disruptive behaviour, worked intermittently at the task. When not engaged in on-task behaviour, this child displayed off-task behaviours such as sitting down, playing with the throwing equipment and fiddling with shoelaces. The proportion of total time which this child spent engaged in on- and off-task behaviours did not vary between the three films. The actors changed their roles from one film to the next so that subjects' responses would not be affected by what they had seen previously. Both children were shown to score 10 points in the first film and 2 points in the second. However, in the third film, the child working intermittently scored 24 points whilst the child working continuously scored only 6.

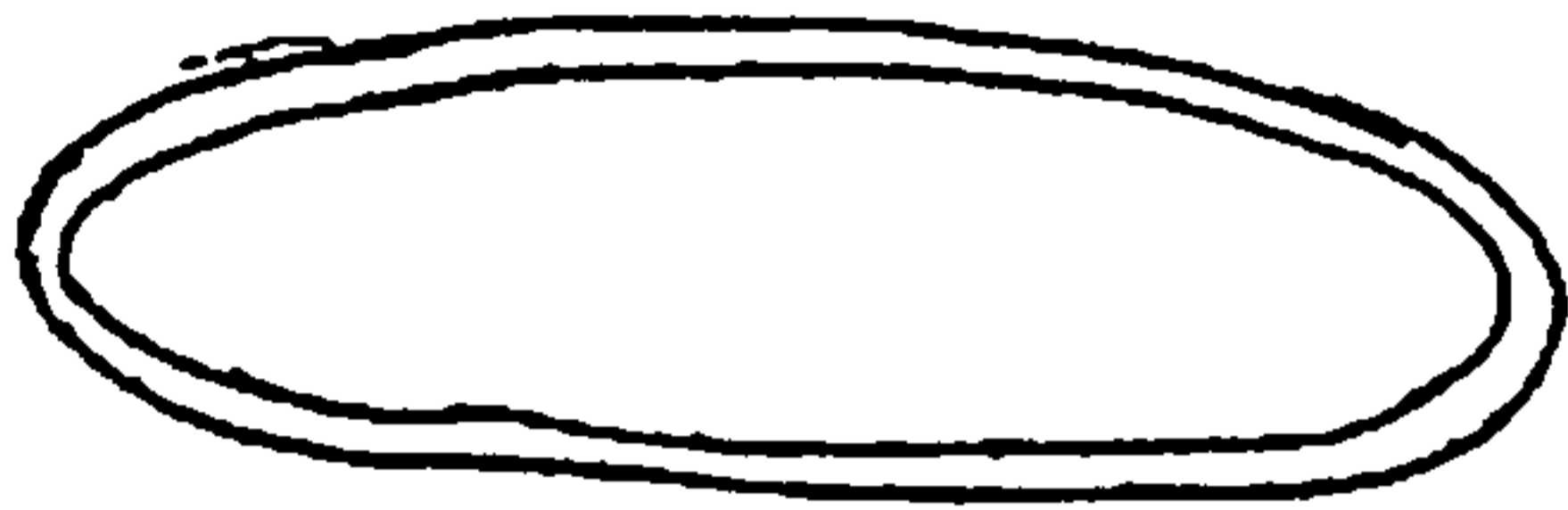
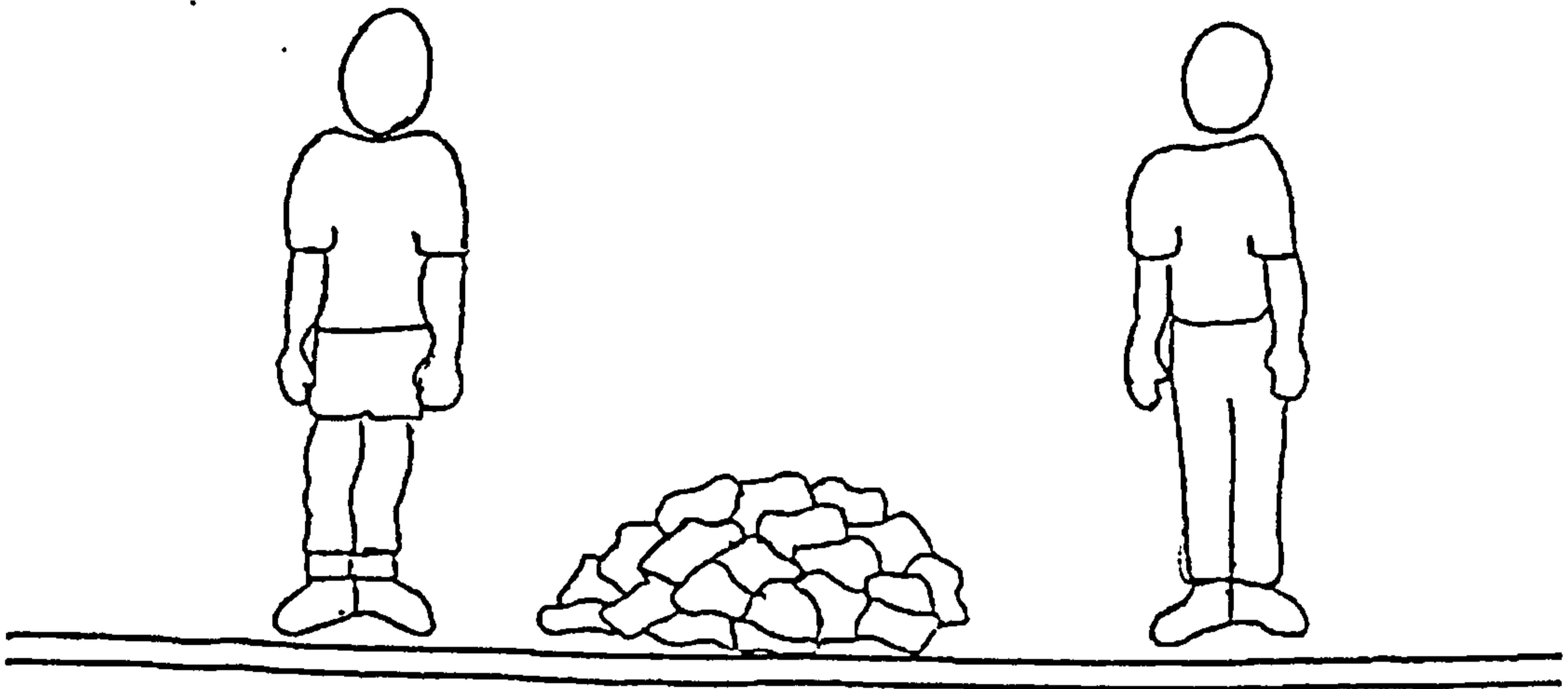
Nicholls (1978) has demonstrated that the above format is an effective method of examining reasoning about effort and ability. We can determine children's understanding of these concepts by assessing their explanations for equal outcomes gained from unequal effort or for a higher score achieved by a child



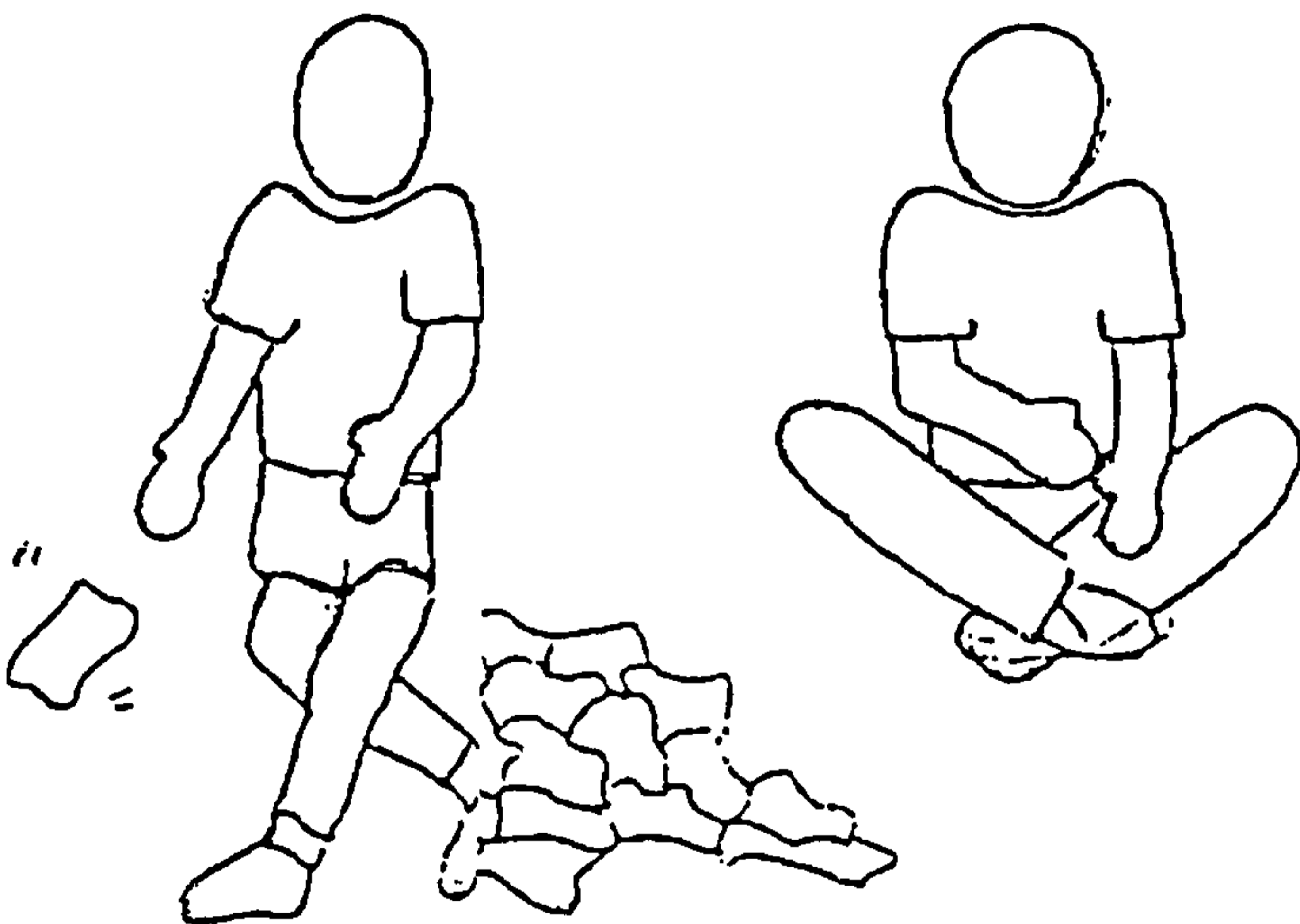
who applies relatively less effort to the task than does another child.

Developmental changes in conceptualisations of effort and ability can be identified if a cross section of age groups is included. Moreover, adapting Nicholls' (1978) protocol to a physically oriented context allows direct comparison with the development of effort and ability understanding demonstrated in the academic domain.

All three of the films comprised a sequence of three different episodes. Episode one demonstrated the requirements of the task which the children in the film were to perform. The two children were seen standing behind a line marked on the floor and facing two targets equidistant from this line. In between them was a pile of beanbags (see figure 2.1). Each child had their own target which was a hoop in film one and a bucket in film two. They scored one point for every beanbag which landed in the target. In film three, the children faced a flat, circular target which was divided into three rings. On the innermost ring was the number 3, on the middle one, the number 2, and on the outermost, the number 1. These numbers indicated the points which would be scored if a beanbag landed in these areas. In episode two, the children were shown playing the game which included the off-task behaviour of the child whose role was to work intermittently. Throughout this episode, the subjects could not see the children's targets, only the children themselves (see figure 2.1). Episode three depicted the children's scores at the end of the game. Subjects saw both of the targets including the beanbags which were said to have landed inside the target and those which were said to have landed outside. Cards indicating the children's scores were placed next to their targets (see figure 2.1). Finally, the two children were seen holding similar cards which displayed their respective scores (see figure 2.1).

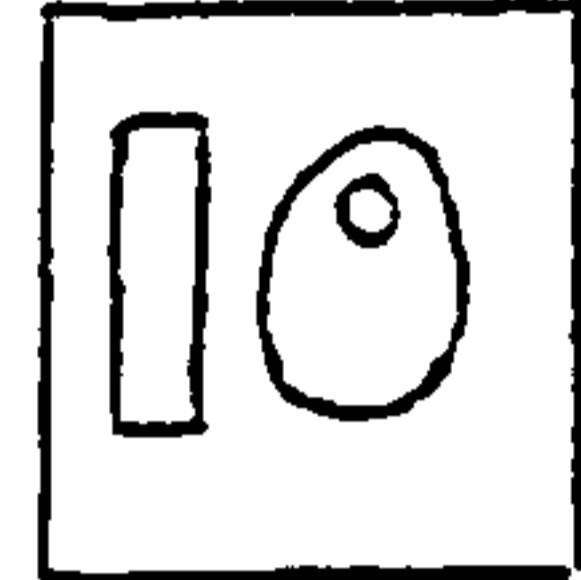
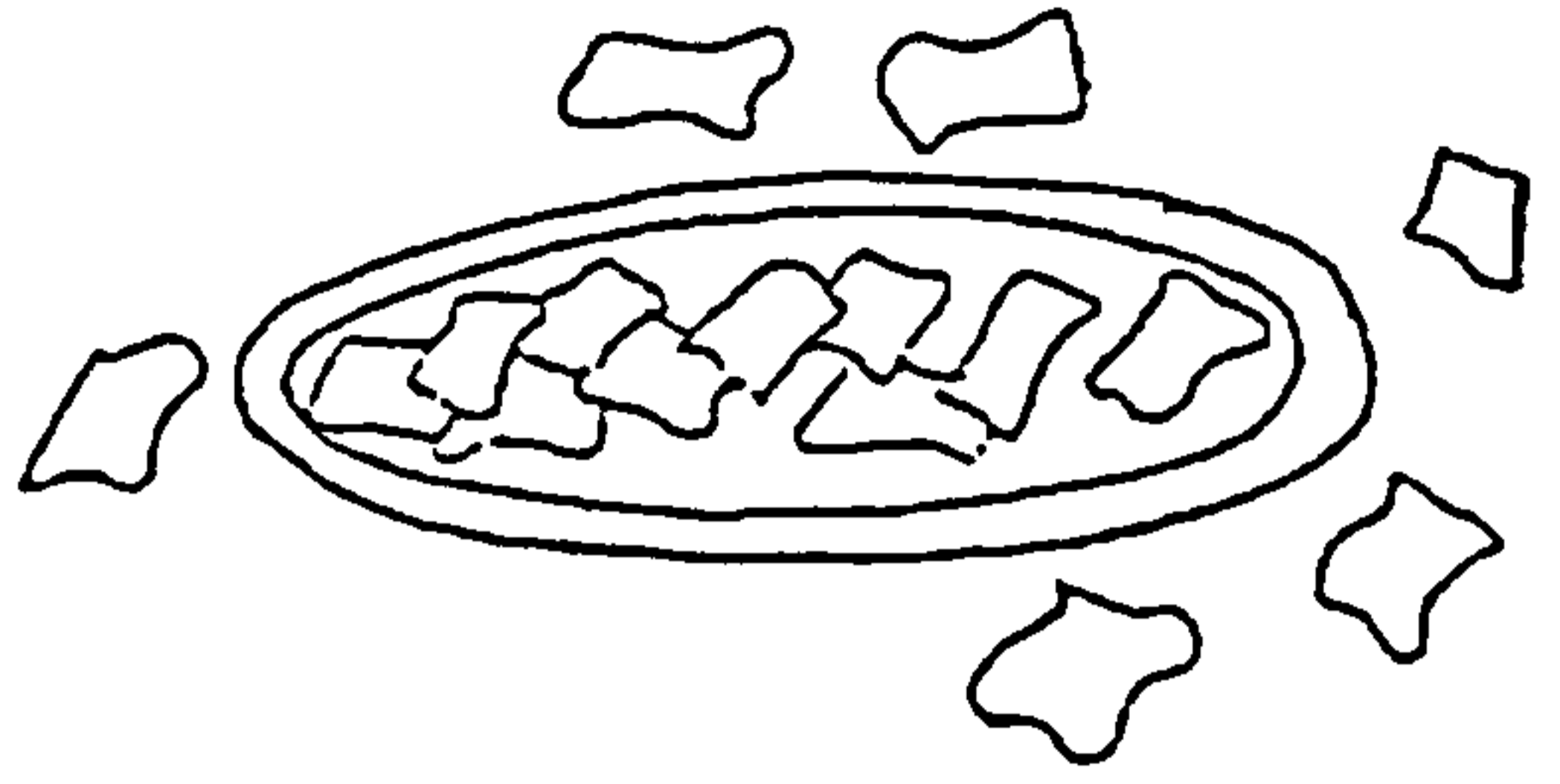
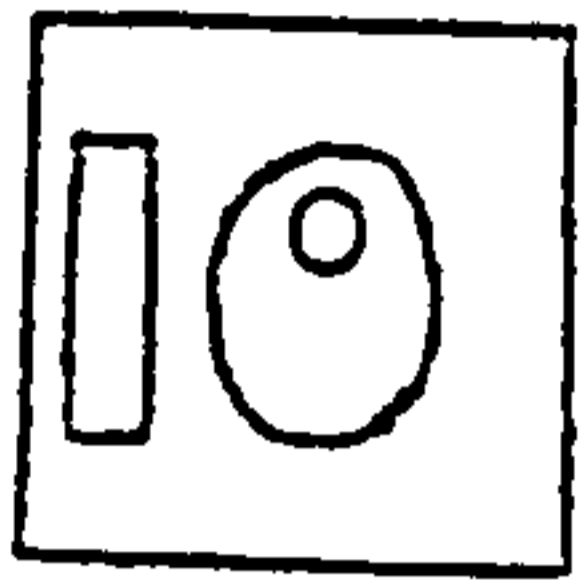
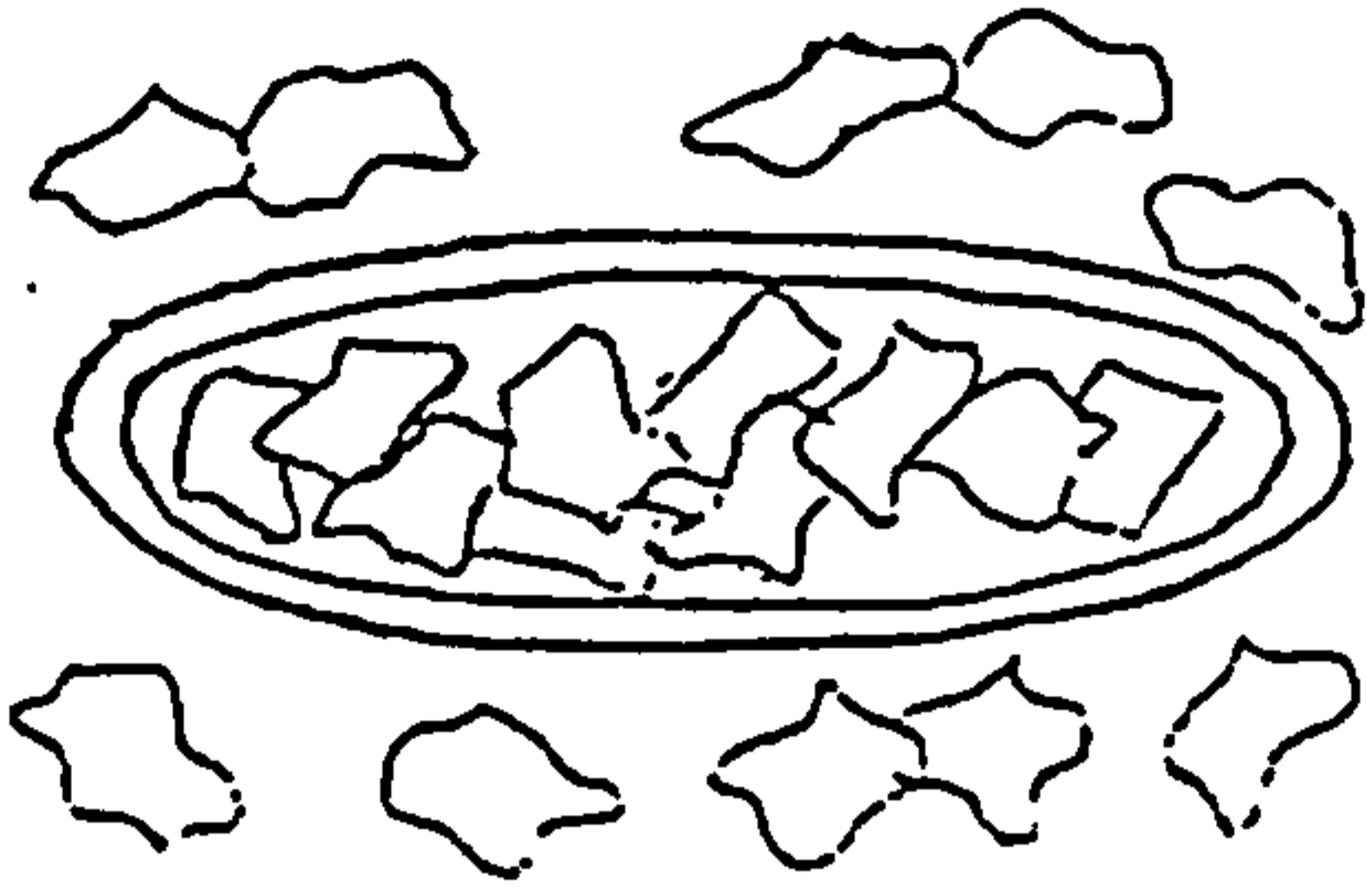


Episode One



Episode Two

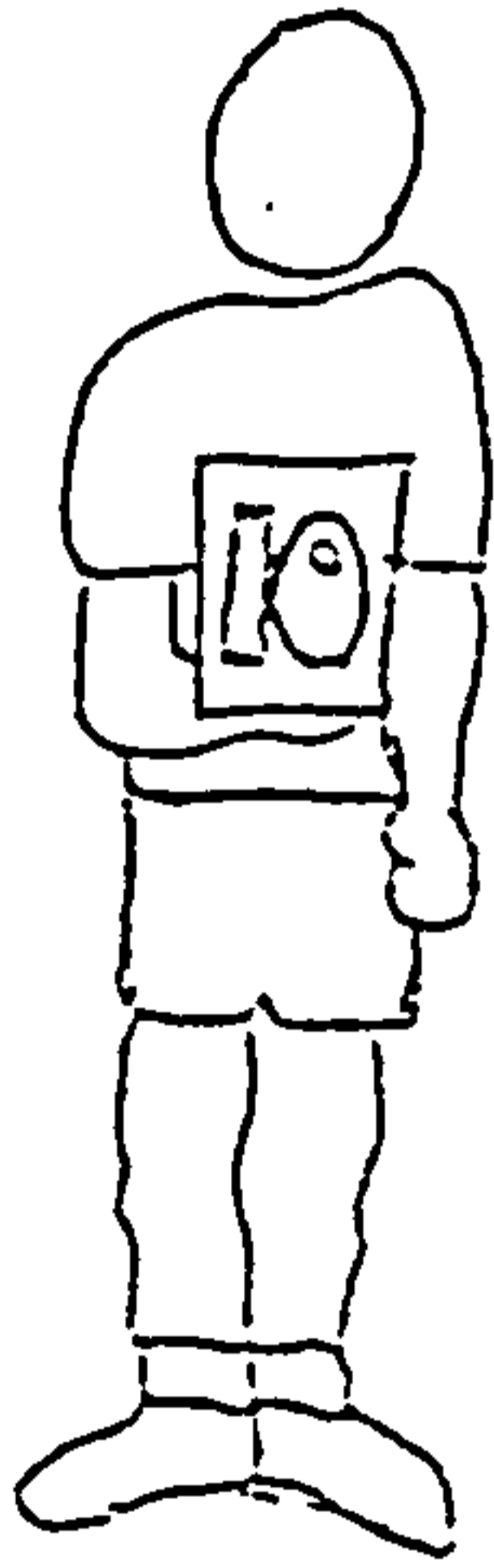
Figure 2.1: Still versions of episodes one and two of the films which were shown to children



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Episode Three

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Episode Four

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Figure 2.1: Still versions of episodes three and four of the films which were shown to the children

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### **2.2.3. Procedure**

The same procedure was employed for all of the films, and the script used is shown in Appendix One. Subjects were informed that they were about to see short films of two children playing throwing games and would be asked to talk about what they had seen in each film. They then watched episode one, during which the requirements of the task were explained by the experimenter. A number of facts were emphasised in this explanation: the children had to throw across equal distances and had to remain behind the marked line; there were sufficient numbers of beanbags available for each child to throw as many as they wanted; and, each child had to aim for their own target. The subjects were then told how much both children had scored on the game and cards depicting these scores were placed on the table in front of the appropriate actor. Next, subjects were asked to watch the children playing the game (episode two) and to think about how hard they were both trying and how good they were at the game whilst they watched. Immediately afterwards, subjects watched episode three during which the number of beanbags in each target were counted and each child's score reiterated. After each of the three films, the subjects were asked the following questions (based on Nicholls (1978)):

- (1) Did one boy/girl work harder than the other or did they work as hard as each other?
- (2) Is one girl/boy better at this game or are they as good as each other?
- (3) How can you tell?
- (4) How come they got the same when one tried harder than the other? [For film three: How come one scored more than the other but didn't work as hard as him/her?]
- (5) If they tried the same, would they score the same or different points?

Although standardised questions were used, the children's responses necessitated some re-structuring of the questions at times. These interviews were recorded, transcribed at a later date and assessed in relation to Nicholls' (1978) levels.

### **2.3.1. Results**

#### **Interrater correlation:**

Two independent raters assessed the transcripts of children's interview responses to determine each child's level of effort and ability understanding. The two raters agreed on the classification of all but four of the 137 subjects. Using Pearson's Product Moment measure of correlation to calculate the level of interrater agreement revealed a correlation coefficient of 0.9865 (2-tailed probability level = 0.01), which indicates that the subjects' levels of effort and ability understanding were accurately assessed.

After rating the interview transcripts independently, the two raters discussed the four transcripts which they had allocated to different levels of effort and ability understanding. For two of these they reached a general consensus on the child's level of conceptual development. However, they were unable to agree on the level demonstrated by the remaining two subjects. These subjects were therefore excluded from subsequent frequency distributions describing conceptual development in relation to age and gender.

### **2.3.2. Nature of effort and ability understanding**

The present results indicated that the pattern of stages in the development of effort and ability understanding is not domain specific (Hudson, Fazey & Fazey, unpublished). The developmental trajectory demonstrated in the physical domain exhibits similarities to that previously revealed in the academic domain. This finding supports the claims of Flanagan (1984). He discusses five criteria of stages and their patterns in relation to Piaget's stages of cognitive development. One of these criteria is relevant to the present discussion. Flanagan (1984) states that, regardless of the dilemma with which they are presented, individuals reason at the same developmental level. He cites moral reasoning as an example but it is apparent from the present findings that this criterion also applies to children's reasoning about effort and ability concepts. However, this argument does contradict the proposals of Piaget and Baltes (1987) concerning issues of development such as horizontal *décalage* and multidimensionality.

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Four levels of effort and ability understanding were defined when interview transcripts were examined. Although each level displays qualitative differences from the next, some individuals did exhibit reasoning which was characteristic of two adjacent levels. This suggests that, rather than experiencing discrete transitions from one level to the next, the individual progresses gradually towards higher levels of understanding. When reasoning reflected characteristics of two adjacent levels, considerable difficulties were involved in determining the individual's level of conceptual development. However, a decision was made possible as one of these levels commonly dominated the child's schema. Individuals could then be classified according to this dominant level of understanding, as defined by their verbal responses. The different levels of reasoning about effort and ability demonstrated in a physically oriented context are presented below.

#### **Level 1:**

When scores are equal but effort is not children at this level state that the model who tried the hardest is the best because of their greater effort input. Therefore these children demonstrate the belief that effort is an indication of ability. This reasoning is exhibited by some, but not all, children when they observe someone gaining a higher score whilst expending less effort than a comparison other. For instance, regardless of the fact that the hardest working child achieved the lowest level of success, some children at this level claim that this child is the best at the game. Again, the inference of higher ability is justified by the fact that the model expended greater effort. However, other children will state that the model who scored the most was the best, demonstrating their perception that outcome is an indication of ability. Some children further state that this model did try harder even though they were not observed to. They appear to display the belief that effort, ability and outcome are inextricably linked. Whether the child focuses on effort or outcome as an indicator of ability appears to depend on whether the situation presents the outcomes of performance attempts as equal or unequal. Therefore children at level one appear to believe that regardless of the respective success levels of two individuals, the one who tries the hardest is perceived as the more able of the two. If an individual is seen to achieve a higher level of success with little effort, these children will nevertheless claim that effort expenditure was

high. When children do acknowledge lesser effort input by the highest achieving individual, they do not attribute this high success level directly to ability but to factors such as size, desire to win, resting to save energy, concentration, speed, and, throwing technique. It may appear at first that these last two factors are ability-related. However, these factors are more likely to reflect the female models' behaviour in the present methodology rather than the child's belief that they are ability-related factors which contribute towards the outcome of a performance attempt. Although consistency between the two models' behaviour was desired, obviously, individual differences between the two resulted in differences in their exhibited behaviour. For example, one of the girls adopted a more "hurried" throwing style than the other girl who tended to throw in a more studied manner. These differences in task performance may have prompted the children to cite speed and throwing technique as factors to explain higher levels of achievement in the absence of a high degree of effort input. This interpretation appears to be satisfactory as the same children would cite throwing too quickly as a reason for a higher level of success when previously they had cited throwing slowly when asked for a similar explanation. Therefore speed or throwing technique are not factors which play a logical role in the child's beliefs about effort, ability and outcome.

It is important to note however, that the use of the word, "ability" here may be somewhat misleading. Employing this term does not imply that these children perceive ability as a capacity in the same way that adults do. Nicholls (1978) suggested that, when asked to apply their reasoning to academic tasks, very young children believe that effort or outcome are synonymous with ability. Although this was apparently the case in the present experiment when children were asked to apply this reasoning to physical tasks, certain factors indicated that this finding may not accurately reflect young children's beliefs about effort and ability. Instead, it may reflect developmental differences in construct interpretation or the nature of the cues which children are presented with during the present methodology. In Chapter One, research was cited which indicated that young children receive praise and reinforcement from significant others for, for example, trying hard and following given instructions. As children get older however, feedback from significant others increasingly emphasises ability and normative evaluation. It is likely that young children will perceive that being good at something is indicated by the degree of effort expended in an attempt to achieve



success. To adults, being good at something indicates that the individual possesses ability in the sense of a present capacity. It is therefore conceivable that when discussing who the most able of the two models is, the child subject and the adult experimenter possess varying definitions of what ability is. Moreover, it is possible that these children demonstrate the tendency to equate effort and ability because the methodology employed to assess this understanding presents the children with concrete and tangible effort cues. As a result, these young children may base their responses to interview questions on the concrete cues with which they are presented. These issues are discussed in greater detail further on in Chapter Two and an experiment is described which attempts to address whether young children do believe effort and ability to be synonymous or whether this finding is attributable to the above factors.

### **Level 2:**

Individuals now focus on the relationship between effort and outcome. Unlike level one reasoning, perceived effort is seen as the determinant of outcomes. Subsequently, if two individuals exert equivalent amounts of effort, resulting success levels are expected to be the same. This belief in effort as an outcome determinant is demonstrated by explanations for higher scores achieved with relatively less effort than someone else. They will claim that the individual who tried the least but scored the most points must have gained the advantage by resting, aiming better, or having the sense to sit down. Conversely, the child who tried the most but achieved the lowest score, must have aimed for the wrong target or knocked the other child's beanbags into their hoop for them.

Explanations for superior performances such as, the child aimed better, may be defined as ability-related. Children's use of ability-related factors at this level could provide an indication of their initial recognition that ability is a separate entity from effort and outcome. Moreover, that, although these children do not perceive ability as a current capacity in the way that older individuals do, they acknowledge individual differences in ability which affect the outcome of a performance attempt. Even when effort employment is observed to be unequal, when similar levels of success are achieved, children will assert that effort expenditure was the same.

**Level 3:**

Children are beginning to recognise that ability mediates the effects of effort on performance outcomes. This is apparent in the child's understanding that if a high level of success is achieved without trying hard, then ability must be high.

However, such principles are not consistently employed. For example, when scores are equal, children correctly state that the individual who did not have to try as hard is the most able but they do not necessarily attribute this to ability. Instead, they attribute this success to, taking more care, reducing effort to distract the other child, trying really hard when effort was exerted (on the part of the child who worked intermittently), and, luck. Furthermore, children at this level often maintain that effort is a determinant of outcomes.

**Level 4:**

Individuals understand that ability is a capacity which interacts with effort to determine level of success. Similar to level three reasoning, these children realise that to score the same as someone else without trying as hard requires greater ability. However, unlike children at level three, they apply this reasoning systematically over a variety of contexts. Moreover, children can appreciate that, depending on ability level, the same task can be difficult or easy for two different individuals.

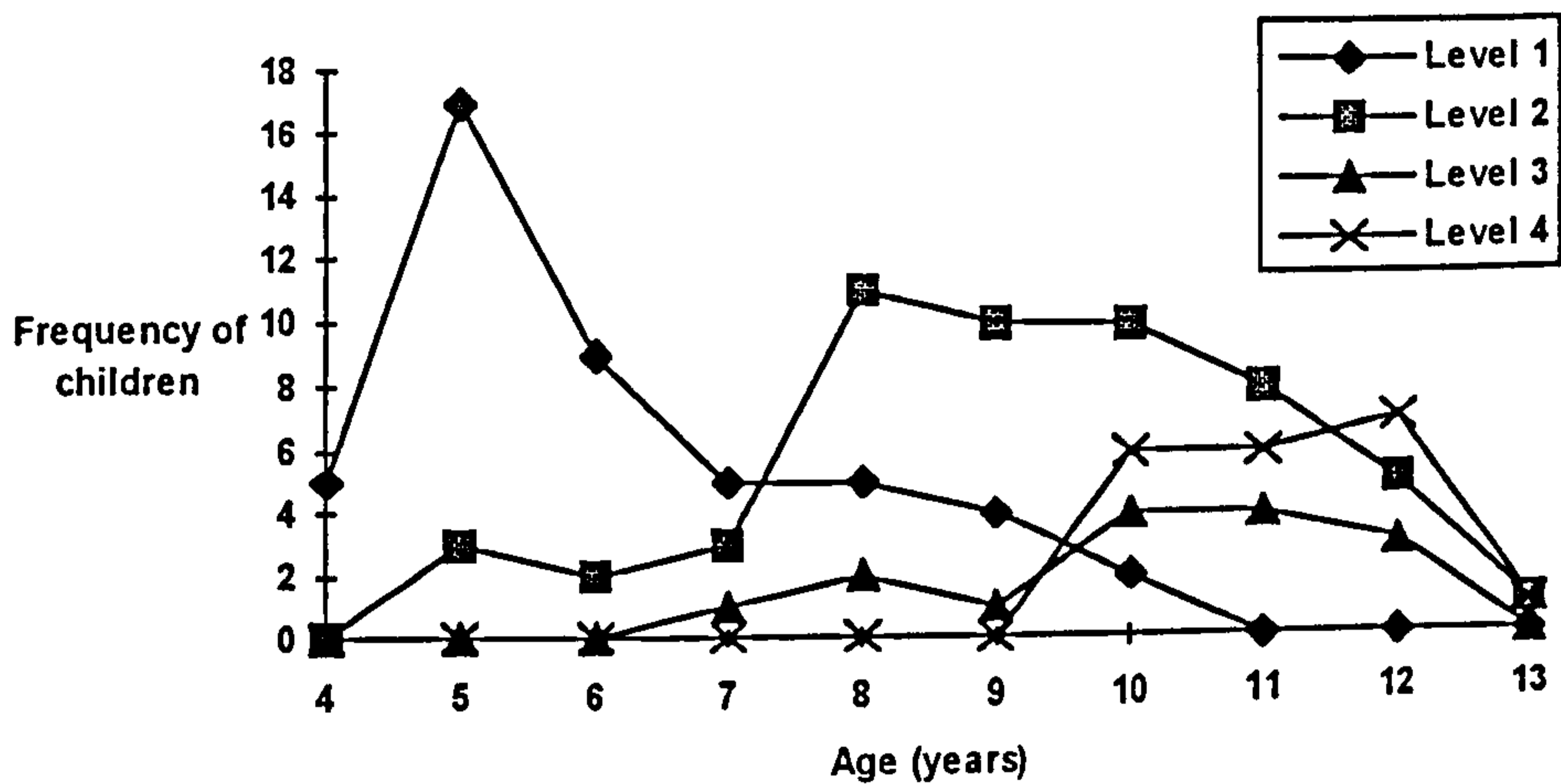
**2.3.3. Temporal sequence of effort and ability understanding**

The pattern of the frequencies of children of different ages at each of the four levels is expected to demonstrate that higher levels of conceptual development are manifest in older children and lower levels in younger ones. Table 2.1 and figure 2.2 demonstrate this pattern. Level one reasoning is exhibited mainly up to 6 years of age, decreasing gradually until 11 years of age when no more children reasoned at this level. By 8 years of age, most children had achieved level two which predominated between the ages of 8 and 11 years. Again, the numbers of children who exhibit level two reasoning decreased following this period. Emerging initially at 7 years of age, level three reasoning was exhibited mainly by children aged between 10 and 12 years. Finally, level four reasoning was not manifest until 10 years of age and then proceeded to dominate over the previous three levels although more than half of the twelve year olds tested had not achieved level four.

		AGE										
		4	5	6	7	8	9	10	11	12	13	N
LEVEL												
1		5	17	9	5	5	4	2	0	0	0	47
2		0	3	2	3	11	10	10	8	5	1	53
3		0	0	0	1	2	1	4	4	3	0	15
4		0	0	0	0	0	0	6	6	7	1	20
N		5	20	11	9	18	15	22	18	15	2	135

**Table 2.1: Frequencies of children at each level of understanding across the ages 4-13 years.**

**Figure 2.2: Frequencies of children at each level of understanding across the ages 4-13 years.**



	AGE (YEARS)				N
	4-7	8-9	10	11+	
LEVELS 1 & 2	44	30	12	14	100
LEVELS 3 & 4	1	3	10	21	35
N	45	33	22	35	135

**Table 2.2: Frequencies of children in different age groups representing the lower and upper ends of the continuum of effort/ability understanding**

When a chi-squared analysis was conducted on the data shown in table 2.1 this was rendered invalid as too many of the cells had expected frequencies less than five. Although this does not present too much of a problem when the frequency table is large, it is recommended that in such situations the data is grouped into far less categories (Hinkle, Wiersma & Jurs, 1988). It was felt that too many of the cells did not meet the required expected frequency count in this analysis.

For the purpose of statistical analysis, children's initial classifications were therefore collapsed into two categories. These categories were: levels one and two, and levels three and four. Chi-squared analysis conducted on the data in table 2.2 indicated that significant differences did exist,  $\chi^2 (3) = 43.565, p < 0.001$ . One sample follow-up tests were subsequently carried out to ascertain where these differences could be found. The results of these follow-up tests (which are displayed in table 2.3) demonstrate that, as expected, significantly more children between the ages of 4 and 9 years reasoned at levels one and two than at levels three and four. However, no differences existed between the numbers of 10 year old children reasoning at levels 1 and 2 and levels 3 and 4. Similarly, although more children who were 11 years and over did reason at levels three and four than at levels one and two, this difference did not reach traditional significance levels.

AGE GROUP	CHI-SQUARED (1)	PROB.
4-7 YEARS	82.178	<0.001
8-9 YEARS	44.182	<0.001
10 YEARS	0.364	>0.05
11+ YEARS	2.80	>0.05

**Table 2.3: Results of one-sample follow-up tests**

It is evident that the temporal sequences of effort and ability understanding in the academic and physical domains demonstrate similarities when the age boundaries which are cited here are compared with those previously revealed by Nicholls (1978) in Chapter One. The small differences which are revealed in the chronological age boundaries between domains are most likely to be attributable to individual differences between subjects. Table 2.1 shows that within the same chronological age group, different children have achieved different levels of understanding. For instance, if we examine the frequency distribution of 10 year olds, who are expected to have reached level three, not all children conform to this predicted norm. Although some of the children have achieved level three most of them still demonstrate reasoning characteristic of levels one and two and a number of subjects have already reached level four reasoning.

These individual differences indicate that chronological age is not necessarily a good predictor of level of conceptual development and necessitate empirical assessment if children's effort and ability understanding is to be fully understood.

#### 2.3.4. Gender differences

Gender differences were not expected but were examined within the four age groups and two level divisions cited above in table 2.2. These data are shown in table 2.4.

	AGE (YEARS)								N
	4-7		8-9		10		11+		
	f	m	f	m	f	m	f	m	
LEVELS 1 & 2	20	24	16	13	7	5	10	5	100
LEVELS 3 & 4	0	1	1	2	3	8	8	12	35
N	20	25	17	15	10	13	18	17	135

**Table 2.4: Frequencies of children, divided by age and gender, at each of the specified age groups (f = female; m = male)**

Again, the expected frequency counts of too many of the cells were less than the required minimum of five, rendering any analysis invalid. However, an initial examination of the frequencies in table 2.4 indicates that gender differences are unlikely to exist.

### 2.3.5. The mental and physical connotations of effort

By level two, children begin to understand that effort has both physical and mental connotations even though the present context is physically oriented. Consider this quotation from a girl who is at level two and who is discussing the film in which both children scored the same but the actor in yellow tried harder than the one in pink.

**One girl tried harder.**

*Which one?*

**One in yellow.**

*Was one girl better or were they as good as each other?*

**One of the girls was better.**

*Which one?*

**One in yellow.**

*How come they got the same when one girl tried harder than the other?*

**She was thinking.**

*Which one?*

**The one in pink.**

*Was one girl better?*

**No.**

*Did they try the same?*

**Yes.**

Initially, this girl states that the actor in yellow, who exerted more physical effort, did try the hardest. However, when asked how identical outcomes were obtained by unequal effort input, she cannot accommodate this information into her schema as she believes that effort is the cause of outcomes. She then states that the actor in pink was thinking about the task when she was not seen to be exerting physical effort. Therefore she appears to conclude that both actors were trying hard but in different ways: one mentally, and one physically. Now perceiving effort to be equal, this girl is able to assimilate this information into her present schema of effort and ability understanding.

Recognition that mental effort is important when engaged in physical tasks is demonstrated by the following quotation from a boy at level 2 who is discussing the film in which the boy in yellow scores more than the boy in black but does not try as hard as him.

*Did one try harder or did they try the same?*

**I noticed the one in yellow was sitting down, I think he was trying to concentrate on a battle plan.**

*What was he planning?*

**Try and get a better target to beat his opponent.**

*Did the boy in black try harder?*

**I noticed he had quite a good aim, he was going a bit too quickly and he never did a battle plan.**

### **2.3.6. Outcome as an indicator of effort and ability**

Before the subjects saw each film they were told the actors' scores and asked to think about their ability levels and their effort employment. Subjects at the lowest levels of the continuum often answered these questions prior to seeing the films. When they were told that the children scored equally, subjects stated that both effort expenditure and ability level would be equal. Similarly, when one child was said to score higher than the other, subjects judged that this child would try the hardest and was the most able of the two. It appears then, that without any other information available, young children feel sufficiently equipped to make ability and effort judgements based only on an individual's level of success. Unfortunately the numbers of children at different levels of effort and ability understanding who made such *a priori* judgements were not recorded. Therefore this finding can only be presented as anecdotal evidence.

### **2.3.7. Level one reasoning**

Reasoning at level one was associated with the equation of effort and ability both in the present and Nicholls' (1978) study. However, based on characteristics of the methodology and subject and experimenter interpretations of interview questions, the present study offers an alternative explanation. It is proposed that the finding that effort is ability does not necessarily reflect young children's cognitions. Subsequently, it is hypothesised in the following discussion that these children do not have the capacity to conceptualise the existence of ability. Such speculation can only be made about children's reasoning in the physical domain at present. Empirical investigations which follow attempt to assess the validity of these claims in both the physical and academic domains.

An individual's interpretation of events and related constructs changes with increasing experience (Kelly, 1955). According to Korthals (1994), developmental theories are reconstructions of the constructs which individuals employ when interpreting their own behaviour. However, the theoretical proposals which are made are constructed from the perspective of the developmental theorists themselves. Therefore this construction reflects the developmental level which they have currently achieved. This level may not reflect the level of development reached by the individuals to whom these theoretical proposals are applied.



Therefore the same constructs may be differentially interpreted by two individuals at different developmental levels. For instance, Harter (1983) claims that kindergarteners and first graders perceive that smartness is indicated by a level of skill which is dependent on practice. This definition appears to indicate that, unlike the adults' beliefs that ability is an innate capacity, these children believe that smartness can be acquired by any individual if sufficient efforts are made towards its acquisition. Stipek, Roberts & Sanborn (1984) have discussed that to young children, smartness is internally determined. Presumably, they do not imply that these children perceive smartness to be an innate capacity but they believe it to be an ability which can be determined by the individual. Perhaps the individual's internal determination of whether or not they are smart is based on their desire or expectation to be smart as Stipek et al (1984) have demonstrated that children's desires influence their expectations and self-evaluations. Due to experiential and developmental differences, it is likely that the subject and the experimenter do not always interpret questions such as, "Who is the best?" and "Are both boys good at this game?" in the same way. This issue was initially addressed in a previous section of this chapter, see page 34. The experimenter is referring to ability in the sense of a relatively fixed innate capacity whereas the child is likely to interpret these questions in terms of behavioural conduct, and task involvement and interest. This interpretation is supported by research findings presented in Chapter One. For example, Stipek & MacIver (1989) demonstrated that pre-school children's work is often deemed acceptable if sufficient time and effort has been invested in it. It seems therefore that children learn from teachers that their work is good and that they have achieved if they fulfil these criteria. A logical extension of this argument is that children will then assign the labels "smart", "clever" or "good" to themselves as a result of this information. Evidence of these interpretational differences is demonstrated by children's responses to interview questions. The following quotation is from a boy at level one who is discussing the film in which the actor in black works continuously and scores six points, yet the actor in yellow works intermittently and scores twenty four points.

*Did the boy in black try harder?*

**Yes.**

*Was he better or were they as good as each other?*

**The boy in yellow wasn't good but he still won.**

*Why wasn't he as good?*

**Because he stopped throwing.**

*Who was the best?*

**The boy in black.**

From the boy's claim that the actor in black was the best it could be inferred that he equates effort with ability. However, consideration of his additional statements implies a different explanation for his reasoning. Although he states that the boy in yellow "won" the game and therefore indicates recognition of a superior performance, he nonetheless concludes that this boy "wasn't good". A possible explanation for this is that he interprets "being good" in terms of demonstrated task-related behaviour. He is not proposing that the boy in black is good in the sense of being able (demonstrated for example by achievement level) but by being well-behaved and involved in the task, unlike the boy in yellow. This reasoning does not clearly demonstrate a belief that effort and ability are synonymous, and may suggest that the subject bases judgements of whether someone is "good" on exhibited task involvement and effort investment.

This interpretation is demonstrated further in the quotations cited below, the first from a boy at level one and the second from a girl at level two. (By including this last example I do not imply that children at level two would be expected to equate effort with ability. Nonetheless this excerpt serves to illustrate the differences in two individual's interpretations of the same construct).

*Did one boy try harder here?*

**Not exactly, the only thing that I think, he was better than him because he never kept on sitting down and didn't stop throwing the beanbags, he kept on throwing them.**

*Why was he better?*

**Because he tried harder it makes him better, because the other one was just being silly like he was before, but it doesn't mean that he would win.**

The statement, "Because he tried harder it makes him better,...., but it doesn't mean that he would win." implies that this boy also interprets "being better" in

terms of being better behaved and that he does not equate effort with ability. He perceives the actor's maintained effort expenditure as an indication of good behavioural conduct not as ability as the adult experimenter expects.

*Was one trying harder or were they trying the same?*

**They tried the same.**

*How could you tell?*

**Because they had ten.**

*Were they as good as each other or was one girl better?*

**One of the girls was better.**

*Which one?*

**The one in yellow because she [the girl in pink] sat down and she [the girl in yellow] didn't.**

Because outcomes are equal, this girl states that effort employment was also equal (as we would expect from a child who has achieved level two reasoning).

However, she further claims that the girl who did not sit down was better. Her interpretation of "better" therefore appears to be based on exhibited behavioural conduct. The subject believes that this girl was better not because she was more able, but because she was well-behaved and demonstrated the task involvement which was expected of her.

Nicholls (1992) refers to this issue in relation to research which has investigated the child's developing conceptualisations of effort and ability. He presents a variety of sources of misinterpretation and confusion which can arise based on his own investigations. For instance, Nicholls (1992) describes the issue of whether children perceive the harder worker as smarter as one possible source of confusion of interpretations. This issue can be viewed as one which addresses whether or not children believe that ability and diligence are attributes which commonly accompany each other, that is, if children believe that people who work hard are generally smart (Nicholls, 1992). However, this question is not of particular interest when assessing how children construe the concept of ability in relation to effort (Nicholls, 1992). The question which is of interest is how children at different developmental levels construe the meaning of ability and the

relative contributions of effort and ability towards the final outcome of a performance attempt. Nicholls (1992, p. 58) goes on to state that,

...children's judgements indicating that effort and ability are positively correlated are ambiguous. Such judgements do not tell us whether or not children understand that smarter people are those who are able to do as well as others without trying as hard.

A second issue which Nicholls considers and which has been discussed previously in the present thesis relates to the several meanings which the word "smart" can demonstrate. This claim supports the previously cited work of, for example, Kelly (1955) and Korthals (1994) and claims made within the present research. In the following quotation, Nicholls (1992, p. 44) demonstrates that his beliefs reflect those of the aforementioned authors,

When studying achievement-related concepts, we must try to ensure that everyone answers the same question. It quickly becomes apparent that when interviewing children...that what appear to be simple and unambiguous questions are often subject to diverse and unexpected interpretations. In effect, when you ask them one question, different people answer different questions.

Nicholls (1992) also states that children often recognise that the word "smart" can embody different meanings. He cites, for example, a child who states that the harder worker is smarter as she does the work whereas the other child, who tries the least, is also smart as she knows the work better. Young children will often initially select the harder worker as the smarter of the two as they believe that it is not "smart" to be lazy. According to Nicholls (1992) questioning children as to how equal outcomes can be obtained from unequal effort expenditure shifts the focus of the question from diligence to ability and that this line of questioning does not rely on the child's interpretation of the word "smart". It seems however, that this is not altogether a foolproof argument. Although such questioning does not explicitly refer to "ability" or "smartness", the child's interpretation of these constructs seems to be unavoidable. It is possible that young children will interpret the situation in accordance with the constructs evident in their schema and how they perceive the different meanings of these constructs, and that the

child's verbalisations will reflect their own interpretation of the constructs involved. In summary, Nicholls (1992) believes that there is greater potential for individuals to display different interpretations of the concepts under consideration when these concepts are effort and ability than when they are luck and skill. He also believes that by simply asking children to assess others' ability based on observed differences in their effort expenditure and performance outcomes, this method will not adequately control for variations in different individuals' interpretation of the word "ability". This statement provides further support for proposals which are made below and experiments which are carried out on the basis of these proposals, that the removal of effort cues from situations which display differences in achieved levels of success will partially control for developmental differences in construct interpretation. These proposals are discussed in more detail further on in this chapter and the one which follows.

It is apparent from the previous discussion that significant others around children who have achieved level one of effort and ability understanding emphasise the role of effort in achievement situations. These children, with their inability to conceptualise abstract entities, will likely focus on concrete entities, of which demonstrated effort expenditure is an example. The methodology employed to assess effort and ability understanding presents the child with very tangible effort cues, particularly in a physically oriented environment. The more overt nature of effort and ability in physical settings compared with academic ones (Roberts & Pascuzzi, 1979) is discussed in Duda (1987). Consequently, the child is likely to be drawn towards these concrete effort cues to provide a basis for their reasoning. If such cues were not made available to the child their focus on effort may be removed and the belief that effort and ability are synonymous may not be demonstrated. This proposal is supported by comments made by both Johnson-Laird (1983) and Neisser (1987). Johnson-Laird (1983) suggests that the relationships which children perceive between concepts influences the mental models or theories which they subsequently construct about these concepts. These models or theories may then determine how concepts are organised by constraining which features the child focuses on in a given context and the meanings they derive from this construct (Keil, 1991). Neisser (1987) presents a similar perspective. He proposes that the degree to which a context highlights an event determines how it will be construed by the individual. As a result, different "highlights" may induce different conceptual models.

It was suggested previously that young children cannot conceptualise that such an entity as ability exists. To provide a preliminary assessment of this hypothesis children's explanations for equal outcomes derived from unequal effort were examined. Table 2.5 (see page 50) displays these explanations from which it is apparent that at all levels of effort and ability understanding, with the exception of level one, children employ ability as a referent. The fact that children at level one employ factors other than ability, such as effort, as a referent could be a consequence of their belief that effort is synonymous with ability, as Nicholls (1978) suggests. An alternative explanation is that they do not use ability as a referent because they are unable to conceptualise its existence.

If we consider the general cognitive development of very young children it becomes increasingly likely that they are unable to conceptualise ability. Innate ability is an abstract concept and they have not yet reached the stage where they are able to reason on a hypothetical and abstract level. If this is demonstrated in subsequent experiments it is conceivable that in the physical domain, and possibly the academic domain, effort and ability do not become more differentiated from each other at level two. It remains possible that young children only appear to equate effort with ability as a result of their interpretation of these constructs and cues with which they are presented, as discussed earlier. Moreover, if this is the case it is equally likely that young children do not conceptualise the existence of ability.

The validity of this hypothesis could be examined by assessing young children's explanations for unequal outcomes in a situation in which no effort cues are presented. This seems a reasonable approach to adopt as Nicholls (1992) claims that questioning children as to how unequal outcomes are obtained from unequal effort expenditure shifts the focus from diligence to ability and eradicates the confusion which can arise from children's general association of diligence and ability. A logical extension of this argument is that if children are questioned about performance differences when effort cues are removed, then the focus on

diligence is completely removed and the focus on ability is paramount. Employing effort as an explanation for a higher score would indicate that this result is an accurate reflection of the child's reasoning and is not prompted by explicit effort cues incorporated in the methodology, therefore supporting Nicholls' (1978) suggestion that young children do equate effort with ability. However, if the children do not employ effort as a referent in the absence of tangible effort cues then support is lent to the present hypothesis that young children do not equate effort with ability. Moreover, ability-related explanations can provide an indication of the child's capacity to conceptualise ability. If children rely on factors other than ability, such as luck, to explain relatively superior performances, this would then demonstrate that young children cannot conceptualise ability. An investigation which explores this issue in the physical domain is described in experiment two.

**Level 1 Explanations:**

don't know; luck; he enjoyed doing the task more; he kept throwing again; he threw more beanbags; he was a slow coach; one boy did more, then he sat down, then the other boy started then the other one started again; he had one or none first then he got another one and they ended up with the same score; because he sat down; he wanted to win; he was the biggest; one girl was faster; she was trying harder and getting lots in because she was trying hard and she was getting most of them in and the other girl was just throwing and getting some of them in and most of them out; because they did it at the same time; because the one in red threw two in at the same time; because the boys have different clothes on; because the one in red tried to work hard but she had to sit down; because he never sat down for a long time, he got up quick; because she sat down...and then she caught up.

**Level 2 Explanations:**

she was thinking; that girl grabbed about three; because the girl in pink kept sitting down, waiting for the yellow one to throw; she was keep on missing it; because she was throwing, she got up straight after she sat down; because she was taking her time; she got two lucky shots; I think the one in yellow was trying to help the black one as well; the rests I suppose; *because they both aimed properly*; he was quite confident; *it looked like he was aiming; I noticed he had quite a good aim*; because the one in yellow was throwing quite quick although he had to stop to tie his shoelaces; can't explain it; *maybe the one in yellow if he didn't stop he might have got more points*; he wasn't concentrating; by throwing more beanbags; the boy in black probably knocked some into the other boy's hoop; because that one stopped for a bit...so the other one could catch up with her; *because the one in red was a bit better than the other one; because the one in yellow might have been better and the pink girl might have tried harder because she knew the other girl was better*; maybe she was trying too hard; because when the one in yellow got up she went really fast.

**Level 3 Explanations:**

don't know; luck sometimes; *because the other girl was better at the game*; because the girl in pink kept sitting down; because the girl in pink was trying but she wasn't getting very far because the other girl was going faster than her, and getting more, well the same amount in, but she was going faster; *if he didn't keep on stopping he would have got more; the boy in black was a better shot*; they might have been told to try and get the same amount; *he might have found it easier to do than the other one*; he was more into sports and that.

**Level 4 Explanations:**

because the boy in black missed; when he was tying his shoelaces, the other boy was rushing; *maybe he was the best but he was just like showing off; a good aimer; he would have got them in quicker if you wouldn't have counted him sitting down; well, he was trying harder but he wasn't a good shot*; by chance; *because the one that didn't try as hard was the best; the one in pink was more accurate*; because he stopped and had a break and started again.

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**Table 2.5: Children's explanations for equal outcomes from unequal effort expenditure (cited verbatim with ability-related explanations shown in italics)**

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### **2.4.1. Experiment two**

#### **Introduction**

In a physically oriented environment which involved no effort cues, and where one individual scored more than another on a given task, adults' and 4-5 year old children's explanations for this higher score were expected to differ. Because adults are able to conceptualise ability and no information is provided to suggest that the superior score is not ability-related, they were expected to attribute this outcome to greater ability level. However, it was hypothesised that young children are unable to conceptualise ability and do not equate effort with ability. Therefore they were expected to cite any number of factors, other than effort or ability, as reasons why one individual gains a higher score than another. This experiment was designed to investigate two issues- whether young children's verbalisations demonstrate that they equate effort with ability and whether they are able to conceptualise the existence of ability in relation to physical tasks.

#### **2.4.2. Subjects**

Group one comprised 21 adults between 18 and 46 years of age, 18 of which were female and three of which were male. This group served as a control to demonstrate that when an individual has the capacity to conceptualise ability, observed differences in performance outcomes in the present methodology will be attributed to individual differences in ability level. Group two consisted of 19 children between the ages of 4 and 5 years, 8 of which were male and 11 of which were female. All subjects were randomly selected to participate in the experiment, were Caucasian in origin and spanned a range of abilities.

#### **2.5.1. Experimental procedure**

Subjects were shown a picture of two children holding a beanbag and standing behind a line marked on the floor. Each child faced a hoop which lay on the floor at equal distances from the line (see figure 2.3, page 54). Throughout the experiment, pictures involving girls and boys were shown to female and male subjects respectively. Subjects were told that the children were about to play a game in which they were required to stand behind the line, and, within a minute, throw as many beanbags into their own hoop as they could. Subjects were then shown a picture of the two children in a throwing stance (see figure 2.3, page 54)

and told that this would enable them to see how they played the game. After viewing this picture, subjects were asked to predict whether the two children would score the same or differently or asked to make any other comments they felt were appropriate. If they responded that the children would achieve different outcomes they were asked to state which child they thought would score the most, and why. Finally, subjects saw a picture of the two children standing beside their hoops which contained the number of beanbags they were said to have thrown in (see figure 2.3, page 54). One child's hoop contained a great deal more beanbags than the other's and subjects were asked to explain why this child had scored more than the other. If subjects claimed that external factors had caused the difference in outcomes, for example, that this child had practised more or had more bean bags, they were told that this was not possible as neither child had ever played the game before, or that both had the same number of beanbags available. Questioning continued until subjects either cited ability as an explanation or could offer no more explanations of any nature. Subjects' responses were recorded and analysed at a later date.

### **2.6.1. Results**

#### **Outcome predictions- Adults**

Based on the fact that no information was presented to indicate that the two children would score differently, adults were expected to predict that outcomes would be the same. Alternatively, they were expected to state that no such prediction could be made as insufficient information about the two individuals was provided.

Of the 21 adults questioned, the majority (18) responded as predicted. Using a chi-squared analysis to compare the number of subjects who responded as predicted with the number who did not, revealed that significantly more subjects fell into the former than the latter category,  $\chi^2 (1)=10.714$ ,  $p<0.01$ . 15 subjects in this category said that outcomes would be the same or similar, one that the outcomes depended on how good the children were at throwing and the remaining two subjects said that not enough information was provided on which to base a prediction. Of the three subjects who predicted that outcomes would differ, two claimed that the outcomes depended on: whether the children were left

or right handed, and probability, whereas the final explanation employed was that the two girls used different throwing styles.

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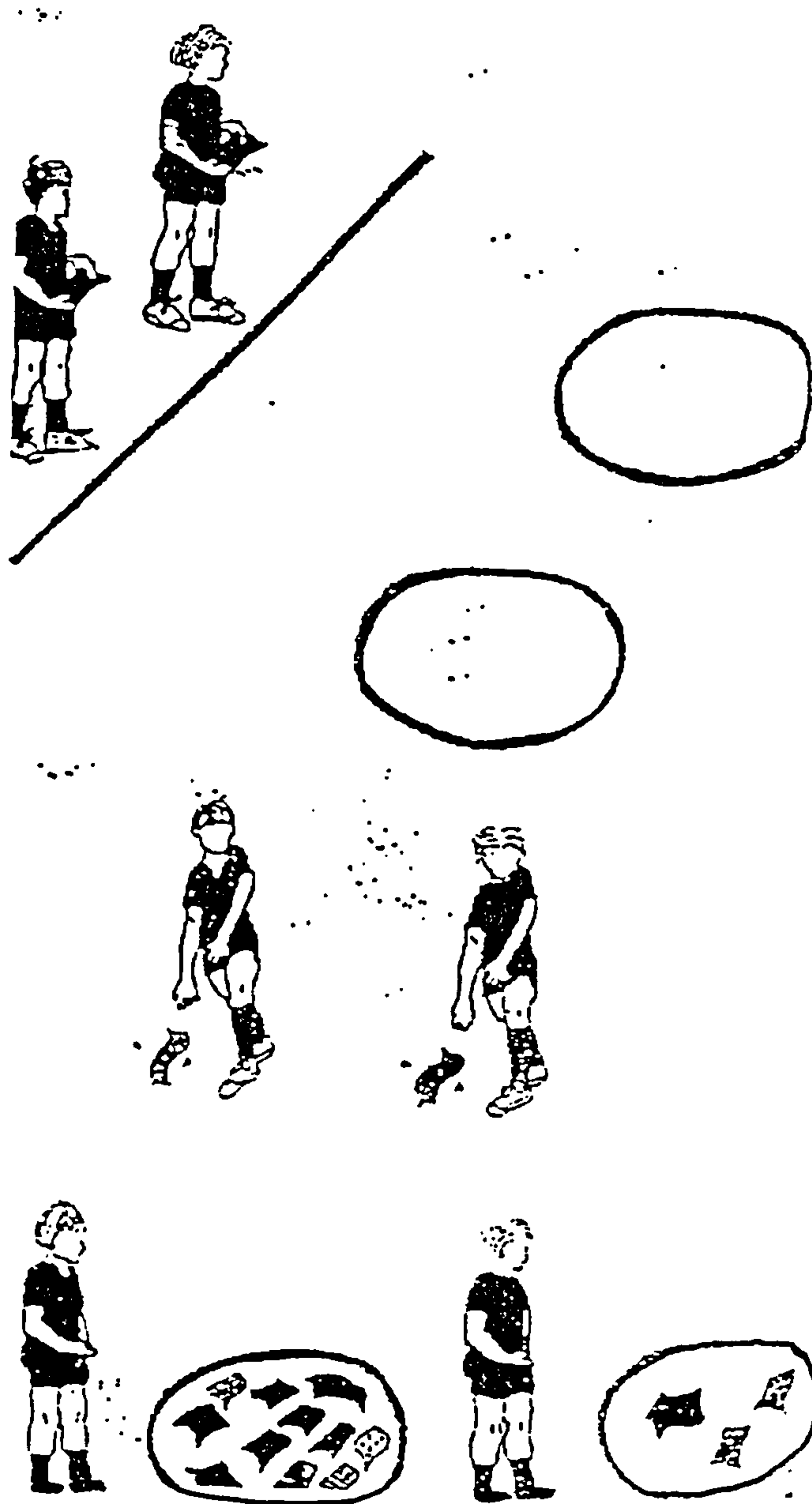


Figure 2.3: Pictures shown to both adults and children who were asked to discuss performance outcomes, in the absence of effort cues, on physical tasks

### **Outcome predictions- Children**

As a result of their egocentricity, children's own beliefs and desires are expected to influence their outcome predictions, and their explanations for these are likely to be illogical. It was hypothesised that no differences would exist between the frequencies of children who predict unequal and equal outcomes. Of the 19 children interviewed, 7 predicted that outcomes would be equal, whilst the remaining 12 predicted that outcomes would differ. As expected, the frequencies of children in these two response categories were not significantly different,  $\chi^2(1)=1.315$ ,  $p>0.05$ . Also as hypothesised, there was no apparent logical basis for explanations which were provided to support predictions that outcomes would differ. These explanations were modified to suit the current context and the child's assumed developmental level, and were as follows: I want him to win; Don't know, she just will win; I know that one can throw higher; I know that one always scores higher; He's higher up in the picture.

### **2.6.2. Reasons for different outcomes- Adults**

Adults were expected to cite greater ability as an explanation for one individual scoring more highly than another. Accordingly, 14 subjects' initial responses were ability-related, as were those of a further 5 subjects when other possibilities had been eliminated. Only 2 subjects did not offer ability-related explanations when their initial suggestions were exhausted. A chi-squared analysis demonstrated that the difference between the number of subjects who gave ability-related explanations and the number who did not, was significant,  $\chi^2(1)=24.3810$ ,  $p<0.01$ . Both the subjects' ability- and non-ability-related statements are shown in table 2.6. These subjects have therefore demonstrated their suitability as a control group. With the exception of 2 subjects, when the situation does not indicate that other factors such as luck or effort are involved, superior performance outcomes were attributed to greater ability.

**Non ability-related explanations:**

she had more beanbags; she's colour blind, she can't see the hoop; her bags are heavier; just chance; short sighted; one of them's blind; plays more sport, greater involvement; a bigger hoop; she's nearer, I don't know.

**Ability-related explanations:**

the way she throws them, the other one's not particularly co-ordinated; she's got better hand-eye co-ordination as to where it's going, she judged it better than the other one; her aim's more accurate and she's got better hand-eye co-ordination; she's better at judging distances, her skill level's higher; she was more accurate; he's a better shot; that one's better at throwing than that one; that one's better at throwing it into the hoop than she is; better aim; one is a worse aim than the other one.

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**Table 2.6: Adults' explanations for differences in performance outcomes  
(cited verbatim)**

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**2.6.3. Reasons for different outcomes- Children**

As table 2.7 depicts, no effort- or ability-related attributions were made by the children, even when all previous suggestions were eliminated as possible explanations for observed differences in outcomes. Those explanations which are marked with an asterisk may be related to the young child's understanding of ability. Perhaps they perceive this as a construct which is related to age and size, as they generally see that older, bigger individuals are able to achieve greater success than them on more difficult tasks. However, interpreted from an adult conception of ability, these statements are not ability-related.

**Reasons cited for performance differences:**

he had more beanbags; he was scoring more...because he had loads of beanbags; he had a bigger hoop; don't know; she's got more... because she threw some in; she did a little throw; she was young\*; she's got a blue hoop; she's got three and she's got twelve; she took them out of the other girl's; she wanted to get more; she's a daddy and she's a lady; because she had, her mother didn't have any more; because they're both sisters; he's big\*; he got them quickly; he could carry them all and he couldn't carry them to the hoop; the teacher gave them more; she got tired.

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**Table 2.7: Children's explanations for differences in performance outcomes (cited verbatim)**

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Overall, this study has revealed that young children do not employ effort or ability in their verbal explanations for performance outcomes. This finding reflects either their reasoning about these concepts or their ability to verbalise (Hudson, in press) suggesting that they may not equate effort with ability nor do they appear able to conceptualise the existence of ability when asked to reason about physical tasks. However, the multidimensional nature of development does not allow Nicholls' (1978) findings in the academic domain to be dismissed. It is possible that Nicholls' explanation describes reasoning in the academic domain whereas the present explanation is more appropriate when judging a very visible performance in the physical domain. Experiment three attempts to resolve this issue by replicating the above experiment in an academically oriented context.

### **2.7.1. Experiment three**

#### **Introduction**

By removing effort cues from the presented situation, the previous experiment revealed that young children, when asked to reason about outcomes on physical tasks, do not use effort or ability, or ability-related factors. This result provides an initial indication that, when asked to reason about physical tasks, these children do not conceptualise the existence of ability or are unable to verbalise this concept and may not use effort and ability interchangeably. In Chapter One, the multidimensional and domain specific nature of development was discussed. These features of development do not allow the present findings to be directly applied to children's reasoning about these concepts in relation to academic tasks.

Empirical investigation is required to assess whether similar results will be revealed when children are presented with situations which portray academic tasks. The study which follows investigated whether children equate effort with ability and are able to conceptualise and verbalise ability when they are asked to apply their understanding to academic tasks.

### **2.7.2. Subjects**

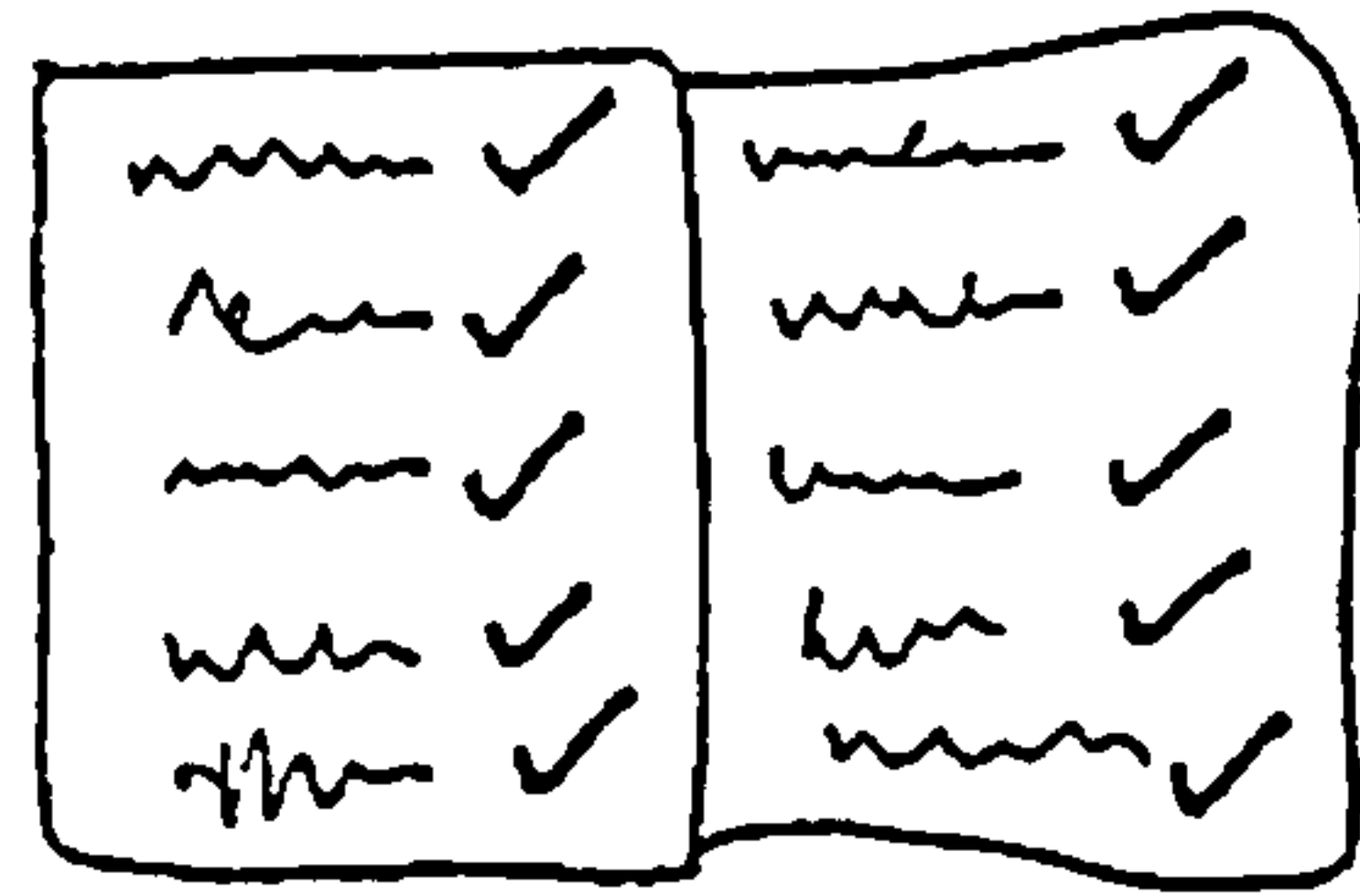
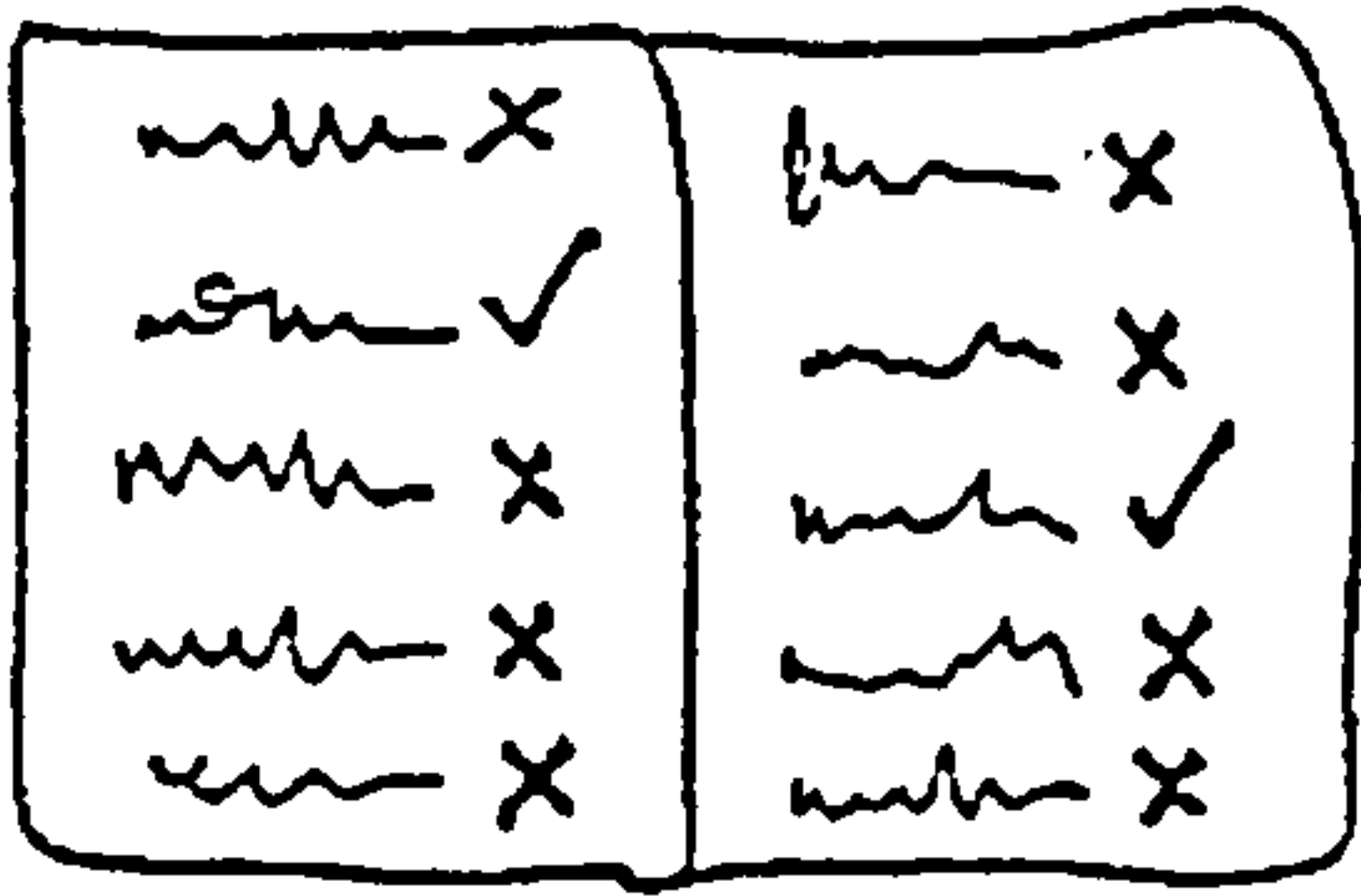
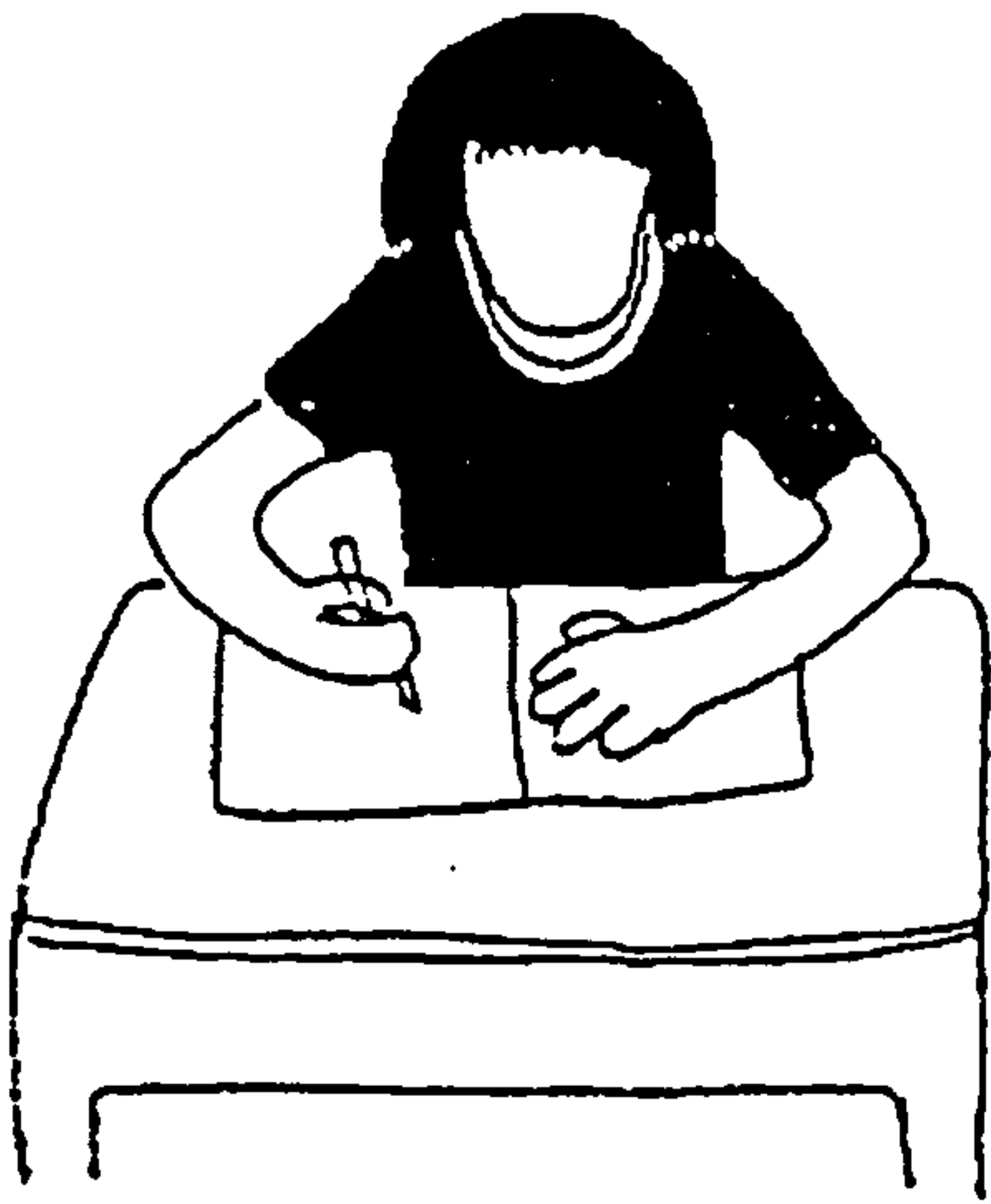
Two groups of subjects were employed, Group One consisted of 23 adults, 14 of which were male and 9 of which were female. Group One represented a control group for the experiment, the purpose of which is explained more fully in experiment two (see page 51). The second group (Group Two) comprised 16 4-5 year old children, 7 of which were female and 9 of which were male.

### **2.8.1. Experimental procedure**

**Adults-** The adult subjects were shown a picture of two children sitting at adjacent desks and each writing in a book which lay on the desk in front of them (see figure 2.4, page 60). They were told that the children were taking a test in school and asked to predict whether the children would score the same or differently on the test. If their prediction was that outcomes would differ they were asked to provide an explanation for their answer. Next the subjects saw a picture of the two children's workbooks. One child's book showed that they got all 10 answers correct (indicated by a tick next to each one of their answers) and the other's that they only got 2 answers correct (indicated by ticks next to two of their answers and crosses next to the remaining eight). Underneath each book was a number corresponding to the number of questions which each child was said to have answered correctly (see figure 2.4, page 60). Subjects were then asked to explain why one child had scored more than the other on the test. If their explanations suggested for example, that one child had done more revision for the test or that factors such as help from others were responsible for the outcome, they were told that this was an impromptu test and supervised to prevent collaboration between students. Questioning continued until subjects cited ability as an explanation or until they had exhausted all alternative explanations.



**Children-** Pilot interviews conducted with 4 year old pre-school children indicated that although these pictures were suitable for use with adults, they could not be used with young children. These children could not relate to the situation as easily as adults could, as children and adults define cognitive tasks in different ways and have different experiences. It was decided therefore to interview 4-5 year old children who had already entered school and to use a different task. The task selected was taken from Harter & Pike's Pictorial Scale of Perceived Competence and Acceptance for Young Children (pre-school and kindergarten, 1980). This task involves completing a jigsaw puzzle and is one of a number of tasks which are used by Harter & Pike to measure children's perceived cognitive competence.



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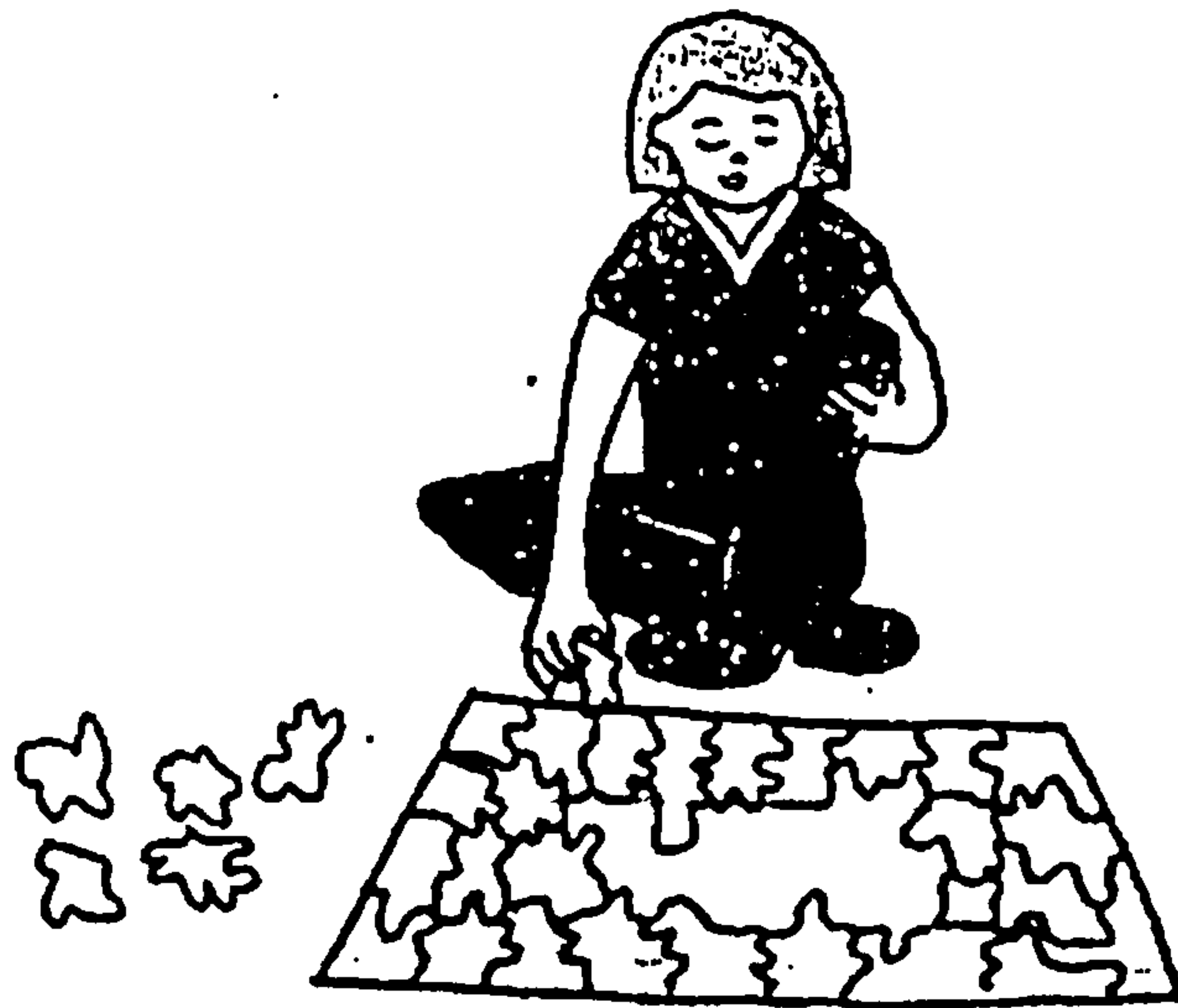
**Figure 2.4: Pictures shown to adults who were asked to discuss performance outcomes, in the absence of effort cues, on academic tasks**

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Subjects were shown a picture of two children working side by side at this task. One child's puzzle was almost finished, only a few pieces lay outside the puzzle and the child was shown placing a piece in the jigsaw. The other child's puzzle contained only a few pieces and the majority of the pieces still lay outside the jigsaw (see figure 2.5). The subjects were told that both children were trying to complete the same jigsaw puzzle and were asked to explain what the children had to do and which child had inserted the most pieces in their jigsaw. These questions were used to check that the subjects understood the task requirements and the children's outcomes on the task. Following this, subjects were asked to explain why one child's jigsaw was more complete than the other's. Again, any initial explanations relating to previous experience or to factors which could not be controlled by the child were counterbalanced by the experimenter. Throughout the experiment, all subjects were shown pictures of same-sex children to eradicate gender bias from their responses.

### **2.9.1. Results**

**Adults' Outcome Predictions-** As demonstrated in a physically oriented context, the majority of adults were expected to predict that outcomes would be the same or similar or that insufficient information was provided to enable such a prediction to be made. Of the total 23 subjects, 14 stated that the two children would obtain the same score whilst 9 stated that they would score differently. The reasons for these predicted outcome differences did not provide any insight into the subjects' reasoning, but appeared only to reflect their idiosyncrasies. For example, they related to variables such as, hair colour, colour of clothes, conforming to "clever" or "conservative " stereotypes and purely for argument's sake.



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**Figure 2.5: Pictures shown to children who were asked to discuss, in the absence of effort cues, performance outcomes on academic tasks**

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**Adults' Explanations for Different Outcomes-** Adults were expected to cite ability as an explanation for one individual gaining a relatively higher level of success than another. Such explanations were anticipated either in initial responses or in responses which followed the dismissal of all other factors which could contribute towards a performance outcome. The adults' explanations for different outcomes are shown below in table 2.8. Although some non-ability-related explanations were given, a chi-squared analysis indicated that the number of adults which gave ability-related explanations was significantly greater than the number who did not,  $\chi^2 (1)= 22.2609, p<0.01$ .

**Non ability-related explanations:**

the exam suited the other girl better, better exam technique; he's more conservative; parental input: he's wearing a v-neck, his parents are more old fashioned; she appealed to me; she's wearing green, a happy and relaxed colour, red indicated the other girl is tense and worried.

**Ability-related explanations:**

she's cleverer; she conforms to society's expectations of what a clever girl should look like; she just knew her stuff better, it must have been a subject she was better at; she's more intelligent; perhaps he's intelligent and the other one's stupid; he knows the answers, better memory retention or he's able to work things out better; she's brighter.

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**Table 2.8: Adults' ability and non-ability related explanations for differences in performance outcomes on academic tasks (cited verbatim)**

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**2.9.2. Children's Explanations for Different Outcomes-** The children were not expected to refer to either effort or ability as an explanation for unequal outcomes in the absence of effort cues. Although subjects did not provide any effort-related explanations, it is evident from table 2.9 that a number of children (6) did give ability-related explanations for observed differences in outcomes. The number of children who gave ability-related explanations did not differ significantly from the number who did not,  $\chi^2 (1)=0.375, p>0.05$ .

Non ability-related explanations:

she was older\*\*; she's tired; doing different puzzles; don't know; he must have a map; didn't know he had a map; he went faster\*\*; he doesn't want to; he likes doing jigsaws; it's in a picture; he's got his hand out but he's not picking none up\*; she's happy; she's getting on with it\*; that one's the biggest and that one's the smallest \*(children, not jigsaws); he's a little girl and he's a big boy\*\*; she's looking at the top of the jigsaw; he's not putting the pieces in\*; he wants to take his time; his hands are going fast\*; his hands are slow, he's looking for the side pieces.

Ability-related explanations:

put the wrong pieces in the wrong place; he fit more pieces in; he's not very clever; she doesn't know what to do; he doesn't know where the pieces go; she put them right, but the other one doesn't know which is which; he knows how to do his jigsaw and he doesn't; the other one was thinking where the pieces go; she was good at doing jigsaws when she was a little girl, she turned them all over and she looked at the pieces; she wasn't good at doing jigsaws because she didn't turn them all over; he started off with the edge pieces; every time he puts one in, it fits.

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**Table 2.9: Children's explanations for different outcomes on academic tasks (cited verbatim). \*= possibly effort-related  
\*\*= possibly ability-related**

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Some of the children's explanations again raise the issue of differences in interpretation. The statements labelled with an asterisk may be interpreted by some individuals as effort-related. However, such an interpretation does not appear appropriate in the present context as the children's statements can be directly related to the behaviour of the models in the pictures. For instance, one child stated about the model who had completed less of the jigsaw, that, "He's not putting the pieces in." This could be construed to mean that the model is not performing the task as required and not trying to put any pieces in. However, examination of figure 2.5, which shows the pictures which were used, indicates that this child is referring only to the behaviour which he sees exhibited in the picture. In the picture, this model is not putting any pieces in at that time. It appears that, as many children do, this boy is simply describing what he sees, rather than providing a causal explanation for this. As was evident when children were asked to discuss physical tasks, some explanations were provided which may represent the child's concept of ability if it differs from the adult's. For instance, they may believe that ability is related to gender, size or age, if the explanations cited above are considered. These explanations could be interpreted as ability-related by the young child, but not by the adult experimenter and are marked with a double asterisk in table 2.9.

### **2.10.1. General Discussion**

#### **Young children's equation of effort and ability**

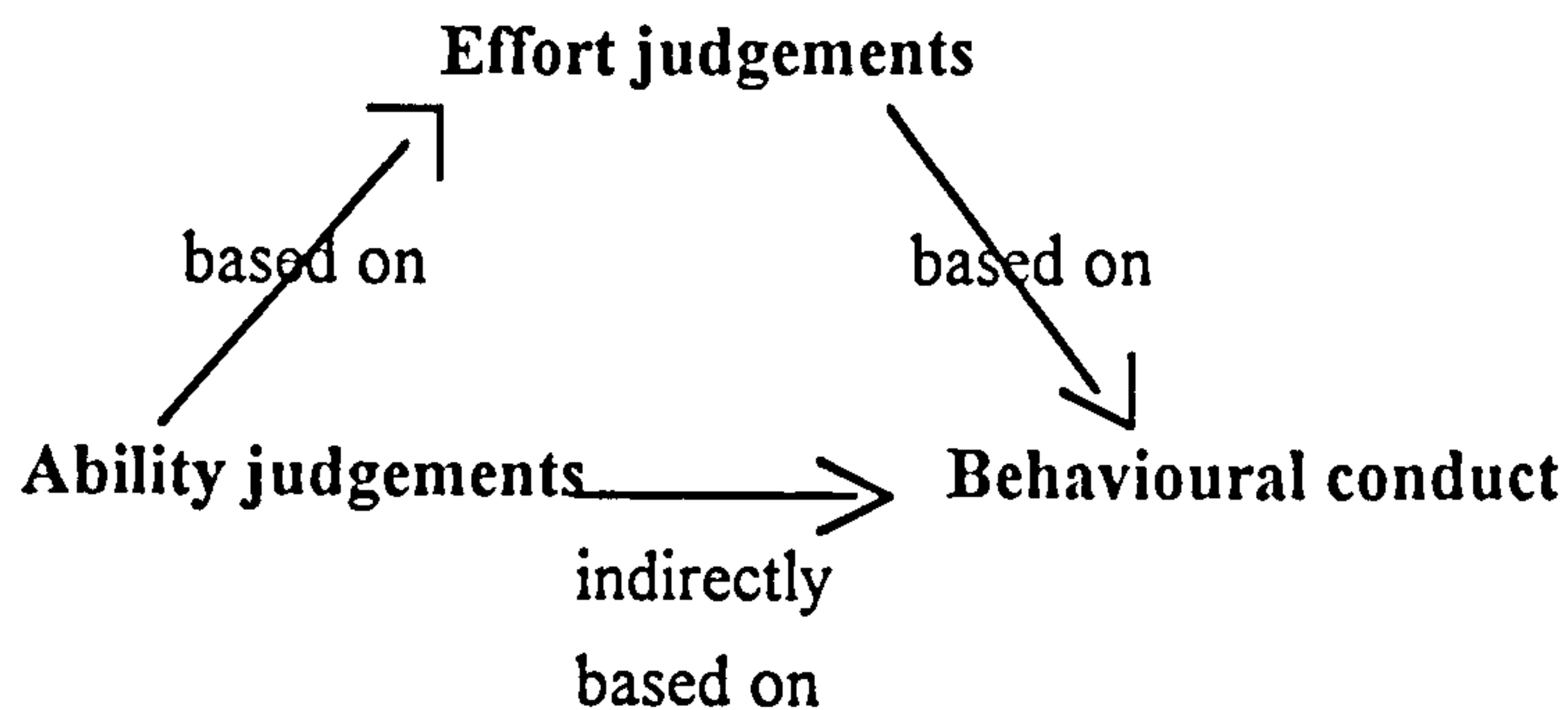
The present study demonstrated that, regardless of whether children are asked to reason about academic or physical tasks, they do not use effort and ability concepts interchangeably (Hudson, in press). When asked to explain one individual's relatively superior performance to another's in the absence of effort cues, no effort-related explanations were provided. It appears therefore that when very young children appear to equate effort with ability their reasoning is based on the effort-related information with which they are presented and not on their internal system of beliefs. They provide what, to them, is the most obvious explanation for performance outcome.

An examination of the present results together with those discovered by Stipek & Tannatt (1984) and Blumenfeld, Pintrich, Meece & Wessels (1981) provides further support for the current proposal that young children's concepts of effort and ability cannot be described as existing within a single schema. Stipek & Tannatt (1984) asked children from pre-school through to the third grade to rate themselves and their classmates on their smartness levels and to rate which children in the class were the best and worst thinkers and the best and worst at two specific tasks. The children's explanations for their ratings provided information about their use of effort and ability and what these concepts mean to them. Subjects often employed work habits to justify the levels of smartness which they attributed to their classmates, suggesting that they equate effort and ability. However, contrary to their predictions, Stipek & Tannatt (1984) discovered that work habits were cited by pre-school children no more frequently than those in the later grades. Even the second and third graders, according to Stipek & Tannatt (1984), did not clearly distinguish between work-related behaviours and ability in the explanations which they provided for their classmates' smartness levels and their ratings of the best and worst thinkers in the class.

Stipek & Tannatt (1984) suggest that their results support claims made by Blumenfeld et al (1981) that elementary school children believe that trying and good conduct are synonymous with each other. In addition, they suggest that their findings lend further support to previous research which has indicated that young children believe that effort and ability are synonymous with each other. However, it seems that both Stipek & Tannatt's (1984) results and arguments presented by Blumenfeld et al (1981) can alternatively be employed to support current proposals about these issues. According to Stipek & Tannatt (1984), Blumenfeld et al (1981) state that young children base their effort judgements on observed behavioural conduct and that effort expenditure provides the basis for their judgements about levels of ability. Stipek & Tannatt (1984) claim that the results of their 1984 study support this argument as young children justified their low smartness ratings by stating that children to whom such ratings were given fooled around instead of getting on with their work. Contrary to Stipek & Tannatt's (1984) suggestion that Blumenfeld et al's (1981) argument favours the young child's equation of effort with ability, closer inspection of this argument appears to indicate quite the opposite. If, as Blumenfeld et al (1981) suggest, young children base their effort judgements on behavioural conduct and their ability judgements on effort expenditure, then their ability judgements seem indirectly to be based on behavioural conduct. Figure 2.6 demonstrates this relationship which has been proposed by Blumenfeld et al (1981) and includes the indirect relationship between ability and behavioural conduct which is proposed by the present author. It seems that young children do base their ability judgements on effort but only because these effort judgements are based on behavioural conduct. This may also indicate an early understanding that success can be acquired through effortful practice, something which is assumed only to occur with the developmental advances associated with later child or adulthood. It is not surprising that young children do not differentiate between effort and behavioural conduct when both are constantly reinforced by significant others (see for example, the quotation from Stipek & Tannatt, 1984, on page 67). This may result in the proposed relationship between success, or ability, and behavioural conduct, and may indicate that young children believe that ability may be something which can be gained through effortful practice and following procedural instructions, and that ability is under the control of the individual. If this is the case, this perceived controllability reflects the young child's egocentrism, which leads them to believe that their experiences are to some extent, personally controllable and modifiable. The only aspect of behavioural conduct which is available for reference to the young child when their understanding about effort and ability is assessed is effort



expenditure, hence, they may then appear to base their ability judgements on effort when in fact effort is merely a manifestation of behavioural conduct. The confusion of behavioural conduct, effort and ability, as proposed by Blumenfeld et al (1981), also reflects the differences in interpretation which exist between the adult's and child's interpretations of ability




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**Figure 2.6: Relationship between effort, ability and behavioural conduct proposed by Blumenfeld et al (1981) with additional relationships suggested by the present findings between ability and behavioural conduct**

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related interview questions. If young children base their ability-related judgements indirectly on behavioural conduct as is suggested by the present results, then it seems that this would lead, through differences in construct interpretation, to the child's apparent belief that effort and ability are synonymous. As suggested previously, it seems that young children may base their ideas about effort on behavioural conduct as this is the only behaviour related variable with which methods assessing their effort and ability understanding presents them. This hypothesis also supports present proposals that young children interpret ability-related questions, for example, "Are both girls good at this game?" in terms of behavioural conduct instead of ability. As Stipek & Tannatt (1984, p. 82) state,

Considering the degree to which procedural issues and conduct are stressed in early elementary school classrooms (Blumenfeld, Hamilton, Wessels & Falkner, 1979), it is perhaps not surprising that children's concepts of ability, effort and conduct are confounded.

Although the present findings demonstrate some support for this confusion of these concepts, whereas Stipek & Tannatt (1984) believe the source of this confusion derives from the child's confounding of effort and ability, findings from

the present thesis indicate that this confusion is more likely to derive from the child's confounding of ability and behavioural conduct. Although it does seem that, if young children see ability and success as under their personal control, as was suggested previously, it may not be necessary for them to differentiate between ability and behavioural conduct. If confounding of these factors results in the belief that success can always be achieved then the young child will remain optimistic about their own ability and levels of future success. Further support for the present argument is provided by Stipek & Tannatt (1984). They revealed that to some extent, pre-school children used "smart" and "likeable" interchangeably when discussing reasons for the ability-related evaluations which they were asked to make. They suggest that the interchangeable use of these concepts could arise as a result of the emphasis which pre-school teachers place on exhibiting socially acceptable behaviour. Subsequently, young children may then base their ability related judgements on behavioural conduct, as proposed previously in the present research. It seems that two interrelated issues are evident here: differences in the way in which individuals at different developmental levels interpret the same constructs, and the tangible effort cues which children are normally presented with when their understanding of effort and ability is assessed. Stipek & Tannatt (1984, p. 83) reiterate statements made previously which have highlighted the importance of allowing for developmental differences in construct interpretation when assessing young children's conceptual development,

...in studies of children's self-concept of ability, it is important to consider the child's definition of the terms being used.

They cite as an example that young children may be referring to the fact that they like this individual or that this individual exhibits socially acceptable behaviour when they state that this child is smart. As a result, Stipek & Tannatt (1984, p. 83) claim that,

...we cannot assume that evaluative terms in measure of self-concept have the same meaning for all children,

or, it seems for all adults.

### **2.10.2. Young children's conceptualisation of ability**

The present study hypothesised that very young children cannot conceptualise the existence of ability as a factor involved in task outcome. Unless ability is explicitly

referred to, these children will not employ this concept as an explanation for one individual's greater level of success than another's. Alternatively, if the child does have an "ability" schema, even when ability is not explicitly referred to by the experimenter as a possible cause of outcome, he/she will provide ability-related explanations.

There appears to be some domain specificity involved in this issue and only inconclusive support was revealed for the original hypothesis in this study. As expected, when children were asked to reason about physical tasks, no ability-related explanations were offered. However, when they were asked to reason about academic tasks, some children did provide ability-related explanations (Hudson, in press). These domain specific differences cannot be explained by the current data and should be addressed by future research but, this finding does emphasise the need to be aware of the possible domain specific nature of developing beliefs about effort, ability and the assessment of competence. It also suggests that 4-6 year old children *are* able to recognise the mediating effect of ability on the task performance of others in an academic context. The finding that children who were asked to discuss performance outcomes on academic tasks employed ability related explanations whilst those who were asked to discuss physical tasks did not is surprising. Duda (1987) cites work by Roberts & Pascuzzi (1979) which demonstrated that effort and ability can be more easily determined in physical than in academic contexts. Also, Duda & Nicholls (1992) stated that sporting competence is more visible to others than is academic competence. This is obviously an area for future research to address. The flaw in the research design which meant that no direct comparison could be made between the academic and physical domains within one group of children renders it impossible to state that it is domain rather than subject differences which revealed these results.

When asked to reason about academic tasks, children's responses indicated that, contrary to predictions, they are capable of conceptualising the existence of ability. This was demonstrated by responses such as the highest achieving child, "knew what to do", or, "knew where to put the pieces in the puzzle". With the exception of two children who substantiated their explanations by saying that this

child was "clever" or "good at puzzles when she was younger", the remaining subjects could not explain their reasoning in terms of ability. It therefore appears that although young children can conceptualise the existence of ability, they are sometimes unable to verbalise their reasoning. This explanation is supported by Harter's (1986) claim that before eight years of age, children do possess a feeling of general self-worth but cannot verbalise their judgements about this global concept. Young children's statements made here appear to indicate that they recognise positive affect in others and that others can derive positive affect from performing tasks which they enjoy. For example, they cited explanations for superior performance levels such as, "Because he likes doing jigsaws" and, "Because she wants to do it". These responses also indicate that young children appear to associate success with affective reasons for performing a task. Their responses do not clarify whether they believe that positive affect mediates success on a task or whether success derives from positive affect and the desire to perform the task. The direction of this relationship presents a possible question for future research to pursue.

It is possible that possessing knowledge about a concept and employing this concept in verbal statements presents two differing perspectives to the current findings. The present data can be interpreted in one of two ways. First, young children could be capable of conceptualising the existence of ability but do not use it, perhaps because they are unable to, in their verbal explanations for performance outcomes. Alternatively, young children may not employ ability in their verbalisations because they cannot conceptualise the existence of this concept. The present findings indicate initial support for the former explanation. That children who discussed performance outcomes on academic tasks provided ability-related explanations seems to suggest that young children can conceptualise the existence of ability but have difficulty verbalising their beliefs about this construct.

Current findings also support those of Stipek & Tannatt (1984) whose study investigated young children's ability-related judgements of their own and their peer's academic ability, as cited previously. Stipek & Tannatt (1984) examined the factors which the children used to substantiate their ratings and revealed that

young children, when discussing academic competence, can employ ability-related factors, as did the present research. The children's responses were grouped into categories which included, for example, "work habits", "tautological responses" and "mastery". Examples of mastery related explanations which Stipek & Tannatt (1984, p. 78) cite are,

He colors inside the lines. [and] She can count to 100.

It appears that such explanations can also be interpreted as ability-related, when the examples which Stipek & Tannatt (1984) have provided are considered. Their results revealed that even very young children could employ such criteria and only on ratings of "worst thinker" did significant differences exist between the numbers of children at different grade levels who employed these mastery-related explanations. First and second graders were more likely to employ mastery-related criteria as explanations for their ratings of who was the worst thinker than children in the other grades. Consider table 2.10, which is taken from the data provided by Stipek & Tannatt (1984) and which shows the frequencies of children in each age group who provided mastery-related explanations for their ratings of the listed variables. These data indicate that even at pre-school age, the frequency of mastery-related explanations was comparable to those provided by children from the two older age groups. Results of the present research mirror these findings which also appear to indicate that young children can verbalise their ideas about academic ability. Also in line with current proposals, these results suggest that young children may see ability as a concept which is distinct from effort, evidenced by their ability-related explanations for performance levels.

	Pre-school	Kindergarten & 1st grade	2nd & 3rd grade
Best at task 1	7	10	7
Worst at task 1	7	7	3
Best at task 2	9	9	8
Worst at task 2	4	6	11
Best thinker	5	9	5
Worst thinker	1	10	5
Classmates' smartness	5	7	6

**Table 2.10: Frequencies of children of all ages who cited mastery-related explanations for their ratings of the variables listed, taken from Stipek & Tannatt (1984)**

Findings from the present study provide direct evidence concerning the effort and ability-related content of young children's verbal explanations for observed differences in performance outcomes. Although no similar direct evidence can be presented which demonstrates how the young child construes the meaning of ability, the author believes that findings from this study can be used to make strong suggestions, or inferences, about how the child construes the meaning of this concept. There are various reasons why this position is adopted, which are discussed below.

In her consideration of developmental approaches to children's achievement motivation, Duda (1987) discusses Nicholls' work which has investigated the child's developing conceptions of effort and ability. This research required children to provide verbal explanations, in relation to ability level and effort expenditure, for performance outcomes, as demonstrated previously in Chapter One. Duda (1987, p. 132) states that,

Nicholls' theory considers the meaning of ability or *how ability is construed* in respect to performance and persistence in achievement settings,

and, the assumption is,

that the concept of ability has different meanings to individuals at different stages of development.

The important phrases to consider from these quotations are, "the meaning of ability" and, "how ability is construed". It is apparent that Duda (1987) is suggesting that young children's explanations for performance outcomes can provide information about how they construe the meaning of ability. Similar evidence that Nicholls makes such inferences is demonstrated in Nicholls (1992). He firstly discusses the roles which the concepts of luck, effort, task difficulty and ability play in the individual's interpretation of their immediate performance outcomes. He then proceeds to propose that developmental changes are involved in the child's conceptualisations until the complete differentiation of ability from effort, luck and task difficulty results in the understanding that ability is a current capacity. Following this, Nicholls (1992, p. 34) states that the issue under consideration is,

...what children think ability is- the meaning of ability.

Prior to this, when discussing the developmental continuum of effort and ability which he has determined, Nicholls (1989) again refers to these findings as a possible source of information about how the child construes the meaning of ability, referring to the different levels as,

different levels of meaning (p. 51)

and the reasoning which is revealed as reflecting,

the meanings of ability and effort (p. 52).

It appears that both Nicholls (1989; 1992) and Duda (1987) have suggested that young children's explanations for performance outcomes and the developmental changes involved in these explanations can be employed to make inferences about the meaning of ability to children at different levels of this understanding. For instance, Nicholls (1978; 1989) states that to very young children who have only

achieved the initial level of this understanding, the meaning of ability is effort expenditure or level of outcome.

A reasonable assumption which can be made, based on the writings of both Duda (1987) and Nicholls (1989; 1992), is that although findings from the present study can provide only direct evidence about children's use of effort and ability in their verbal explanations for outcomes, these explanations can be employed to infer how these young children construe the meaning of ability.

### **2.10.3. Criticisms**

One major criticism must be aimed at experiments two and three. This relates to the criteria which were employed to assess whether or not young children's statements were ability-related. The children's statements were evaluated from an adult perspective. For instance, if a child stated that one child managed to achieve a higher level of success than another because they were older or bigger then this was not labelled as an ability-related explanation. It remains conceivable that size or age represent the meaning of ability for the young child, but assessed from an adult perspective, these factors are not ability-related. This issue does seem to be somewhat unavoidable and allows us only to conclude from these experiments that young children cannot easily verbalise their ideas about ability in a way which can be interpreted from an adult's perspective of this concept but, contrary to previous research findings, do not appear to employ effort as a referent for ability when effort cues are removed.

A more effective method of assessing young children's conceptions of ability should, if possible, be determined, although when one considers the following statement from Nicholls (1992, p. 34) this does not present an easy challenge:

Children's conceptions are often difficult for adults to understand (Nicholls, 1989)...It is hard not to project our own conceptions on children when they lack understandings that are, for us, axiomatic.



**CHAPTER THREE.**

***THEORIES OF  
DEVELOPMENTAL  
CHANGE.***

### **3.1.1. Introduction**

Previous chapters have discussed research which has investigated the development of children's understanding of effort and ability concepts when they are asked to reason about academic tasks. Subsequently, experiments have been described which examined children's ability to apply their knowledge of these concepts to physical tasks. This empirical investigation established that where both domains are concerned, similar developmental trajectories of effort and ability understanding are exhibited. A relevant issue to pursue at present is the pattern of developmental change which is demonstrated by this conceptual understanding. In this chapter a number of developmental theories are considered which present a common perspective on the nature of developmental change. Although the theories discussed demonstrate dissimilar aetiologies, associations between the approaches which they propose are apparent. These approaches share common elements which effectively link them together. The principles which provide this link between these different approaches are as follows, the developing system, or organism: is dynamically stable; has the capacity to self-regulate; demonstrates a tendency to reduce dissonance; requires disequilibrium or instability to effect developmental change, and, experiences developmental periods which exhibit differential degrees of stability.

The first section of this chapter introduces the main features of the four different theories which contribute towards the approach adopted in this thesis. Parallels will then be drawn between the common elements of these and other developmental theories which demonstrate similar perspectives. Implicit within some of these theories is the suggestion that the stability of different developmental periods can be examined by observing exhibited behaviour throughout these different periods (for example, Fogel & Thelen, Gesell and Piaget). Empirical evidence is presented which supports this argument. A description follows of how the present research will attempt to employ this method of assessment to examine the applicability of these theoretical perspectives to the development of effort and ability conceptualisations with regard to the physical domain.

### **3.2.1. Self-organising Systems Theory (Fogel & Thelen, 1987)**

Fogel & Thelen (1987) have incorporated the perspectives of general systems theory (Sameroff, 1984), dynamic systems theory (Wolff, 1987), and domain theory (Fischer & Canfield, 1986) to generate their own proposal of a dynamic, self-organising system. Essentially, self-organising systems theory accounts for developmental change in the absence of inherent instructions (for example, genetics). This approach proposes that intrinsic instructions which direct development are not required as the interactions between the components of the system, or organism, result in developmental change. Order is derived from the process of developmental change itself and not from a set of procedural instructions (Thelen, 1989). For instance, Thelen (1989) cites as an example, the series of reactions which take place when bromate ions which are contained in a highly acidic environment are placed in a glass dish. In the presence of these elements a pattern of reactions is produced which results in the formation of concentric, circular rings and spirals. The production of this series of reactions is not generated by any set of instructions. This order derives simply from the initial configuration of conditions evident at the outset, that is, the combination of these chemicals at a particular room temperature within a confined space. Scientists have further demonstrated this self-determined generation of order (Thelen, 1989). Without providing procedural instructions in the form of a computer programme, they have succeeded in reproducing this series of reactions in computer simulations. The only variables which are entered are the initial conditions from which the computer carries out the same reactions which are observed when the actual chemical constituents are assembled in this configuration. Therefore, in the absence of explicit procedural instructions, these elements demonstrate a tendency to self-organise into a series of ordered patterns. Thelen (1989) proposes that this tendency is a feature of other developing systems, such as the human organism. Subsequently, developmental change occurs not as a result of instructions informing the system how and when to change, but as a consequence of the system's tendency to self-organise as a means of creating order. This process creates the information necessary for development to occur and for individual differences to be manifest within a species. Consequently, self-organising systems possess the properties necessary to describe the genesis of both individual differences and species similarities (for example, Fogel & Thelen, 1987). Essentially,

Order emerges as a dynamic rather than as a prescriptive phenomenon. (Fogel & Thelen, 1987, p.749).

As a result of constant energy exchange with its surroundings, the organism, whilst demonstrating dynamic properties, manages to maintain stability. Each component of the organism has a functional purpose which may not be manifest until some time in the future. This purpose depends on the child's developmental status, previous experiences, and the activity in which they are currently engaged.

A number of concepts and terminologies which are central to self-organising system theory's proposals require definition to facilitate understanding of their roles in developmental change, as discussed in the following section. These features include: critical parameter values; phase shifts; attractor states; disequilibrium, or instability; amplification of natural fluctuations; noise, and, control parameters. Throughout all developmental states, the system displays a preferred range of behavioural outputs which result in greatest system comfort. The most preferred of these is known as the attractor state. When the system experiences disruptions, it self-regulates to settle at this attractor state and regain the comfort, or stability, experienced prior to this disruption. Relocation to the attractor state following system disruption is more easily achieved when the system is presently experiencing a stable developmental phase than when an unstable phase is encountered. Thelen (1989) uses fluctuations in heart rate and body temperature to illustrate this concept. When the system experiences disruptions of these factors, they are effectively dislodged from their normal values, or the system's attractor state. This can occur, for example, during exercise when heart rate and body temperature are increased and the output of the system extends beyond the normal range of behavioural output which is exhibited when the individual is at rest. Although the dynamic stability of the system allows its continued functioning within this normal range of behavioural outputs, to maintain system stability, the system wants to return to its attractor state. Consequently, following the system disruption caused by engaging in exercise, the individual is able to reduce both their heart rate and body temperature to relocate at the attractor state. This example also demonstrates the dynamic stability of the system. Although a preferred attractor state exists, the system is not only restricted to the behavioural outputs exhibited at the attractor state. An acceptable range of behavioural outputs exists between which the system can fluctuate and still maintain some degree of system stability. In the present example, the individual has a preferred heart rate and body temperature. However, the system can be maintained when changes in these values are within certain limits, for

instance, as a result of exercise. The stability of the attractor state, hence of the system as a whole, varies according to the individual's current developmental phase.

Thelen (1989) suggests that development involves alternate periods of system stability and instability. Moreover, that movement from one stable behavioural mode to another involves the experience of an intermediate unstable mode. She refers to this as a phase transition, or phase shift, which she views as an essential requirement for change and to effect the production of novel behavioural outputs. Various factors are involved in effecting movement into a transition phase. The first of these relates to what Thelen (1989) describes as a control parameter. The components of a system do not all change at the same rate, the slowest developing component is known as the control parameter. Changes in the control parameter therefore drive the system into a phase transition which effectively results in movement to new phases of development. Thelen (1989) does emphasise however that control parameters do not prescribe change by instructing the system how and when to change. It is alterations of the control parameter which result in wider system reorganisation and novel behavioural outputs. There are two ways in which control parameters are capable of triggering developmental change. As mentioned previously, the system can maintain stability within a range of behavioural outputs, the limits of which are known as critical parameter values. Changes in one or more system components may move the system beyond the normally accepted range of parameter values and beyond these critical parameter values. Hence, when behavioural outputs are no longer within the accepted range, the system cannot easily relocate to its attractor state and movement into a phase shift is effected. Essentially therefore, control parameters effect developmental change, as initiated by movement into a transition phase, by amplifying natural fluctuations in parameter values to the extent that critical parameter values are exceeded and new behavioural modes are exhibited. Fluctuations in parameter values are constantly produced by naturally occurring noise, or disruption to the system. (Noise can be broadly defined as general perturbation of the system experienced as a consequence of dynamic interaction between system components and between the system and its environment.) The system is able to tolerate these natural fluctuations in parameter values and subsequently maintain an overall system stability. However, when this noise reaches a magnitude which can no longer be tolerated by the system, a phase shift occurs and new behavioural

outputs are observed. Thelen (1989) cites research by Kelso, Scholz & Schöner (1986) which exemplifies the role of the control parameter in effecting a nonequilibrium phase shift. Kelso et al (1986) asked subjects to extend the index finger of one hand whilst simultaneously flexing the same finger on the other hand in time to a metronome which initially dictated a slow pace. As the pace was increased, the subjects involuntarily shifted from this out of phase movement to flexing and extending their fingers at the same time, therefore demonstrating an in phase movement pattern. They concluded that at a critical speed, the system shifted from exhibiting out of phase movements to exhibiting in phase movements. The system was not provided with any instructions which told it to make this shift- the new behaviour resulted merely from the task demands and the thermodynamics of the elements which combined to produce this movement. Therefore Thelen (1989) claims that the energy sent to the system to effect an increase in movement speed represented the single control parameter which produced the phase shift manifest by the change from out of phase to in phase movements. The second source of change related to control parameters lies within the control parameters themselves, or changes from one control parameter to another. These changes are a consequence of movement between different contexts which individuals experience throughout different periods of development, for example, their physical or social environments.

Being independent of a particular time scale, a dynamic systems approach is applicable to both short term changes, such as the phase shift involved in the transition from walking to running and long term changes, and such as skill acquisition over a period of months (Fogel & Thelen, 1987). To date however, this approach has mainly been employed to explain the development of early motor skills (Thelen, 1989) but can potentially describe development in a number of competency domains (Fogel & Thelen, 1987). The most relevant aspect of this theory with respect to the present research is the proposal that throughout development, the system experiences periods of differential stability. Thelen (1989) suggests that in order to move from one stable behavioural mode to another, more advanced state, the system must experience an unstable mode which she refers to as a phase shift, or phase transition. Before developmental change can occur, the system must encounter this period of instability. Essentially therefore, Thelen (1989) proposes that the system experiences alternate periods of stability and instability, with each successive state of stability demonstrating

greater stability than those which preceded it. She further suggests that the stability of the system during different developmental periods can be measured by observing the variability of the behaviour exhibited by the system throughout this period. During stable developmental periods exhibited behaviour demonstrates less variability than that exhibited during unstable developmental phases. These principles are adopted by the present research and consequently form the fundamental basis of the theoretical perspective employed. As such, later sections discuss these principles in greater detail.

### **3.2.2. Piaget's Equilibration Model (see Boden, 1979)**

Piaget proposes that four factors are involved in developmental change: maturation; experiences with the physical environment; experiences with the social environment, and, equilibration. Equilibration co-ordinates the interactions of the first three factors enabling changes in the child's understanding of, and adaptation to, the world. Piaget (1985) defined equilibration as a process which leads the individual from a state of incomplete equilibrium to a state of equilibrium which is qualitatively different from the previous one. This movement results from multiple states of disequilibrium and reequilibration. According to Miller (1993), Piaget suggests, as do Fogel & Thelen (1987), that the system prefers to locate itself at a stable state of equilibrium. The developing child therefore wants to achieve an equilibrium between existing information in their internal schemata and information which they receive from external sources. It is the need to restore equilibrium, produced as a consequence of disequilibrium, or, discrepancies between external and internal information, which effects developmental change. This belief reflects Fogel & Thelen's (1987) proposal that the mediator of developmental change is the instability which the system experiences during transition phases. Also as Thelen (1989) suggests, Piaget claims that although we are able to cope with discrepant information up to a certain magnitude, a point is reached at which the individual is no longer able to cope with the experienced discrepancies. Discrepancies between the individual's environment and their internal cognitive structures, and between these structures, therefore create disequilibrium which subsequently produces developmental change and equilibrium in the form of novel and more advanced cognitive structures. This restoration of system equilibrium is facilitated by the process of equilibration.

Disequilibrium can result from changes in either the organism or its environment. When modifications within the organism are not matched by equivalent alterations within the organism's environment, and *vice versa*, disequilibrium occurs. As discussed previously, this disequilibrium must be stabilised, the achievement of which effects movement into a more advanced state of development. The individual stabilises experienced disequilibrium by carrying out either of the processes of accommodation or assimilation. The process of assimilation involves fitting reality into currently existing cognitive structures. Externally received information is adapted to enable the individual to incorporate it into their present knowledge. Accommodation however, involves modifying internal schemata to result in internal knowledge which matches this externally received information. When these capacities are exceeded and the modifications of either the individual's internal cognitive structures or externally received information become too great for the system to effect in its present state of development, disequilibrium results. The internal or external information cannot be adapted to explain the individual's experiences. From this resulting disequilibrium, developmental change occurs which produces new and more advanced cognitive structures. Again, these proposals are similar to those made by Thelen (1989) concerning the amplification of accepted parameters to a limit beyond which the system can cope. The entire course of cognitive development can be viewed as a process of equilibration as the child continually experiences disequilibrium which effects movement through stages of increasing equilibrium. As does Thelen (1989), Piaget proposes that a period of disequilibrium must be experienced for developmental change to take place. Similar to Thelen's (1989) suggestion that a range of parameter values exists within which the system can successfully cope with natural fluctuations, Piaget proposes that the system is able to deal with discrepancies within a certain range of acceptability and magnitude. Self-regulatory cognitive structures undergo continual development as a result of the organism's interaction with their environment. However, these system components are not merely passive recipients of environmental information as the relationships which are established between them define sources of action and produce developmental change. According to Piaget, the dynamic nature of the system is exhibited by constant transformation and conservation. Transformation ensures that individuals do not exist in a rigid and unchanging environment whereas conservation prevents individuals from experiencing constant flux. Thus whilst there is a mechanism for change in response to situational factors there is also a boundary which creates stability.



As was evident in the proposals of Self-organising systems Theory, the most important feature of the Equilibration Model in terms of this thesis, is Piaget's suggestion that development involves alternate periods of equilibrium and disequilibrium. Similarly, with progressive states of equilibrium, greater system stability is exhibited and the system's present state of equilibrium or disequilibrium can be assessed by observing the variability of behavioural output exhibited throughout these developmental periods.

### **3.2.3. Erikson's Psychosocial Theory (see Stevens, 1983)**

The basis for Erikson's theory was that of Freud's Psychosexual Theory of Development. Erikson acknowledges Freud's psychosexual stages, his description of the subconscious, and the existence of three aspects of the mind (the id, ego and superego). However, he expanded on Psychosexual Theory by exploring, amongst other things: the socialisation of the child, placing special emphasis on the role of play in introducing the child to the particular rituals involved in their culture; the development of a healthy personality, and the post-adolescent period. He also defined eight lifecycle stages during which the individual experiences specific crises, drawing parallels between these stages and Freud's psychosexual stages. His central proposition is that throughout development each individual strives towards a balanced sense of self, or, ego identity. The importance of developmental change in response to unpredicted life events and social influence plus the constraining nature of previous experience and environmental demands is a feature of Erikson's theory.

According to Newman & Newman (1991), a central tenet of Psychosocial Theory is the tension which exists between the individual and their environment. During each life crisis stage, the resolution of conflict results in increased strengths which subsequently produces a balanced state. Erikson's Psychosocial Theory of development presents a perspective towards developmental change which is similar to that of Self-organising Systems Theory and the Equilibration Model. He proposes that before a conflict between two polar constructs, for instance, trust and mistrust, is encountered, the individual experiences equilibrium. However, the tensions which are created by these two opposing constructs results in conflict, or disequilibrium. The disequilibrium which arises from this conflict initiates its

resolution which subsequently results in greater equilibrium. Therefore Erikson's Psychosocial Theory of development also describes developmental change as involving periods which display differential levels of stability.

#### **3.2.4. Gesell's Maturation Theory of development**

Thomas (1979) writes that although Gesell mainly examined developmental growth from birth to adolescence he was interested in pre-natal development but to a lesser extent. Gesell firmly believed that developmental change is governed by internal, maturational forces. He saw the genetic code as the primary determinant of both developmental schedules and the developmental changes which unfold as a result of these schedules. Therefore, his belief was that development always follows fixed sequences, which are initiated at the pre-natal stage. For instance, the individual's genetic blueprint always ensures that the heart is the first organ to both develop and function. Although he claimed that development progresses through a fixed series of internally governed sequences, he did acknowledge that the rate of change may differ from one individual to another. Gesell did briefly discuss the influence of the child's environment but he afforded it little status as an influencer on their development. His belief in the supremacy of maturational factors led him to develop gradients of growth which describe developmental norms for different chronological age groups. Although these norms were concerned with infant neuro motor development, he did devise one of the first tests of infant intelligence (Gesell & Amatruda, 1941). Not only did Gesell believe that maturational factors directly govern physical and motor development, he also believed that they influence the nature of the developing child's personality. He suggested that an individual's somatotype (that is, the physical appearance of the person, for example, muscular or thin and angular) partially determines the nature of their personality. He believed that the source of individual differences lay in the individual's somatotype. Although his child-centred approach to child rearing and education emphasised the individuality of every child (Crain, 1992) Gesell did not afford individual differences in development much consideration (Thomas, 1979). It is apparent therefore that Gesell believed that genetic factors are the most influential determinants of developmental change. His proposals differ greatly from those of other developmental theorists such as Piaget, Thelen and Erikson. Unlike Gesell, these theorists propose that the environment does not merely support the production of internal patterns (Crain, 1992) but through dynamic interaction with the individual, it actively participates in their development.

Although Gesell views the impetus of developmental change very differently from these other theorists, he makes proposals about development which mirror theirs. Gesell's proposals concerning the self-regulatory capacity of the organism and its fluctuation through periods of stability and instability are similar to those of the aforementioned theorists. Gesell suggested that self-regulation was, amongst other factors, a principle of growth (Crain, 1992). He believed that the organism's internal mechanisms are so powerful that to a certain extent the organism is capable of regulating their own development. For instance, if babies are allowed to, they will learn to regulate their own sleeping, waking and feeding patterns. However, in the attainment of a stable pattern, fluctuations frequently occur. As a result, the individual experiences periods of stability followed by periods of instability. However, even when instability is experienced, the individual's self-regulatory capacities ensure that they never stray too far from a balanced state. In so doing, they manage to maintain an overall integration and equilibrium. Gesell expands on his proposal that development fluctuates between periods of stability and instability in his description of the cycles of good and bad years through which individuals progress (Thomas, 1979). He referred to better and worse years, in relation to children's behaviour (Thomas, 1979), which accompany the child's transitions from introverted to extroverted phases (Crain, 1992). According to Thomas (1979), during better years the child is well adjusted and in balance both within themselves and with their interactions with others. During worse years however, the child is confused within themselves and is not in balance with their physical and social environments. These cycles are essentially invariant for all children and recur at different chronological ages (Thomas, 1979). The first cycle extends from two to five years, the second from 5 to 10 years and the third from 10 to 16 years (Thomas, 1979). Thomas (1979) describes the first cycle of worse and better years, which is shown below in table 3.1.

<b>AGE</b>	<b>BEHAVIOUR EXHIBITED</b>	<b>AGE</b>	<b>BEHAVIOUR EXHIBITE</b>
2	Better	3.5	Worse
2.5	Worse	4	Better
3	Better	4.5	Worse
		5	Better

**Table 3.1: Gesell's first cycle of worse and better years (taken from Thomas, 1979)**

Whether a year is described as better or worse is determined by maturational factors (Thomas, 1979). It is apparent therefore that Gesell's position on certain features of development is similar to those of the developmental theorists previously discussed. His suggestion that the individual possesses self-regulatory capacities and experiences fluctuations between stability and instability match their proposals on these issues. This latter feature represents the most important contribution of Gesell's developmental theory to the present thesis.

The above discussion demonstrated that common elements are shared by the theories presented. The section which follows expands on this discussion to present the perspectives of these and other theories on a number of aspects of developmental change. This discussion will demonstrate that such theories share a common approach to these issues, regardless of their widely differing origins and initial emphases. The features of developmental change which are similarly approached by these theories are as follows, the system: is dynamically stable; has the capacity to self-regulate; displays a natural tendency to reduce dissonance; requires a period of disequilibrium to effect developmental change, and, displays alternate periods of stability and instability. These features of development provide the basis for the approach which is adopted in this thesis to address the issue of developmental changes in effort and ability understanding.

### **3.3.1. System stability**

Stability and instability can be loosely defined as situations in which internal and external conditions are congruent and incongruent, respectively. Dynamic stability of the system is a feature of Self-organising Systems Theory (Fogel & Thelen, 1987), Piaget's Equilibration Model, Kelly's Personal Construct Theory (1955) and Gesell's maturational approach to development (see Crain, 1992). The dynamic stability of the system allows the organism to maintain overall stability even when instability is experienced during periods of developmental change. It is also reasonable to argue that Erikson's description of conflict between two opposing constructs at each stage is an indication of the dynamic stability of the system. The conflict which the individual experiences results in disequilibrium, or instability. However, even when such instability is encountered, an overall, general balance or equilibrium is maintained by the system. Similarly, when constantly

faced with unpredictable life experiences and social forces, the individual is able to deal with the inconsistent and unexpected to preserve this overall balance.

According to Self-organising Systems Theory, the organism's continual exchange of energy with its surroundings facilitates the organisation and maintenance of stability. The organism has a range of states in which it functions most comfortably, the most preferred of these being the attractor state. The organism remains stable within a range of parameter values but greatest stability is demonstrated when the system is located at its present attractor state. Thelen's (1989) example of heart rate and body temperature which was cited earlier can serve as a reminder of how the attractor state functions. Individuals function best and feel most comfortable at optimum values of heart rate and body temperature. Representing the most stable levels of these factors, this optimum level is called the attractor state. Under some circumstances, for example, during exercise or illness, changes in heart rate and body temperature are exhibited and the system deviates from its attractor state. The system is still able to function within a range of parameter values, and will return to the attractor state once the disruption, that is, exercise session or illness, is over, if stability of the present state allows. Therefore the system is able to cope with changes within the critical limits of these parameter values and effect relocation to the attractor state. However, when these factors (heart rate and body temperature) change to such an extent that critical levels are surpassed beyond which the system cannot maintain overall stability in its present developmental state, the system shifts to a new behavioural mode.

In terms of Piaget's Equilibration Model, system regulation results in instability yet also demands that some degree of stability is maintained. Hence, dynamic stability of the system is required to produce simultaneous stability and instability. Miller (1993) provides an example which Piaget uses to demonstrate the dynamic stability of the system. Most of the individual's encounters with their environment are novel in some way. For instance, previously experienced events may be interpreted in new ways by the individual in their current presentation and the context in which an event is experienced may differ across time. Therefore minor cognitive adjustments, or accommodations, accompany these novel experiences to enable the individual to cope with them. These adjustments constantly decrease

the discrepancy between reality and internal cognitive structures. However, as discussed earlier, boundaries exist within which experienced discrepancies are deemed acceptable. Consequently, if discrepancies are located within these boundaries, elaborate cognitive restructuring is not necessary. These boundaries therefore help the system to maintain overall stability even in the face of constant discrepancy between internal and external information, caused by these "new" experiences. Although discrepancies between these two types of information exist, the individual does not undergo constant cognitive restructuring when the discrepancies lie within the boundaries of acceptability.

Similar views are expressed by both Kelly and Gesell. Kelly's belief is that individuals are constantly engaged in interpreting themselves and their environment, which effects developmental change. However, amidst this internal and external flux, the organism is still able to maintain a general stability. According to Personal Construct Theory (PCT) (Kelly, 1955), the individual's primary concern is with anticipating future events. Through their behaviour, individuals experiment and question their experiences to gain a better understanding of their world (Kelly, 1970). They constantly interpret and reinterpret both themselves and their experiences, a process which shapes their psychological characteristics. As a result of this, in PCT terms, development is a continual process involving no discernible end product (Bannister & Fransella, 1989). The individual is constantly responding to experiences within a framework of past events. Gesell states that throughout the disequilibrium which is encountered during growth, the organism nevertheless has the capacity to carry out integration processes and maintain an overall equilibrium. This overall equilibrium is achieved through the individual's capacity to self-regulate. Self-regulation ensures that throughout all developmental periods, the individual never deviates too greatly from a state of balance or equilibrium. For instance, when children experience the unknown for the first time, they also encounter an accompanying tension. However, even in the midst of this experienced tension, self-regulatory processes enable the child to remain in a general state of balance or equilibrium.

### **3.3.2. Self-regulation**

Although approached from differing perspectives, many developmental theorists propose that developmental change is intrinsically governed. Gesell, and Fogel & Thelen (1987) adopt divergent positions on this issue but do agree that the system is capable of self-regulation. Gesell believes that internal mechanisms are solely responsible for controlling and producing developmental patterns, to such a degree in fact, that the organism is capable of regulating its own development. He cites, as discussed previously, that when infants are left to their own devices, they are able to regulate their own sleeping, waking and feeding patterns. Montessori (see Crain, 1992) also appears to see maturational forces as the source of self-regulation. She claims that children are capable of developing skills and competencies independently of external input. She believes that the information they require for learning to occur is internally generated.

In contrast, Fogel & Thelen (1987) reject the notion of genetically pre-determined instructions and claim that development occurs in the absence of such instructional information. Developmental pattern and order are obtained as a result of the interactions which occur between system components. Prior to this assembly of order, no prescriptive instructions are provided, the order derives directly from the relationships between the elements of the system. Genetic information defines only the initial conditions of the system but not the developmental changes which subsequently occur. Hence, no instructions are provided which inform the organism that it must return to a stable attractor state, and the mechanisms by which this can be achieved. The organism automatically regulates itself to settle at this attractor state because this state represents greatest comfort and stability of the system. When located at this state, behavioural outputs are at their most stable and the system can easily accommodate experienced system disruptions. Although Fogel & Thelen (1987) do not deny the existence of a genetic code, they are not of the opinion that developmental plans and instructions are contained in the genes. They do not ignore maturational or environmental factors, perceiving the demands of the task and the individual's environment as equally important as internal information in the production of novel behavioural forms. Maturational factors include, for example, increases or decreases in neural elements and changes in the child's cognitive and motor abilities (Fogel & Thelen, 1987). The physical and social contexts of the organism are essential components of the system, and variations within these contexts may

represent control parameters of developmental change (Thelen, 1988). For instance, parents provide their children with a means of access to objects within the child's environment which they would not normally have gained through the course of development governed by maturational forces. System elements are assembled in a task-specific manner, the order of which is influenced by maturational factors, the current context of the behaviour, and, the child's current and previous experiences. Fogel & Thelen (1987) afford all these developmental forces equal status, and claim that the behavioural output of the system is a result of the organisation of all of these factors.

Piaget sees the mind as a system of self-regulating cognitive structures, and this active construction by the individual as the basis of developmental change. To a lesser extent, Erikson, Kelly and Social Learning Theory (see Crain, 1992) describe a system which is self-regulating. From Erikson's perspective, development depends on the individual's resolution of conflicts, a process which takes place internally, but within a social setting. Internal regulation, manifest in the individual's interpretation of events and constructs, is the determinant of unique personality characteristics (Kelly, 1955). Hence, personality development derives from the individual's own interpretations of events they experience in different contexts. Furthermore, social learning theorists suggest that with increasing development and socialisation, the individual's use of external rewards and punishments to determine individual standards is ameliorated. Standards of success in various competency domains are increasingly self-regulated and based on internally produced criteria rather than externally established ones.

### **3.3.3. The system's tendency to reduce dissonance**

Self-regulation can be seen as a manifestation of the system's desire to dissipate experienced inconsistencies. Van Geert (1986) has claimed that the organism aims to acquire an internal, stable state of equilibrium with constant attempts being made to reduce dissonance, or incongruence between external and internal conditions.



When experiencing disruptions, the self-organising system will automatically self-regulate to return to its attractor state and reduce instability of its behavioural outputs (Fogel & Thelen, 1987). A general tendency towards ever greater stability is demonstrated by the increased stability which is experienced by the system with successive developmental states. The greater equilibrium exhibited by advanced developmental states again exemplifies the system's constant attempts to reach greater levels of equilibrium. Gesell sees the individual's self-regulatory mechanisms as instrumental in maintaining equilibrium as they ensure that the individual never moves too far away from equilibrium, and therefore never has to experience a high degree of inconsistency between internal expectancies and external experiences. From a Psychosocial Theory perspective, the individual's constant attempts to resolve experienced conflicts and to develop a coherent sense of ego identity demonstrate their natural inclination towards internal stability and comfort. This inclination is apparent in Personal Construct Theory's proposition that individuals aim to anticipate events they may encounter in the future. The constant reinterpretation which individuals engage in is an active attempt to reduce incongruencies between internal and external experiences, in order to further their understanding of themselves and their environment.

The organism's tendency to reduce dissonance is also a feature of the Equilibration Model. Piaget's beliefs on this issue appear to be based on his early doctoral study. This study examined the ability of simple organisms to maintain their internal fluid balance whilst experiencing different environmental conditions. Essentially, his research exemplified the homeostatic principle at work, whereby the individual has a basic need to maintain internal coherence and congruence between internal and external conditions. At a cellular level, this involves maintaining the correct balance between different internal fluids and between the concentration of these fluids and those in the organism's external environment. To remain in a homeostatic state, the organism must continually reduce discrepancies between internal and external fluid concentrations to ensure its survival. Having established his knowledge of the homeostatic principle at a cellular level, Piaget then sought to examine its applicability to cognitive development. He proposed that the homeostatic principle can be employed as an explanation for cognitive development. Just as the simple organism needs to maintain a balance between internal and external body fluid concentrations to enable its survival, the developing child must maintain an equilibrium between internal cognitive

structures and externally received information. Homeostasis is disrupted when internal and external fluid concentrations of the simple organism are incongruent. Similarly, dissonance between internal information and information received from external sources disrupts the child's cognitive equilibrium. Comparative to the simple organism's need to reduce inconsistencies which threaten homeostasis, the child needs to reduce dissonance which threatens their cognitive equilibrium. Based on the principles of homeostasis, Piaget claims that the developing child demonstrates a tendency to reduce dissonance and maintain equilibrium within cognitive structures and between these structures and their external environment.

This tendency to reduce dissonance is evident in Erikson's Psychosocial Theory. Psychosocial Theory emphasises the existing tension between the individual and their environment (Newman & Newman, 1991) which can arise from the conflict which the individual experiences during each lifecycle stage. Throughout development, the individual strives to maintain balance by resolving these conflicts and ameliorating the tensions created by the dissonance which may exist between internal and external conditions.

#### **3.3.4. Mechanisms of developmental change**

A period of disequilibrium, or instability, must be successfully dealt with before the individual moves into a more stable state and for developmental change to occur. Self-organising Systems Theory refers to this period of instability as an unstable transition phase during which the present attractor state destabilises to allow novel states to emerge (Thelen, 1989). Fogel & Thelen (1987) describe two sources of developmental change, the first of which involves scalar changes in one, or a number of, system components and existing relationships between these components. As previously mentioned, the organism is capable of functioning within a range of parameter values. Within this range, a preferred set of values exists which represents the system's attractor state (Thelen, 1989). The system is able to tolerate natural fluctuations or noise which cause deviation from its attractor state, providing these fluctuations are within a range of acceptability, or within critical parameter values. When fluctuations are amplified to such an extent that they exceed these critical parameter values, in order to accommodate these fluctuations, the system moves into a new state which results in novel behavioural

modes (Kelso, Scholz, & Schöner, 1986). The instability produced by the amplification of these natural fluctuations effects a phase shift where the system reorganises to eventually exhibit a new level of stability and new behavioural modes which accompany this advanced state of development (Thelen, 1989). At critical developmental points only slight disruptions, or small changes in the system components (Gleick, 1987), will initiate a phase shift and the subsequent manifestation of novel behavioural forms. With progression through successive phase shifts, the system exhibits increasing levels of complexity. Fogel & Thelen (1987) suggest that the second source of developmental change emanates from changes within the control parameter or the replacement of an existing control parameter with a new one. The control parameter, which is either internally or externally determined, is generally the slowest system component to develop. Control parameters therefore catalyse movement through phase shifts but do not encode or prescribe developmental change. Changes in the control parameter can essentially be viewed as the final system modification which subsequently leads to developmental change. The nature of the control parameter can change from context to context and between different developmental periods. It is these changes, according to Wolff (1987), which result in ontogenetic change, and not a genetic blueprint. As effectors of development, natural fluctuations which cause changes within or between control parameters result in the system's movement to an entirely new behavioural state.

Piaget discusses this issue with respect to the internal conflicts which the individual experiences during periods of disequilibrium. These conflicts are necessary for the initiation of equilibration and subsequent transition to a state of further equilibrium. Two processes enable the individual to deal with disequilibrium: accommodation and assimilation. In much the same way that the amplification of natural fluctuations causes movement into a phase shift, when discrepancies between internal schemata and external information are so great that the individual's assimilatory and accommodatory capacities are exceeded, developmental change takes place. Thus, the individual's inability to cope with discrepant information, and incorporate it into an adapted schema, marks the transition into a new developmental stage.

Gesell shares this view to a certain extent. He believes that the tension created as a result of encountering new experiences initiates self-regulatory mechanisms to restore the individual to a state of equilibrium. Similarly, Erikson describes the individual's internal conflicts as the major impetus for developmental change. These conflicts must be resolved to decrease disequilibrium and return the individual to a stable state where no conflicts are experienced. The successful resolution of conflicts in later stages is dependent on the degree to which conflicts in previous stages were successfully resolved. However, in Erikson's proposals, successful resolution of conflicts does not dictate movement between lifecycle stages. Movement occurs as a result of maturational and social forces, regardless of whether the present conflict has been successfully resolved.

### **3.3.5. The differential stability of developmental periods**

It may be apparent from the previous discussion that development involves periods which display differential degrees of stability. With respect to the present research, this phenomenon, which is recognised in a variety of forms by several developmental theorists, is of great interest and is therefore discussed more fully in the following section.

Patterns of development display behavioural stability, followed by an unstable phase from which the organism progresses to a more advanced developmental state demonstrating greater stability (Fogel & Thelen, 1987). This movement, from a stable to an unstable state and then a state of further stability, is referred to as a discontinuous phase shift. Thelen, Kelso & Fogel (1987) present the changes involved in quadrupedal locomotion speed as an example of a discontinuous phase shift. A horse's gait, for instance, differs according to the speed at which it is travelling. This is evidenced by differences in gait observed when walking, trotting and galloping. At low gait speeds, the horse's limbs move out of phase which produces an asymmetric gait. However, when speed of locomotion is increased, the horse's limbs move in phase, resulting in a symmetrical gait. As no stable intermediate gait is observed between walking and trotting, Thelen et al (1987) describe this shift as a discontinuous phase transition. Phase stability can be measured by assessing the proximity of the system to its present attractor state. Throughout stable phases, the stability of the attractor state allows it to relocate

easily when perturbations which move the system away from its attractor state are experienced. Subsequently, the behavioural outputs of the system are consistent and invariant. However, during transition phases, when the attractor state experiences a loss in stability, the system does not cope easily with disruptions and relocation to the attractor state is not so readily achieved. Behavioural outputs now display greater variability and are less predictable than those exhibited during stable developmental states. For instance, Thelen (1989) discusses research carried out by Shumway-Cook & Woollacott (1985) which illustrates this phenomenon. This research will be considered in greater detail towards the end of this chapter. Shumway-Cook & Woollacott (1985) examined the ability of children at different developmental stages to compensate for postural disturbances presented by a balance platform. One group of children represented a transition phase, characterised by changes in their body proportions which the children in the other groups were not currently experiencing. Children in this transition group exhibited greater variability of behaviour than those in the other groups, manifest by their longer latencies of response to the postural disturbances which were administered. Therefore because they were experiencing a transition phase, these children demonstrated greatest variability of behavioural output and least capacity to compensate for postural disruptions.

Piaget also describes cognitive development as a sequence of alternating equilibrium and disequilibrium. The individual firstly experiences cognitive equilibrium at a fundamental level of development. Following this, conflicting beliefs result in a period of disequilibrium. On resolution of these conflicts, the individual enters a subsequent stage of reequilibrium, or cognitive equilibrium at a higher developmental level. For example, this process is a general feature of progression through different stages of development. Piaget's theory of developmental change emphasises the stage approach and alternating equilibrium and disequilibrium is apparent in each of the developmental stages he describes. Upon entry into a new developmental state, disequilibrium is encountered as cognitive structures are unstable and loosely organised. At the point of completion of this stage, equilibrium is achieved as cognitive structures are now stable and rigidly organised. This equilibrium is maintained until disequilibrium is once more experienced which effects transition to a more advanced developmental state. Further equilibrium at the point of completion of this developmental stage is then attained through the process of cognitive

restructuring. Predictions made about the system's vulnerability to disruptions and resultant variability of behaviour reflect those of Self-organising Systems theorists. Piaget proposes that when a system is in a state of equilibrium it can more successfully compensate for perturbations than during a period of disequilibrium. For example, consider the progression which the child follows from a state of non conservation of liquids to one of complete conservation (see Crain, 1992). When the child is shown two tall glasses with equal amounts of water in them and the water from one glass is then poured into a shorter but wider glass, this presents the child with a perturbation. Their responses to what has happened depend on what stage of conservation they are currently experiencing. When children are in either of the complete conservation or non conservation stages, their current developmental stage is sufficiently stable to result in responses which demonstrate similar levels of stability. When asked which glass now contains the most liquid, the non conserving child will concentrate on only one characteristic, such as the height of the water, and subsequently state that there is more liquid in the taller glass than in the wider one. The conserving child however, will state that the two glasses contain the same amount of water by consistently applying one of three arguments (identity, compensation or inversion). The perturbation (pouring the liquid into a different shaped glass) has not caused these children confusion as their states of conservation or non conservation are sufficiently stable to allow them to cope with this perturbation as demonstrated by the consistency of their beliefs, demonstrated by the consistent responses which they provide. However, children who are experiencing the intermediate stage between non conservation and conservation are not as easily able to cope with the presented perturbation. These children are able to focus on both dimensions of the glass, that is, height and width, but not simultaneously. This results in confusion and inconsistency of both beliefs and responses. For instance, the child may at first state that the taller glass contains more liquid but then change their mind and state that the wider glass contains the most. The disequilibrium which the child is experiencing results in unstable responses to, and a lesser ability to cope with, the presented perturbation than is demonstrated when children are in a state of either complete non conservation or conservation.

This pattern of differential phase stability is demonstrated by Erikson's lifecycle stages. Following equilibrium at the initiation of a lifecycle stage, the individual experiences conflicting beliefs between which they must develop a:

...dynamic balance, or, a favourable ratio (Stevens, 1983, p. 56).

The resolution of this conflict then restores the system to equilibrium. Some lifecycle stages demonstrate a general lack of stability, for example, the adolescent and two year old periods. Daily fluctuations can be observed in the adolescent's behaviours and beliefs and two year olds exhibit a constant conflict between the desire to assert their independence and their dependency on their caregiver.

Furthermore, Gesell discusses this phenomenon in relation to personality development. Personality development, according to Gesell, displays periods of stability and instability which is manifest in the individual's changing level of introversion and extroversion. This issue was discussed in the introductory section of this chapter. To recall, Gesell proposed that development involves recurring cycles of better and worse years. Throughout better years, the individual experiences equilibrium, they are happy within themselves and in their interactions with others. Conversely, during worse years, children are confused and are at odds with their environment. Therefore, until late adolescence, the individual fluctuates between stable and unstable developmental periods.

It is evident therefore that regardless of their divergent aetiologies and emphases, the above theories share a common approach to developmental change. Their description of developmental change as a series of fluctuating periods of stability and instability is the most salient aspect on which they share a common perspective in terms of the present thesis. Furthermore, Piaget and Fogel & Thelen (1987) suggest that the behavioural output exhibited by the individual is dependent on the stability of the developmental stage they are currently experiencing. They propose that during stable developmental periods when the individual experiences unexpected disruptions, behavioural responses to these disruptions will be consistent and the individual will demonstrate an ability to cope with the disturbances. However, during unstable developmental periods, behavioural responses to such disruptions will be less consistent and the system will demonstrate a decreased capacity to cope with these disturbances. It appears that an inverse relationship exists between the present stability of the system and

the variability of exhibited behaviour in response to experienced system disruptions. As system stability increases, the variability of behavioural output correspondingly decreases. The following section presents empirical evidence which is offered by Thelen (1989) in support of this proposal, which is taken from research examining a wide range of developmental phenomena.

### **3.4.1. Research demonstrating developmental phenomena which exhibit alternate periods of stability and instability**

#### **Postural stability in children**

Postural compensations in response to displacements experienced whilst standing on a balance platform were measured in three groups of children and an adult group (Shumway-Cook & Woollacott, 1985). The children's ages ranged from 15-31 months in the first group, 4-6 years in the second, and 7-10 years in the third. The group of 4-6 year olds represented a transition group experiencing rapid changes in body proportion. As Self-organising Systems Theory would predict, the subjects' behavioural response consistency was related to the stability of their developmental phase. The least overcompensation and response variability was demonstrated by the 7-10 year olds and adults, and, although the youngest children had a longer response latency period, their behavioural responses to the postural displacements were also consistent. However, significantly longer latency, and greater variability, of response was observed in the 4-6 year olds. Thelen (1989) concluded from the above that this more unstable response in the 4-6 year olds than those younger and older resulted from changes in body proportion which the 4-6 year old children were currently experiencing but those in the other groups were not. Thus in comparison with these other groups, the 4-6 year olds were in an unstable developmental phase created by these physical changes. As a result of this, their responses to the postural disturbances demonstrated the greatest variability of all the groups included in the study. This greater variability of behavioural output can be directly attributed to the instability of these children's current developmental state.

### **3.4.2. Piagetian conservation and spontaneous gestures**

Church & Goldin-Meadow (1986) asked children between the ages of five and eight years to make conservation judgements and then to explain their reasoning



behind them. Whilst making these explanations the children made spontaneous gestures. Some children's gestures were congruent with their verbal statements whereas other children's were not. For example, when verbal statements and physical gestures were incongruent, information which could be inferred from children's gestures did not match their verbal explanations. Church & Goldin-Meadow (1986) then noted that when speech and gestures demonstrated incongruence, the child's reasoning was inconsistent. The dissonance between these children's behaviour and reasoning demonstrates the instability experienced in the transition phase between non conservation and conservation. As Thelen (1989) predicts, system instability was exhibited during this transition phase but not during the stable phases which precede and follow it. Church & Goldin-Meadow (1986) further presented support for Self-organising Systems Theory's prediction that the organism is more sensitive to disruption during unstable than during stable developmental phases. They provided the children with training in solving conservation problems, and, although children experiencing the unstable transition phase (indicated by their discordant speech and gestures) increased their knowledge of conservation principles, the other children did not respond to this training.

### **3.4.3. Weaning in rat pups**

Rat pups demonstrate a pattern of feeding which progresses from an initial suckling phase to independent ingestion, normally achieved at around 28 days after birth. The shift from suckling to independent feeding generally occurs between 21 and 24 days after birth (Hall & Williams, 1983). This period therefore represents a transition phase between suckling and independent feeding states. Consequently, rat pups experiencing this transition phase are more likely to display greater variability of behaviour than those who are in stable phases of feeding at present, in accordance with Self-organising Systems Theory principles (Fogel & Thelen, 1987). Stoloff & Blass (1983) demonstrated this to be the case. Rat pups of varying age were provided with the opportunity to either suckle or eat independently. Whilst the youngest rats always suckled and the oldest always ate independently, those aged between 21 and 24 days displayed inconsistent feeding patterns, sometimes suckling and sometimes eating independently.

The research cited above demonstrates both patterns of development which involve alternate phases of stability and instability, and the increased consistency of behavioural output which accompanies increases in phase stability.

The present chapter has discussed a number of theories which have explored the nature of developmental change. Although their proposals originate from different perspectives, these theories demonstrate a common approach to this issue. To differing degrees, they all advocate that development involves periods of stability and periods of instability. Throughout development, whilst maintaining an overall equilibrium, the individual fluctuates between stability and instability. Movement between these different phases produces novel behavioural modes and progression to more advanced developmental states than those previously experienced. The periods of instability experienced by the individual play an important role in their development. Their function is to effect developmental change. Progression to new and more advanced states of stability only occurs if a preceding period of instability has been encountered. Thelen (1989) proposes that system stability can be assessed by observing the behaviour which organisms exhibit at different stages of a developmental phenomenon. She has presented evidence from other authors in support of this proposal (see for instance, Shumway-Cook & Woollacott (1985); Church & Goldin-Meadow (1986), and, Stoloff & Blass (1983)). As Thelen suggests (1989), the aforementioned research revealed that the different phenomena investigated progressed in each case from initial stability to a period of instability and on to further stability. The relative stability of each stage was indicated by the variability of the organism's behavioural responses to disruptions of the system whilst experiencing that stage. When behaviour was consistent and did not vary, the organisms were experiencing either of the outer states of stability. However, when behaviour varied either between individuals at the same developmental stage or in comparison with the behaviour exhibited by individuals experiencing stable states, the organisms studied were experiencing the unstable state in-between these two states of stability. Having established the developmental trajectory of effort and ability understanding when children are asked to apply their knowledge to physical tasks in experiment one, an interesting issue which will be addressed in the following study is whether or not this conceptual development displays periods of differential stability, mirrored in behaviour, as the theoretical approaches considered here would suggest.

Thelen (1989) discusses that the individual's behaviour can be examined to assess stage stability and the present research will employ this method. However, *a priori* hypotheses can be formed about the stability of different stages of effort and ability understanding based on the stability of the child's schema in relation to these concepts. During levels one and four, it seems that the child's conceptual schema has rigidly fixed boundaries. Their perceptions of the relationship between effort, ability and outcome are clearly defined. New information which they receive about these concepts does not easily penetrate the boundaries of this schema to effect changes in their exhibited reasoning. The focus of their schema is therefore fixed and new information does not easily cause the individual to shift from this focus. For example, children at level one believe that effort, ability and outcome are consistently related but display illogical patterns of reasoning. At level four, systematic reasoning is displayed by the individual's belief that ability is a capacity which limits the effects of effort on the outcome of a performance attempt.

This can be related to Thelen's (1989) beliefs about the stability of the attractor state throughout different developmental levels. The stability of the conceptual schema at levels one and four produces a state of developmental stability. During which, the attractor state is stable and fluctuations cannot easily shift the system away from its attractor state. When these fluctuations do cause the system to deviate from its attractor state, relocation to this state is easily effected by the system. In comparison, throughout levels two and three, the child's conceptual schema possesses relatively flexible and loose boundaries. The child's beliefs about the relationship between effort, ability and outcome are changing and their current verbal reasoning demonstrates inconsistencies. They no longer believe effort, ability and outcome to be linked by a consistent, non causal relationship as children at level one do, nor do they yet perceive ability as a capacity as do children at level four. Instead, children at levels two and three appear to be experiencing a transition between levels one and four of this continuum. Evidence of this transition is demonstrated by children's initial acknowledgement of ability as a separate entity at level two and by the child's partial differentiation of effort and ability concepts at level three. As a result, the boundaries and focus of the schema are not clearly defined. Therefore it is likely that new information can permeate through this boundary and alter the focus of the schema. In relation to Thelen's (1989) proposals about the attractor state, during levels two and three of

the continuum of effort and ability understanding, the attractor state is relatively unstable. New information can easily dislodge the system from this attractor state and relocation to this state is not easily accomplished. The child's developing understanding of the conservation of liquids can again provide an example to illustrate changes in the rigidity of schemata boundaries, according to the stability of the developmental stage experienced by the individual (see Crain, 1992). When children are experiencing the stages of either complete conservation or non conservation, their schemata are rigidly bound. Children who are unable to conserve will focus on only one dimension, either the width or height of the glass. The focus of their attention and their schema is fixed on only one dimension and they do not allow information about the other dimension to enter their schema and their reasoning. For example, these children demonstrate a real disbelief in what adults say about the matter when they attempt to teach them the principle of conservation (Crain, 1992). Such schema rigidity is also demonstrated by children who do understand the principle of conservation of liquids. They are able to apply one of three arguments, such as identity, where the child reasons along the lines of, "No water has been added or taken away when it was poured into a different container, therefore there must be the same amount of water in the two containers" (Crain, 1992). Having reached the stage of complete conservation, the boundaries of the child's schema are now rigidly fixed so as not to allow conflicting information to affect their beliefs. However, when children are experiencing the unstable, interim stage between non conservation and conservation, their schema about this concept is not so tightly bound. This is apparent in the shift of their attention from one dimension to another. The relative flexibility of their schema boundary allows new information into this schema which subsequently affects the child's beliefs and responses. It is this flexibility of schema boundaries and the permeation of new information into the child's schema which results in confusion, or disequilibrium, and eventual movement to the more advanced stage which involves mastery of the principle of conservation of liquids.

Thelen (1989) offers various suggestions of how system stability can be assessed in general and it is this method which is to be employed in the present research to examine the stability of developing conceptualisations of effort and ability.

The first consideration concerns what Thelen (1989, p. 106) refers to as,

...variability in the age-dependent onset of new behaviours.

When such variability is exhibited, individual developmental profiles should be employed to examine shifts from one mode to another. Once individual developmental profiles have been established, individuals at different developmental levels could be exposed to experimentally induced perturbations in order that their behavioural response to such disruptions can be observed. Thelen (1989) states that this disruption must be a context manipulation which is appropriate for the developmental phenomenon under investigation. Having defined and administered appropriate disruptions, behavioural responses to this disruption may be observed. The stability of the system at different stages of development can then be identified by examining behavioural variability during these stages. As previous research, cited above, has demonstrated, when the system is experiencing stable developmental states, exhibited behavioural responses to experimental disruptions do not vary between individuals and display predictable patterns. However, during transition phases, where stability is lessened, these behavioural responses vary in relation to the mean response exhibited during stable stages and are less predictable. As a result, displayed behaviour deviates from the mean performance demonstrated during the stable state which precedes this phase of instability and the new behavioural mode which follows it (Thelen, 1989). Experiment one revealed that variability is apparent in the onset of new modes of reasoning about effort and ability concepts, in other words, children of the same chronological age will not necessarily have achieved the same level of conceptual development. Therefore if the above procedure is employed to examine the stability of effort and ability understanding, individuals' achieved levels of this conceptual development can be assessed. Assessment will account for possible individual differences and ensure that subjects are correctly classified at their own developmental level. This assessment will be carried out by administering the procedure described in experiment one which revealed that this method provides a reliable measure of effort and ability understanding in the physical domain.

Following this empirical assessment of effort and ability understanding, individuals who have achieved different levels of conceptual development will be faced with an appropriate context manipulation, as advocated by Thelen (1989). This

experimental disruption will be presented in the form of manipulated information about individuals' own performance outcomes on a motor task which appears to be a relevant context for this question. An individuals' beliefs about how performance outcomes are determined has been demonstrated (see Chapter One) to be closely related to their conceptualisations of effort and ability. How an individual perceives the relationship between effort, ability and outcome depends on their achieved level of understanding. During levels one and four the relationship between effort, ability and outcome is clearly defined. At level one, children consistently demonstrate the belief that effort is the primary indicator of ability or outcome and are expected to be able to verbalise this belief. Similarly, when level four reasoning is achieved, children will consistently apply their knowledge of how effort and ability interact to determine the outcome of performance attempts. However, whilst experiencing levels two and three, the relationship between these concepts is less clearly defined. On achieving level two, children believe that effort is the major cause of outcomes but are beginning to understand that ability is a separate construct. Although they are unlikely to refer explicitly to ability as a cause of performance outcomes, they do acknowledge its existence by correctly classifying individuals according to their effort expenditure and level of performance outcome. Children who have reached level three display reasoning which indicates that their beliefs about effort, ability and outcome are also not rigidly fixed. Although these children have developed a fundamental understanding that effort and ability interact to determine performance outcomes, they do not apply this reasoning systematically and consistently. These differences therefore allow the stability of effort and ability understanding to be examined by observing individuals' behavioural responses to experimentally manipulated information concerning their performance outcomes. Although the child's understanding of effort and ability concepts is assessed by asking them to reason about others, manipulating their own performance outcomes is still appropriate as Nicholls & Miller (1984) have demonstrated that concepts of effort and ability are consistent regardless of whether reasoning is applied to the self or to others.

The motor task which the children performed required them to provide behavioural responses to presented experimental disruptions. The behaviour referred to in this context is the child's choice of task difficulty at various points throughout the procedure, which will be explained more fully in Chapter Four. It

is the variability and predictability of this behaviour which was used to assess system stability. It was anticipated that children at levels one and four are experiencing stable states of effort and ability understanding and would demonstrate predictable behaviour. However, it was suggested that children at levels two and three are experiencing unstable states of this conceptual development. They were therefore expected to exhibit behavioural variability and performances which deviated from the mean performance of those children experiencing levels one and four. The method discussed above was employed to conduct an investigation of the stability of different developmental stages of effort and ability understanding, which is described in Chapter Four.

To maintain overall coherence throughout the thesis, the experiments described in Chapters Two and Four are not presented in the chronological order in which they were conducted. Experiment four was concluded before experiments two and three were carried out and thus the protocol used to investigate stability of conceptual understanding in experiment four was that established by Nicholls (1978). Had the sequence been as is described in the thesis, the categories into which children were placed in experiment four might have been different.

**CHAPTER FOUR.**

***AN EXAMINATION OF  
BEHAVIOURAL VARIABILITY  
IN RELATION TO STABILITY  
OF EFFORT AND ABILITY  
UNDERSTANDING BASED ON  
PERFORMANCE FEEDBACK.***



### **4.1.1. Introduction**

Chapter One described an experiment which explored developing conceptualisations of effort and ability in the physical domain. In the previous chapter various developmental theories (for example, Self-organising Systems Theory, Fogel & Thelen (1987)) which describe a developmental pattern progressing through alternate periods of stability and instability of the organism's system, were discussed. The present chapter describes a study which investigated whether or not the developmental changes in understanding of the relative contributions of effort and ability to performance outcomes, as revealed in Chapter One, demonstrate this pattern in the physical domain.

Research evidence has been discussed previously concerning a variety of developmental phenomena which have been shown to demonstrate a pattern of differential relative stability, for example, Shumway-Cook & Woollacott (1985). System stability was indicated by the variability of behaviour exhibited during different developmental periods when the system was presented with appropriate context manipulations. Behaviour varied less between subjects when they were experiencing stable developmental states than during unstable developmental states. The present study adopted this approach to examine system stability at different developmental phases of effort and ability understanding.

Prior to this, a pilot study was carried out to determine the validity and reliability of the task intended for use as a context manipulation in this investigation. This pilot study is described before the main investigation is presented.

In this main study, as Thelen (1989) suggests, individuals' levels of this conceptual development were assessed empirically. Having identified individuals who had achieved different levels of reasoning about effort and ability, they were presented with experimentally disrupted performance information. This experimental disruption offered an appropriate context manipulation in which children's behavioural responses were examined for indications of system stability or instability.

#### **4.2.1. Pilot study**

##### **Aims**

The aims of this pilot study were as follows, to examine whether: gender differences affect performance on the motor task employed; order of presentation of different levels of task difficulty affect performance; the task is appropriate across a variety of ages; the task provides a reliable performance measure between different testing sessions; and, it discriminates between performance on different levels of designated task difficulty.

#### **4.2.2. Subjects**

The subjects were 39 children aged between 4 and 8 years, 19 of which were male and 20 of which were female. They were classified according to their year at school, (one, two, or three) with 13, 11, and 15 children respectively in the three year groups.

#### **4.3.1. Experimental procedure**

**The game-** The task was a hand-eye co-ordination game which is shown in figure 4.1. The children were presented with a computer screen displaying a convoluted path which extended the entire width of the screen. In the path's uppermost left-hand corner a cursor was located. By correctly manipulating a joy-stick, the cursor could be moved a desired amount in a desired direction along the path. The aim of the game was to move the dot along the whole of the path's length in a limited time period. However, whilst moving the dot along the path, subjects had to prevent it from touching the path's sides. If this happened, a "beeping" noise sounded and an error was incurred by the subject. Before playing the game, subjects were questioned to ensure that they understood both of the game's requirements. All children's responses indicated this understanding. Various attributes of this particular task warranted its selection for use in the present investigation. First, it represented a task which was novel to the subjects which eliminated the possibility of prior task experience confounding the results. As required, this task incorporated different difficulty levels and could accommodate children of all different ages. Finally, being computer based, the game was mobile which was an essential requirement as subjects were taken from various schools in two different counties.

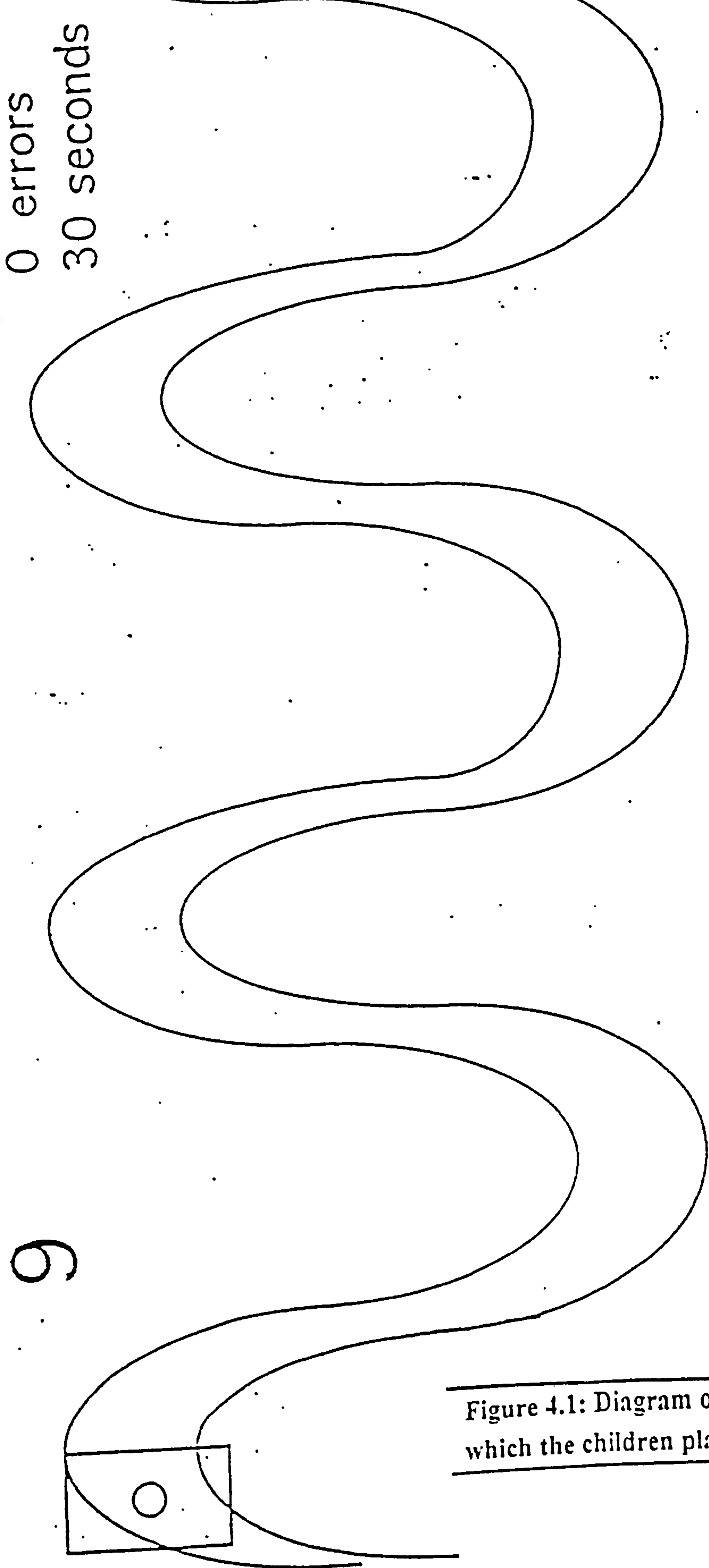


Figure 4.1: Diagram of the game which the children played

The game could be played at nine different levels, gradually increasing in difficulty. Increased difficulty was manipulated by decreasing the path width and simultaneously increasing the speed at which the dot responded to the subjects' movements of the joy-stick. It was felt that with such young subjects, repeated trials on all nine difficulty levels would not be possible. Therefore, although it was intended to employ nine levels in the main study, the children only played on three of the difficulty levels in the present study, which were, levels 3, 5, and 7. Preliminary trials conducted with other children revealed that these levels appeared to represent appreciably different levels of difficulty. This pilot study examined children's performances only on levels 3, 5, and 7.

Three sets of the three levels of difficulty (that is, levels 3, 5 and 7) were employed. One of these sets of three difficulty levels was used with each of the three year groups. As the child's age increased, so did the relative difficulty of the levels on which they played. Therefore, the level 3 which year one children played on was easier than the level 3 which the year two children played on, who correspondingly played on an easier level 3 than the year three children. This was also the case with levels 5 and 7. Year one subjects played on the easiest set of three difficulty levels in comparison with the sets on which children in the remaining two years played. This set had the thickest path widths, the slowest dot speeds and a trial length of 50 seconds. In comparison with the sets of difficulty levels which children in years one and two played, year three subjects played on the most difficult set with the narrowest paths, fastest dot speeds and a trial length of 30 seconds. Year two subjects played on a set of intermediate difficulty (easier than the set on which year three children played yet more difficult than that on which year one children played), again with a trial length of 30 seconds. As children scored errors, this was indicated by a beeping noise from the computer and a cumulative error score was constantly displayed in the right hand corner of the screen.

**4.3.2. Session 1-** Children were familiarised with the game through verbal instruction from the experimenter and practice trials on level two. All subjects then performed three trials on each of levels 3, 5, and 7. However, order of trial presentation was varied between three subject groups to allow any effects of this

variable to be assessed. A group of 15 subjects, including 4, 4, and 7 children from years one, two, and three, respectively, were presented with a fixed random trial order sequence. This sequence was as follows: 3, 7, 5, 5, 3, 7, 5, 3, and 7. A second group of 12 subjects, consisting of equal numbers of children from each age group, performed three trials on level 3, followed by three on level 5, and three on level 7. The third group of 12 subjects, again in which each year group was equally represented, performed one trial on level 3, one on level 5, then one on level 7. This sequence was performed three times. For each subject, an average error score on each level was calculated, resulting in three error scores for every individual.

#### **4.4.1. Results of session one**

Previous discussion (see page 26) considered the generalisation problems incurred when empirical investigations employ small sample sizes and also introduced concern surrounding the use of parametric statistical techniques with small sample sizes. As certain parametric statistics were used on the small samples employed in this thesis (for instance, Pearson's Product moment measure of correlation, analysis of variance and regression analysis), this section discusses the caution which must be adopted when using such analyses with small sample sizes.

A number of assumptions about the samples employed must be met in order to carry out parametric statistics, for instance, normality of distribution, homogeneity of variance and adequate sample size. Kerlinger (1986) discusses the severity of violating these assumptions in relation to the validity of the results of parametric statistical techniques which are employed. He presents two opposing arguments from Bradley (1972), who asserts that when the assumptions of parametric statistical tests are violated then nonparametric methods should be employed, and Gardner (1975), who advocates the use of parametric methods even when faced with violated assumptions. Kerlinger (1986) is in favour of Gardner's position on this matter, as is the author, due to the robustness of such statistical techniques. However, Kerlinger (1986, p. 266) does issue an important *caveat* which should not be overlooked when considering the current findings:

If one uses reasonable care in sampling and analysis and circumspection in interpretation of statistical results, parametric methods are useful, valuable and irreplaceable.

Sampling considerations and limitations of current samples have previously been discussed, however, a further consideration is highlighted by the above quotation. In this thesis, using small sample sizes and parametric statistics, of which some of the assumptions are violated, highlights the need for circumspection in interpreting the results of these analyses. Hence, circumspection is paramount when interpreting the results of parametric statistical analyses carried out in this thesis and the author strongly recommends that future research should explore these issues with greater sample sizes and more rigid adherence to the assumptions of parametric statistical techniques.

The three year groups were treated independently from each other in all analyses.

#### **Gender differences:**

Three 2x3 (gender by difficulty level) ANOVAs were carried out, with average error score as the dependent variable and repeated measures on the second factor. As table 4.1 demonstrates, neither the main effect for gender nor gender by difficulty level interaction were significant in any of the three year groups. Significant main effects for difficulty level were observed,  $F(2,20)=30.45$ ,  $p<0.001$ ;  $F(2,20)=28.83$ ,  $p<0.001$ , and  $F(2,24)=34.94$ ,  $p<0.01$ , for years one, two, and three, respectively. These will be discussed when the data from sessions 1 and 2 are combined for analysis (see page 113).

#### **4.4.2. Order of trial presentation**

Three 3x3 (trial order by difficulty level) ANOVAs were carried out, again with error score as the dependent variable and repeated measures on the second factor. No significant interaction or trial order main effects were revealed, as table 4.2 demonstrates. Again, a significant difficulty level main effect was revealed,  $F(2,18)=39.76$ ,  $p<0.001$ ,  $F(2,18)=29.28$ ,  $p<0.001$ , and  $F(2,24)=39.87$ ,  $p<0.001$ , for years one, two and three, respectively. The significant difficulty level main effect will be discussed on page 113.

	SS	DF	MS	F	SIG. OF F
<b>YEAR ONE:</b>					
Within cells	428.03	10	42.80		
Gender	4.20	1	4.20	0.10	0.760
Within cells	191.92	20	9.60		
Gender x Difficulty	10.48	2	5.24	0.55	0.588
<b>YEAR TWO:</b>					
Within cells	182.90	10	18.29		
Gender	0.04	1	0.04	0.00	0.964
Within cells	108.01	20	5.40		
Gender x Difficulty	12.28	2	6.14	1.14	0.341
<b>YEAR THREE:</b>					
Within cells	343.88	12	28.66		
Gender	22.73	1	22.73	0.79	0.391
Within cells	294.33	24	12.26		
Gender x Difficulty	32.46	2	16.23	1.32	0.285

**Table 4.1: Results of ANOVAs examining gender differences**

#### 4.4.3. Discussion 1

Analyses conducted on the data from session one indicated that neither gender nor order of trial presentation influenced performance on this task. Therefore it was not necessary to vary the order of trial presentation between subjects or to consider gender as a factor in subsequent analyses. It was decided that in session two all subjects would perform three consecutive trials on each difficulty level, that is, 3 x level 3, then 3 x level 5, then 3 x level 7. This format would reduce the overall procedure time and ameliorate boredom and fatigue which young subjects may experience during long testing sessions.

	SS	DF	MS	F	Sig of F
<b>YEAR ONE:</b>					
<b>Between subjects effects...</b>					
Within cells	346.29	9	38.48		
Order	46.69	2	23.34	0.61	0.566
<b>Within subjects effects...</b>					
Within cells	152.42	18	8.47		
Order x Difficulty	19.10	4	4.77	0.56	0.692
<b>YEAR TWO:</b>					
<b>Between subjects effects...</b>					
Within cells	178.85	9	19.87		
Order	4.09	2	2.05	0.10	0.903
<b>Within subjects effects...</b>					
Within cells	95.72	18	5.32		
Order x Difficulty	24.58	4	6.14	1.16	0.363
<b>YEAR THREE:</b>					
<b>Between subjects effects...</b>					
Within cells	332.66	12	27.72		
Order	56.46	2	28.23	1.02	0.390
<b>Within cells effects...</b>					
Within cells	276.11	24	11.50		
Order x Difficulty	65.33	4	16.33	1.42	0.258

**Table 4.2: Results of ANOVAs examining trial order effects.**

#### 4.5.1. Session 2

Session two was completed between 1 and 21 days following session one depending on the time available within the different schools. Although the period between sessions one and two was somewhat longer for children from some schools than from others, this situation was unavoidable. However, any effects of this difference in time between testing sessions were counteracted by including children from all the different schools in each of the experimental groups which were employed. Moreover, when children were asked to recall what they were



required to do on the game, all children had remembered quite correctly. It is possible that the children who experienced a shorter period of time between sessions one and two had a slight performance advantage but allocating children from different schools to the same experimental group eradicated this problem. As the children had played the game previously in session one, they were asked to recall what they had to do and were given two practice trials on level 2. They then completed a total of nine trials, three on each of levels 3, 5, and 7, presented in the order described above. Subjects' average error scores on each of the three levels were again calculated.

#### **4.5.2. Results**

**Correlations between performance scores on sessions 1 and 2-** Pearson's product moment correlation coefficients were calculated between scores on sessions one and two and are shown in table 4.3. Initial coefficients were calculated which included scores from all three difficulty levels. Separate coefficients were then calculated for each level of difficulty. With the exception of those coefficients marked with an asterisk, according to Munro & Page (1993), the remainder indicate high to very high correlations.

#### **4.5.3. Performance differences between the three levels of difficulty**

Using a within-subjects design, three one-way ANOVAs (score by difficulty level) were performed on error scores from sessions one and two. As table 4.4 demonstrates, the difficulty level main effect was significant for all three year groups.

LEVEL	YEAR	r
3, 5 & 7.	1	0.923
	2	0.925
	3	0.903
3	1	0.915
	2	0.904
	3	0.354*
5	1	0.786
	2	0.806
	3	0.647*
7	1	0.834
	2	0.845
	3	0.824

**Table 4.3: Correlation coefficients between error scores on sessions one and two**

Tukey's HSD test was then used to determine at which levels ( $\alpha=0.05$ ) mean error scores differed significantly from each other. For year one, error scores on level 7 were significantly greater than error scores on levels 3 and 5 and significantly more errors were made on level 5 than on level 3. In years two and three, significantly more errors were made on level 7 than on both levels 3 and 5. However, the difference between errors made on levels 3 and 5 was not significant. Although these differences were not statistically significant, the children did make more errors on level 5 than on level 3. Greater standard deviations (provided in parentheses in table 4.5) can be seen for all three year groups on level 7 than on levels 3 and 5. Such a finding is to be expected when we consider that level 7, being the most difficult level played on, is likely to result in widely differing performances by those subjects who are more and less competent at the game.

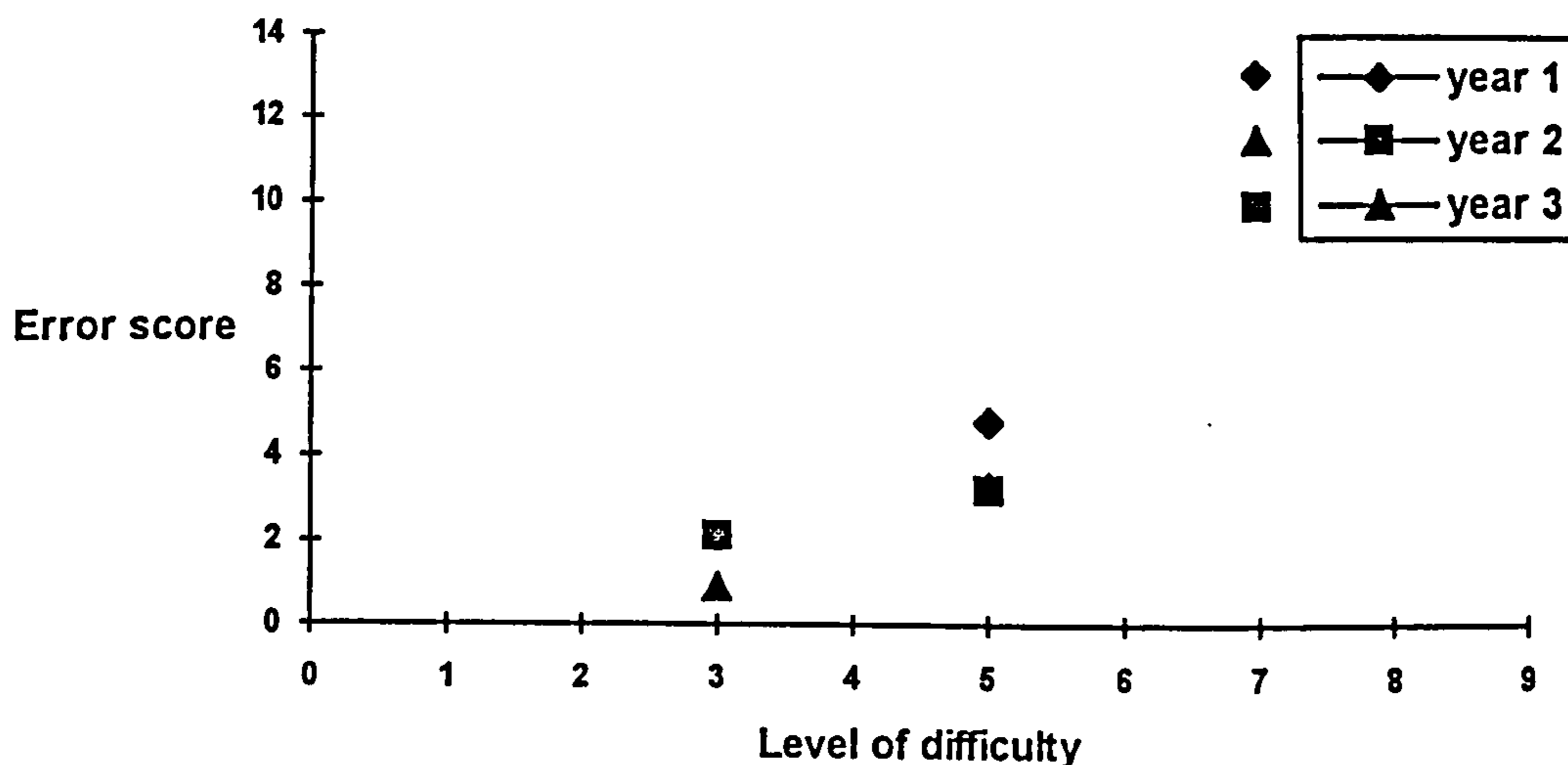
	SS	DF	MS	F	SIG. OF F
<b>YEAR ONE</b>					
Within subjects effects...					
Within cells	145.71	22	6.62		
Difficulty	764.03	2	382.02	57.68	0.0001
<b>YEAR TWO</b>					
Within subjects effects...					
Within cells	209.01	22	9.50		
Difficulty	838.43	2	419.22	44.13	0.0001
<b>YEAR THREE</b>					
Within subjects effects...					
Within cells	442.70	28	15.81		
Difficulty	1814.35	2	907.17	57.38	0.0001

**Table 4.4: Results of ANOVAs examining performance differences between the three difficulty levels**

YEAR	LEVEL		
	3	5	7
1	2.13 (1.95)	4.80 (2.99)	12.96 (5.21)
2	2.10 (1.91)	3.20 (2.16)	9.82 (4.49)
3	0.91 (0.71)	3.27 (2.11)	11.39 (5.72)

**Table 4.5: Mean error scores for all years on levels 3, 5 & 7 with standard deviations in parentheses**

Figure 4.2: Plot of mean error scores for all three groups on levels 3, 5 and 7.



#### 4.5.4. Discussion 2

**Discriminant validity-**Results of the three one-way ANOVAs and follow-up tests indicated that, as required, subjects' performances varied in relation to the level of difficulty played on. Both table 4.5 and figure 4.2 demonstrate that error scores increased with increasing level of difficulty. Although the differences between mean scores did not all reach traditional levels of significance, they exhibited an increase in mean error scores from level 3 to level 7 which was both expected and required. The results indicated that higher levels of the game were, in general, significantly more difficult than lower levels for each age group.

#### 4.5.5. Test-retest reliability

Correlation coefficients between scores on sessions one and two indicated that subjects' performances were consistent from one session to another. All but two of the  $r$  values are defined as high or very high when the criteria suggested by Munro & Page (1993) are employed. Therefore on separate testing occasions, the instrument provided a reliable measure of subjects' performances.

#### **4.6.1. Conclusions from the pilot study**

The aims of the initial testing session were to determine whether or not gender and order of trial presentation affected performance on the task. Analyses which examined these variables indicated that they did not affect performance and these variables were not included in subsequent analyses.

Two testing sessions were employed in order to examine if the task provided a reliable measure of performance over time. With the exception of two correlation coefficients, the remainder were classified as high to very high. This result indicated that the instrument under consideration did provide a reliable measure of performance across time.

A further aim of this pilot study was to examine the discriminant validity of the instrument. Error scores on some but not all levels did differ significantly but on those on which error scores did not demonstrate significant differences, the differences between error scores were in the directions expected and required. That is, more errors were made on levels which were designated as more difficult than on those levels which were designated as relatively easier. Hence, the discriminant validity of this instrument was demonstrated.

A learning effect was demonstrated in all three age groups on some of the levels tested. As table 4.6 indicates, this learning effect was evident in year one at all three levels of difficulty, in year three at levels 3 and 7, but only on level 3 in year two. This learning effect is demonstrated by smaller error scores produced in session two than those produced in session one. This indicates that the children improved their performance on the game with increased amounts of practice. The lesser learning effect for children in years two and three could perhaps be attributed to fatigue or boredom with the game. They may not have found the game as challenging in the second session as the children in year one evidently did. Equally likely is the fact that the children in years two and three may have more quickly reached their maximum level of performance than those in year one. Therefore whilst the younger children still had room for improvement after the

first session, the older ones may have improved as much as they possibly could during this session.

As a result of this pilot study, certain adjustments and practices were adopted in the study which follows. First, the relatively large standard deviations of error scores around the mean indicates that the number of errors incurred varies quite widely between individuals. These individual differences in skill level must be taken into account. It was decided to employ a procedure to obtain individual baseline levels which would indicate each individual's own level of competence on the task. This procedure was as follows. Representing the intermediate level of difficulty, children performed three trials on level 5. Their average error score was calculated on these three trials and a threshold level of six errors was adopted. Given the length of the trial time and the difficulty of this level of the game it was felt that this threshold level was appropriate. If the children's average error score was six, then their baseline was designated as level 5, if this average error score was less than or greater than six, their baseline was designated as level 7 or 3, respectively. It was also decided to keep the different sets of levels for children at different chronological ages as error scores were approximately the same on the three levels for each of the three year groups, demonstrating their suitability for each age group. Similarly, it was decided that in the following study, all the children would perform trials in blocks of the same level of difficulty as order of trial presentation did not affect children's performance on the task.

	LEVEL		
	3	5	7
<b>YEAR ONE:</b>			
Session one	3.21	5.13	13.07
Session two	1.30	4.71	12.89
<b>YEAR TWO:</b>			
Session one	2.28	3.03	8.36
Session two	1.91	3.38	10.78
<b>YEAR THREE:</b>			
Session one	1.12	3.13	11.83
Session two	0.84	3.63	11.73

**Table 4.6: Mean error scores on all levels for all years in sessions one and two**

One major change was made to the appearance of the game. In the pilot study, the screen displayed a blue path on a black background. However, in the study which follows these colours were changed throughout each of the three phases of the experimental procedure employed to make the game more attractive to the children. To remind the children of the difficulty of the current level on which they played, whilst the children were playing on each trial, a large number was displayed in the left hand corner of the screen .

This instrument provides a major strength of the subsequently described main experiment. The pilot study validated and demonstrated the reliability of a task, which, through alteration of the parameters of path width and dot speed, was appropriate for use across a spread of chronological ages. Being able to employ

the same task with children who represent different levels of conceptual development and motor control whilst assessing the same variable, adds validity to the main study described in the following section. The behaviour of children across a variety of developmental levels can then be directly compared in relation to the same task (or, an age appropriate version of the same task). Commonly, different measures are used to assess the same variables in children at different chronological ages and developmental levels, for example, Harter & Pike's (1984) Pictorial Scale of Perceived Competence and Acceptance for Young Children and Harter's (1985a) Perceived Competence Scale for Children are used respectively with younger and older children. Although a necessary step to take, use of different measures could reduce the direct comparability of the variables which they are designed to measure, as pointed out by Marsh, Barnes, Cairns & Tidman (1984). By using the same task with children of different chronological and developmental ages, the present study overcomes this problem.

A final, general comment is warranted concerning the difficulty of selecting a task which would suitably fulfil the requirements of this study. A task was required which was relatively novel to all the subjects, which was sensitive to individual differences in ability level, which accommodated a range of age and skill levels and which would provide an opportunity to assess behaviour across a range of developmental levels. It is felt that this pilot study has demonstrated that the task intended for use in the following study has satisfactorily fulfilled these criteria and therefore demonstrated its suitability for this investigation.

#### **4.7.1. Experiment four: An investigation into the stability of effort and ability understanding**

Having established the validity and reliability of the task which will provide the necessary context manipulation in this study, the study itself is now described. During this study, children at different levels of effort and ability understanding, concerning performance outcomes on physical tasks, were presented with experimentally disrupted performance information. The variability of their behavioural responses to this information was examined to assess system stability at different developmental points throughout this conceptual development. It was expected that children at conceptual levels two and three would exhibit greater



variability of behaviour than children at levels one and four, therefore indicating periods of instability and stability of understanding at the different levels.

#### **4.7.2. Subjects**

The subjects were 51 children (age range 5 years & 2 months to 13 years & 3 months) from primary schools in Gwynedd and Clwyd and a secondary school on Merseyside. They were randomly selected for participation, were mainly Caucasian in origin and represented a wide range of academic abilities.

#### **4.7.3. Experimental procedure**

**Session 1-** Session one involved assessing subjects' individual levels of effort and ability understanding in the physical domain and establishing their baseline level on the computer game to be employed in the study. The level of effort and ability understanding of a number of children was assessed before groups were constructed. Group allocation took place following an assessment of the individual's level of effort and ability understanding. Originally, group size was anticipated to be 20, however, insufficient numbers of children who reasoned at the required level could be found to achieve this target. For example, although 20 children could be found who reasoned at levels two and three, from the subject pool available, only 17 of the children had reached level four of this conceptual understanding.

Conceptual understanding was assessed using the procedure described in experiment one (see page 31). Following this, subjects were allocated to one of three experimental groups. Group one ( $n = 17$ ) comprised children who had reached level one of the continuum, 11 of whom were male and 6 of whom were female. They ranged in age from 5 years & 2 months to 8 years & 3 months, with a mean age of 6 years & 1 month. Group two ( $n = 17$ ) was comprised of children who had reached either of levels two and three of the continuum, 7 of whom were female and 10 of whom were male. Their ages ranged between 5 years & 2 months and 12 years & 5 months, with a mean age of 8 years & 6 months. Group three ( $n = 17$ ) was comprised of children who had reached level four of the

continuum, 12 of whom were male and 5 of whom were female. They were aged between 10 years & 7 months and 13 years & 3 months, with a mean age of 11 years & 9 months.

The aim of the game was explained to subjects and they performed two familiarisation trials on level 2 of their age appropriate set of levels. Level 2 was chosen to introduce the children to the game as it was felt that this level represented one which provided the children with an opportunity to become familiar with the game at a level which was achievable and not too challenging. A baseline level was then established for each subject to determine an appropriate difficulty level for that individual, therefore allowing for existing individual differences in ability level. The method of assessing individual baselines is described in the pilot study (see page 117). As with the pilot study, with increasing age, the subjects played on a set of nine levels of increasing difficulty. Although individual baseline levels were established, children nevertheless played on a set of nine levels which was designed for an age group into which they fell. This was necessary to allow for performance differences resulting from both age and skill level within this age group. As discussed previously in the pilot study (see page 108), three programmes were employed so that the more difficult levels on which the younger children played corresponded in difficulty level to the easier ones on which the next age group of children played.

**4.7.4. Session 2-** This session was divided into three phases which were presented to the subjects in continuous succession. On selected manipulation trials during phases one and two, subjects received manipulated performance information on the game whereas information received throughout the whole of phase three was an accurate representation of their performance on the game. This last phase was incorporated into the design for ethical reasons to negate any effects of the previous two phases.

On the manipulation trials in phase one children received performance information which was designed to suggest higher levels of success than they had previously

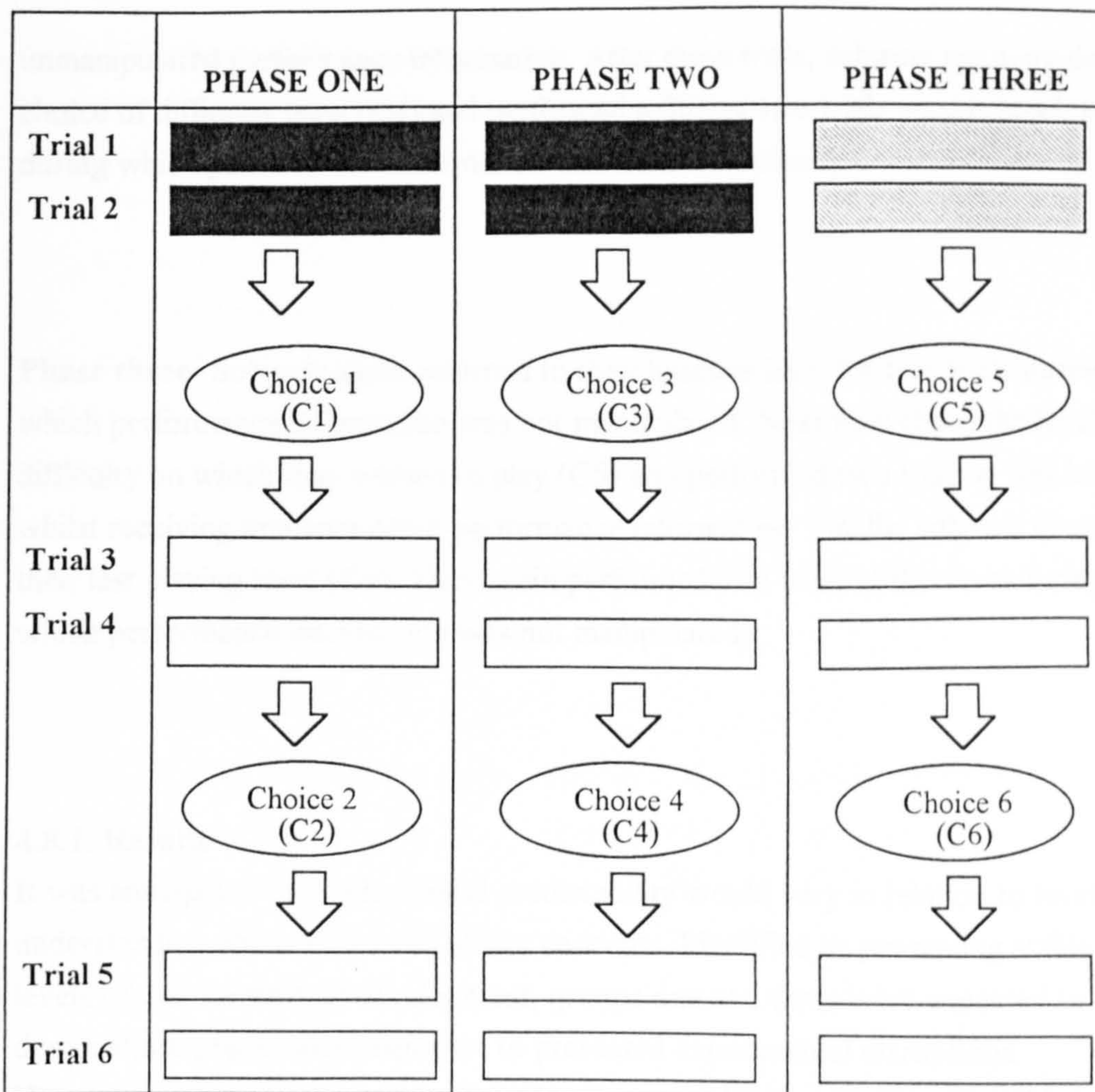
experienced. On similar manipulation trials in phase two, performance information was administered which was designed to suggest lower levels of success than previously experienced. Throughout all trials in the three phases, a large number was displayed on the screen which indicated the level the subject was currently attempting. This was to ensure that subjects were constantly aware of the difficulty level at which they were playing.

#### **4.7.5. Experimental format**

Figure 4.3 shows an abridged version of the experimental format employed.

**Phase one-** Subjects first performed two trials on their individual baseline level. Throughout these trials they received performance information which was manipulated so as to suggest enhanced levels of success, relative to those previously achieved. Following this, they were asked to think about how far along the path they had moved the dot, how many beeps they had made, and to decide which level of difficulty they wanted to play on next. This level choice was labelled C1. At this, and each subsequent point at which they were required to make such a choice, subjects' understanding of the relative difficulty of the different levels was checked. The children were asked whether they wanted to play on a more difficult or an easier level than the present one, and to state on what level they wished to play. They then showed the experimenter their choice by moving an arrow along a scale which portrayed the nine levels, to their own level choice. Once a choice had been made and this check procedure had been carried out, they performed two trials on the level they had chosen. The performance information they received on these trials was not manipulated in any way. Following these two trials, they chose their next level of difficulty (C2) at which they performed two trials and on which they again received unmanipulated performance information.

**Phase two-** Subjects then returned to their baseline and performed two trials at this level. During these trials they received performance information which was manipulated so as to suggest depressed success levels in comparison with those experienced previously. Following these manipulation trials, they chose their next playing level (C3). They then performed two trials at this level whilst receiving



**KEY:**



= Trial performed at baseline level with manipulated performance information.



= Trial performed at baseline level with unmanipulated performance information.



= Trial performed at child's previously chosen level with unmanipulated performance information.



= Point at which child chooses level of difficulty they will play on during the following two trials.

**Figure 4.3: Experimental format.**

unmanipulated performance information. After these trials, subjects again made a choice of difficulty level (C4) and performed a further two trials on this level, also during which performance information was not manipulated.

**Phase three-** Subjects again returned to their baseline level for two trials during which performance information was not manipulated. Next they chose the level of difficulty on which they wished to play (C5) and performed two trials at this level whilst receiving unmanipulated performance information. Finally, subjects chose their last playing level (C6). They again performed two trials at this level during which performance information was not manipulated.

#### **4.8.1. Results**

It was anticipated that behavioural predictability would vary in relation to level of understanding about effort and ability concepts. Identified as possessing stable levels of this conceptual development, groups one and three were expected to demonstrate predictable responses to presented experimental disruptions. However, as group two was proposed to represent levels which are unstable, these subjects were not expected to exhibit such behavioural predictability. An examination of this issue first requires a definition of behavioural predictability in the present context. The following discussion describes the behaviour which only groups one and three were expected to exhibit and figure 4.3 will increase the clarity of this explanation. In the absence of other cues, it is reasonable to presume that we assess personal capability on the basis of performance outcomes. If we perceive ourselves to be capable of achieving a task we might either choose to continue at that task or increase the difficulty level of the task. Conversely, if we perceive ourselves as not capable of succeeding on a task, we might choose to decrease the level of task difficulty, or remain at this level to achieve success with subsequent performance attempts. Following information which indicates increased levels of success, at C1, subjects were expected to choose a level which was more difficult than their baseline. Subsequently, when performance information was not manipulated on trials performed at this chosen level, success levels were effectively lowered and subjects were expected to choose a lower level of difficulty at C2. A similar reduction of difficulty level, in relation to baseline, was expected at C3 when subjects had received performance information

which indicated decreased levels of success. However, in response to unmanipulated performance information received on trials at this chosen level, subjects were expected to elect to play at a more difficult level at C4. Because phase three did not present subjects with any experimental manipulations they were expected to demonstrate similar responses regardless of experimental group. Individual differences in actual and perceived competence levels could affect behavioural responses to performance information which accurately reflects performance. Therefore no *a priori* hypotheses were made about subjects' level choices at C5 and C6. What may be revealed is that no differences exist between the frequencies of subjects electing to increase and decrease the level of difficulty during this phase of the experiment, regardless of experimental group.

If actual and predicted behaviour are congruent, significantly more subjects in groups one and three would elect to increase than to decrease the difficulty of their playing level at C1 and C4. Alternatively, at C2 and C3, significantly more subjects in groups one and three would elect to decrease than to increase the difficulty of their playing level. However, such significant differences would not be evident in the choices of children in group two. Moreover, at C5 and C6, the numbers of children electing to increase and decrease the level of difficulty would not differ significantly from each other in any of the three experimental groups. To examine the validity of these hypotheses, chi-squared analyses were used.

The anticipated results related to whether the three groups demonstrated behaviour which could be predicted as a result of the performance information with which children were presented. Group behaviour following the receipt of performance information was then examined. The present study was interested in the direction of children's level choices rather than the mean level of difficulty chosen by each group as this latter method would not allow for individual differences in ability level. As a result, the most effective method of assessing the present hypotheses was to compare the frequencies of children who chose to move in either direction at each point when a level choice was required. Chi-squared analysis provides the most appropriate method of analysing differences between frequency data.

#### 4.8.2. Chi-squared analyses

At each point when subjects made a level choice (i.e. C1-C6), three options were available. They could either increase the difficulty level, decrease this level, or remain at their present level of difficulty. Therefore three response categories were formed, "Increase", "Decrease", or "Same". Table 4.7 shows the frequencies of children from all three groups who fell into each of these categories at all six response points during the experiment.

<b>GROUP 1</b>	<b>C1</b>	<b>C2</b>	<b>C3</b>	<b>C4</b>	<b>C5</b>	<b>C6</b>	<b>N</b>
<b>Increase</b>	11	6	6	7	5	7	42
<b>Decrease</b>	5	10	11	8	12	7	53
<b>Same</b>	1	1	0	2	0	3	7
<b>N</b>	17	17	17	17	17	17	102
<b>GROUP 2</b>	<b>C1</b>	<b>C2</b>	<b>C3*</b>	<b>C4*</b>	<b>C5</b>	<b>C6</b>	<b>N</b>
<b>Increase</b>	5	7	3	14	6	9	43
<b>Decrease</b>	10	8	13	1	9	4	43
<b>Same</b>	2	2	1	2	2	4	13
<b>N</b>	17	17	17	17	17	17	102
<b>GROUP 3</b>	<b>C1</b>	<b>C2**</b>	<b>C3**</b>	<b>C4</b>	<b>C5</b>	<b>C6</b>	<b>N</b>
<b>Increase</b>	11	3	1	11	6	10	42
<b>Decrease</b>	4	13	15	4	9	5	50
<b>Same</b>	2	1	1	2	2	2	10
<b>N</b>	17	17	17	17	17	17	102

**Table 4.7: Frequencies of children, classified by experimental group, who chose to increase, decrease or stay at the same level (C1=following performance information designed to elicit relatively greater perceived success; C3=following performance information designed to elicit relatively depressed perceived success levels; C2, C4, C5 & C6=following unmanipulated performance information; \*=significantly different; \*\*=significantly different, as hypothesised)**

Three initial within-group chi-squared analyses were carried out. However, these analyses were rendered invalid as more than 20% of the expected cell frequencies were less than five. It was the "Same" category which caused the violation of this chi-squared assumption. Therefore this category was excluded from subsequent chi-squared analyses which were performed on only the remaining "Increase" and "Decrease" categories. Three chi-squared analyses were carried out on these data, the results of which are shown in table 4.8. As this table demonstrates, within groups two and three, significant differences were revealed between the frequencies of children found in the two response categories. However, these frequency counts did not differ significantly in group one. One-sample chi-squared analyses were subsequently employed to determine the response points at which significant differences exist for each of groups two and three. The results of these analyses are displayed in table 4.9.

<b>GROUP</b>	<b>DF</b>	<b>CHI-SQUARED</b>	<b>P</b>
<b>1</b>	<b>5</b>	<b>6.52</b>	<b>&gt;0.05</b>
<b>2</b>	<b>5</b>	<b>20.812</b>	<b>&lt;0.001</b>
<b>3</b>	<b>5</b>	<b>26.77</b>	<b>&lt;0.001</b>

**Table 4.8: Results of initial chi-squared analyses**



<b>GROUP 2</b>			
<b>Level choice point</b>	<b>DF</b>	<b>CHI-SQUARED</b>	<b>P</b>
1	1	1.67	>0.05
2	1	0.07	>0.05
3	1	6.25	<0.05
4	1	11.27	<0.001
5	1	0.60	>0.05
6	1	1.92	>0.05

<b>GROUP 3</b>			
<b>Level choice point</b>	<b>DF</b>	<b>CHI-SQUARED</b>	<b>P</b>
1	1	3.27	>0.05
2	1	6.25	<0.05
3	1	12.25	<0.001
4	1	3.27	>0.05
5	1	0.60	>0.05
6	1	1.67	>0.05

**Table 4.9: Results of follow-up one-sample chi-squared analyses**

#### **4.8.3. Group 2**

As expected, significant differences were not revealed between the frequencies of children in the two response categories at C1, C2, C5 and C6. However, at C3, significantly more children elected to decrease the level of difficulty, and at C4, significantly more subjects elected to increase the level of difficulty. These differences were not expected.

#### 4.8.4. Group 3

As expected, at C2 and C3, significantly more subjects elected to decrease than to increase the level of difficulty. Also as expected, significant differences were not revealed between the frequencies of children in the two response categories at C5 and C6. However, contrary to predictions, at C1 and C4, no significant differences were found between the frequencies of children in the two categories. Figures 4.4-4.6 show the frequencies of children in both the "Increase" and "Decrease" categories at each response point and in each of the three groups.

Figure 4.4: Frequencies of directional choices at C1-C6 in group 1.

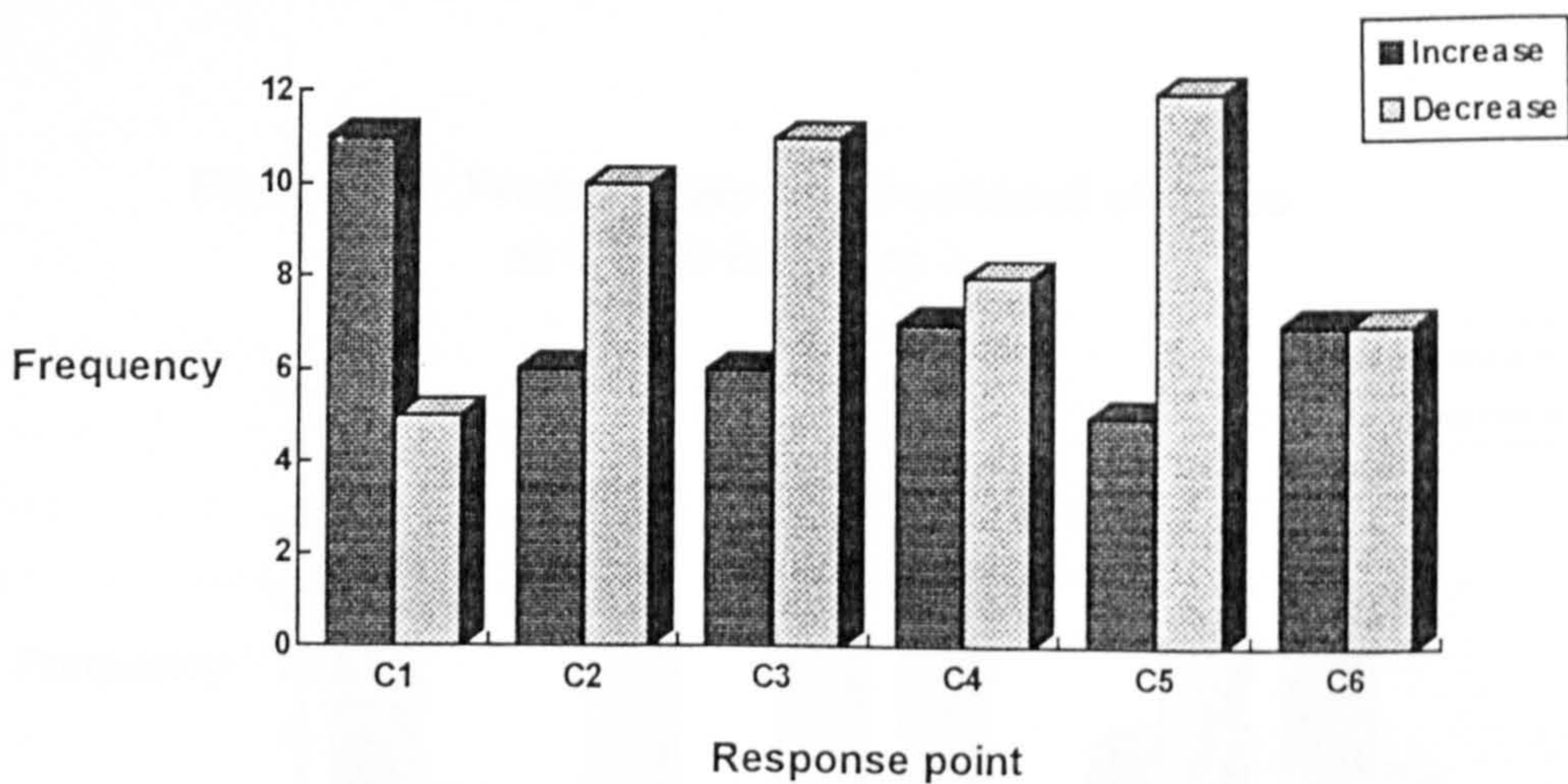


Figure 4.5: Frequencies of directional choices at C1-C6 in group 2.

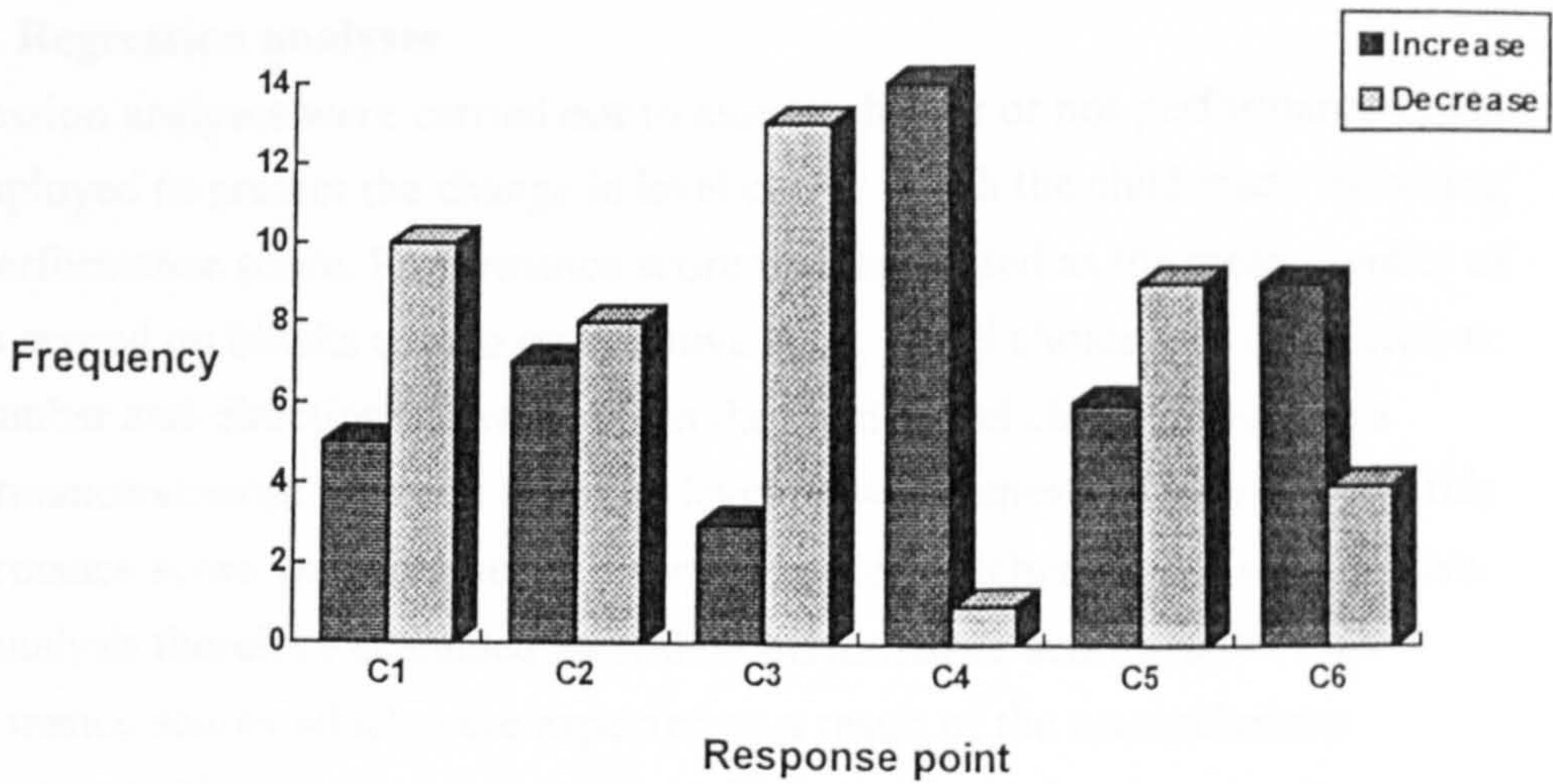
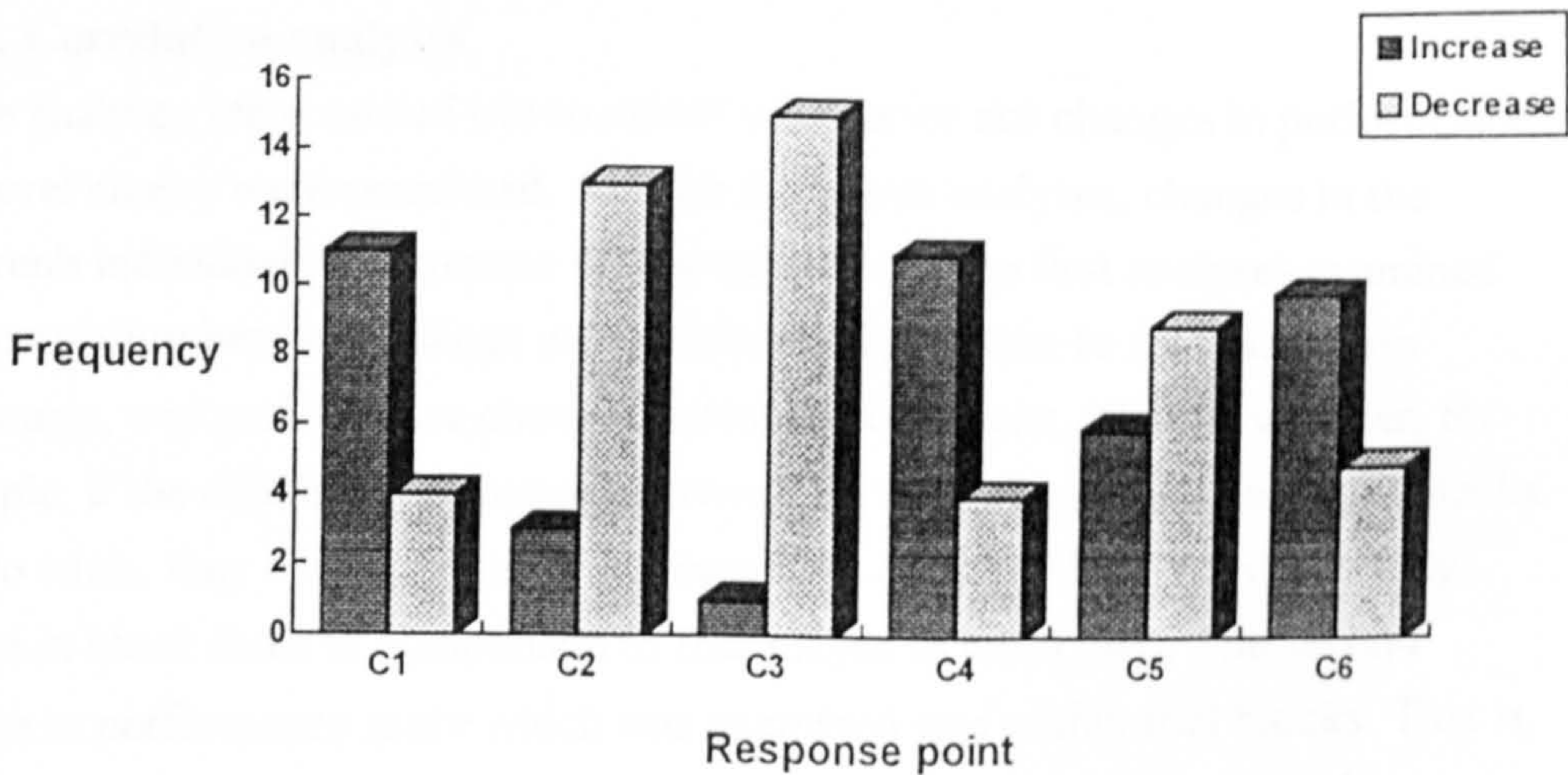


Figure 4.6: Frequencies of directional choices at C1-C6 in group 3.



Considering the somewhat limited support which was provided for predictions made in the present study by the preceding chi-squared analyses, a number of additional statistical analyses were carried out on the data to further investigate the proposed relationships between behavioural stability and conceptual understanding.

#### **4.8.5. Regression analyses**

Regression analyses were carried out to assess whether or not performance could be employed to predict the change in level choice which the child made following this performance score. Performance score was calculated as the mean number of errors scored on blocks of two consecutive trials. Level choice was calculated as the number and direction of levels which the child's level choice following a performance attempt deviated from the level on which they had played when this performance score was obtained. This value could be either negative or positive. This analysis therefore examined individual performance scores rather than performance scores which were expected as a result of the manipulations administered. These analyses revealed no further support for the present hypotheses.

#### **4.8.6. Correlation analyses**

These analyses were carried out to assess whether or not changes in performance and level choice were correlated. As with the above analyses, changes in the children's individual performance scores were used. The first analyses examined the correlation between change in level chosen, in relation to that played on previously, and performance changes between trial blocks. That is, whether, for example, if the child's performance improved between the second and third blocks of two trials, they correspondingly increased the difficulty level on which they played in block three in comparison to that played in block two. The second change in performance score which was examined was within trial blocks. That is, whether, for example, if the child's performance got worse from one trial to the next within the same block of two trials they correspondingly elected to play on a relatively lower level than the level on which they played during this previous performance attempt. Similar to the regression analyses carried out previously, these correlational analyses provided no further support for the predictions made in this experiment.

#### **4.8.7. Examinations of within subject predictability and consistency**

This procedure examined the level of predictability and consistency demonstrated by the direction of children's level choices in relation to changes in the number of errors which they scored. Consistency was assessed by examining whether the direction of children's level choices in relation to changes in their performance score demonstrated a pattern which was consistent across all points at which the children made level choices. For example, a child could demonstrate consistent behaviour by electing to increase the level of difficulty following an improved performance score and electing to move to an easier level of difficulty following an increase in the number of errors scored. A child could also demonstrate consistency by electing to decrease the level of difficulty following a relative improvement in error score but elect to increase the level of difficulty following a relative increase in error score. Predictable behaviour would be demonstrated only when children elected to increase the level of difficulty following decreases in error scores and decrease the level of difficulty following increases in error scores. These two behaviours are not mutually exclusive yet the existence of one does not rely on the existence of the other. As was employed with the correlational analyses, changes in performance score both within and between trial blocks were examined and no further substantiation of the present hypotheses was produced.

#### **4.8.8. Analysis of variance**

An analysis of variance was performed to examine possible differences between the groups in the amount by which their level choices, following the administered performance information manipulations, deviated from individual baseline levels. This would then provide an indication of whether the children in one group tended to remain nearer to their baseline levels than did those in another group and would provide some indication of the variability of the three groups' behaviour. Results from this analysis matched those of previous analyses, with no significant differences between groups.

#### **4.8.9. Individual profiles**

Two types of profile were drawn up for each child to examine whether any trends in the data could be identified. The first portrayed the absolute deviation between adjacent level choices at each of the six level choice points. From these profiles,

the amount of level choice variability within each subject could then be examined. The second profile displayed the child's actual level choices at each of the six response points in relation to their individual baseline level. This profile provided an indication of the amount by which each child's level choices deviated around their individual baseline level. Again, no further support for the current hypotheses was yielded from these profiles.

#### **4.9.1. Discussion**

**Group 1-** The behaviour of group one did not quite match *a priori* expectations. Figure 4.4 demonstrates that although behavioural responses to experimental disruptions were in the predicted directions, traditional levels of statistical significance were not reached in a subsequent analysis of this behaviour. This is perhaps an indication that this behaviour was only partially driven by the performance information with which they were presented. Previous research has suggested that young children are less aware, or make less use, of performance outcomes than children at more advanced developmental levels, particularly when this information refers to the individual's own level of success. Stipek et al (1984) demonstrated that young children's exaggerated competence perceptions can be lowered to approximate actual ability when the salience of the performance outcome is increased. Similarly, Clifford (1978) revealed that first and third graders' predictions of performance on a puzzle task were closer approximations to previous performance when visual cues provided salient reminders of these performances, than when such cues were not provided. It appears therefore that young children's behaviour in the present context is likely to exhibit changes when the child's performance outcome becomes a salient aspect of the situation. The final section of this chapter describes an experiment which explores the effects on young children's behaviour of increasing the saliency of their performance outcomes on a motor task.

#### **4.9.2. Group 2**

In line with current hypotheses, no significant differences were revealed between the number of children who elected to increase or decrease the level of difficulty at each of the response points C1, C2, C5 and C6. Moreover, the behaviour exhibited by these children in phase one (where level choices C1 and C2 were

made) was in direct opposition to that displayed by children in groups one and three. Whilst in groups one and three, more children elected to increase than decrease the level of difficulty, in group two, more children elected to decrease than to increase the level of difficulty at this response point. Although none of these differences reached statistical significance levels in the chi-squared analysis, they do suggest that during phase one, the behaviour of children in groups one and three was somewhat more predictable than that of children in group two. Contrary to predictions, this group did respond in a manner which was similar to that of groups one and three when they were presented with experimentally distorted performance information which suggested depressed success levels. That these children responded predictably to this type of performance information is a matter of concern when the development of achievement motivation and related variables such as perceptions of personal competence are considered. Group two seemed to be sensitive only to "negative" performance information whereas groups one and three appeared to be sensitive to both "negative " and "positive" feedback. During the developmental period experienced by group two children, perceptions of personal competence have commonly been shown to decline. For example, Stipek & Tannatt (1984) demonstrated decreases in perceptions of academic competence from pre-school to the third grade (the latter representing the age group in which most of the group two children occurred). Nicholls (1978) also claims that between 6 & 7 and 8 & 9 years of age, children's self concepts of attainment in reading demonstrate marked declines. Some authors have suggested that changes in the way in which children respond to failure experiences (Stipek & Daniels, 1988) and the child's increasing ability to incorporate failure into their self concept (Stipek & Hoffman, 1980; Parsons, 1982) parallel this exhibited decline in levels of perceived competence. Moreover, previous research (for example, Rholes, Blackwell, Jordan, & Walters, 1980) has revealed that children at this stage of development, or chronological age, are beginning to acknowledge and respond to the limiting effects of negative feedback, the cumulative effects of which, according to Stipek (1984) influence expectations for success in the future. The increasing uncertainty which the child experiences about their personal competence during this developmental period could contribute towards the instability of their exhibited behaviour. The doubt which these children seem to be experiencing about their personal competence levels and whether or not the feedback which they receive indicates failure or success, could result in their adoption of "safe" strategies. Such strategies are evidenced in their choice of easy levels of difficulty during phase one when performance information indicated that success could be easily achieved on the game.

The present findings suggest that children experiencing levels two and three of effort and ability understanding focus on feedback which indicates low personal ability whilst ignoring feedback which indicates that personal ability level is high. It is likely, as previous research has proposed, that this emphasis on negative feedback may contribute towards declining perceptions of personal competence. When the relationship between high levels of perceived competence and participation in physical activity is considered (for example, Weiss & Horn, 1990), the practical implications of this finding must be considered. During this period it appears that practitioners working with children in physical settings should increase the children's awareness of positive feedback to attempt to maintain perceptions of personal competence and sustain the child's participation in physical activity.

#### **4.9.3. Group 3**

Similar to groups one and two, in phase three, the numbers of children in this group who chose to increase and decrease the level of difficulty did not differ significantly from each other. The directions of their level choices in phases one and two matched predictions only to a certain extent. In both phases, choices were made in the predicted directions but only at C2 and C3 did the differences between frequencies yield statistically significant results. These children's more adult-like conceptualisations of effort and ability may contribute towards the relatively more predictable behaviour which they demonstrated in comparison with those at lower levels of this conceptual development.

With respect to developing conceptualisations of effort and ability, the present study provided only limited support for the proposal (for example, Self-organising Systems Theory and Piaget's Equilibration Model) that behavioural variability is related to conceptual stage stability. To a certain extent, when the individual was presented with experimentally derived perturbations, decreases in behavioural variability paralleled increases in stage stability (see Hudson, Fazey & Fazey, 1994a, results presented differ between this publication and those presented in the



present thesis as the data were re-analysed subsequent to publication). This was indicated by the increased predictability of children's behaviour in groups one and three, in comparison with that displayed by children in group two. However, the degrees of predictability and unpredictability of behaviour exhibited by these three groups did not reach a magnitude which indicated overwhelming support for the present proposals. Group two did demonstrate unpredictable behaviour by virtue of the fact that their behaviour in two phases was predictable whereas that displayed in the remaining phase was not. Groups one and three however, did not behave in a manner which was wholly congruent with *a priori* expectations.

As is apparent from the above discussion, although a number of analyses were carried out on various configurations of the data, they revealed no conclusive support for the hypotheses which were currently under examination. Various explanations are offered for the weak support which these findings have provided for the present hypotheses in the final chapter of this thesis.

#### **4.10.1. An experiment to investigate the effects of increasing outcome saliency on young children's behavioural responses to manipulated performance information**

As discussed previously young children tend not to be as aware of their performance outcomes as are older individuals. Research has demonstrated that children's cognitive judgements can be modified by emphasising the outcomes of children's previous performance attempts. For example, Stipek et al (1984) found that young children's commonly high expectations for their own success were lowered when the saliency of their performance outcomes was increased. Similarly, Fazey & Evans (1994) demonstrated that, in relation to their mother's ratings of their performance on potentially dangerous tasks (which is reliably employed as a measure of actual task competence (Linford & Fazey, unpublished dissertation)) young children behaved in a manner which indicated that they possessed accurate estimates of their task competence.

It appears that if cognitive and affective judgements can be modified by increasing the saliency of performance outcomes, so can children's behaviour. This last section of Chapter Four describes an experiment which explores how increasing outcome saliency influences young children's behavioural responses to experimentally disrupted performance information.

#### **4.10.2. Subjects**

The subjects were 15 children ranging in age from 4 years & 9 months to 5 years & 3 months with a mean age of 5 years & 1.6 months. The sample consisted of 8 girls and 7 boys.

#### **4.10.3. Experimental procedure**

**Session 1-** Level of effort and ability understanding was assessed using the method described in previous experiments. As required, all subjects were found to reason at level one of this conceptual phenomenon. Children's baseline levels on the computer game were then obtained, also using the method described in the previous experiment.

**Session 2-** The same experimental format and manipulations employed in the previous experiment were employed here (see pages 123-125 for a detailed description). In this experiment the saliency of performance outcomes was increased to enhance the children's awareness of the performance outcome information with which they were presented. Instructions provided on how to play the game were identical to those given previously but the children were also offered a reward for successful performances. They were given 10 smarties at the start of phase one and told that they would lose one smartie every time they made a beep. The number of smarties which the child lost during a trial was removed following that trial and before they made their decision about which level to play on next. If any smarties had been lost during this phase, at the start of phase two, these smarties were returned to the subject to again increase the number of smarties to 10. The same procedure was carried out at the start of phase three if any smarties had been lost during phase two. Following completion of all three

phases, all children received the same number of smarties, regardless of their performance on the game.

Previous research (for example, Stipek et al, 1984) has indicated that offering children rewards for successful performance attempts effectively increases their awareness of the outcomes of these attempts as children subsequently base their future behaviour on these outcomes. The children in the present study demonstrated that smarties provided a suitable reward by the nature of their affective responses when told that they could receive them as rewards for successful performances.

#### 4.11.1. Results

Children's responses were again allocated to one of three categories, "Increase"; "Decrease", or, "Same", at each of the response points C1-C6. The frequencies of children in each response category at the six response points are displayed in table 4.10.

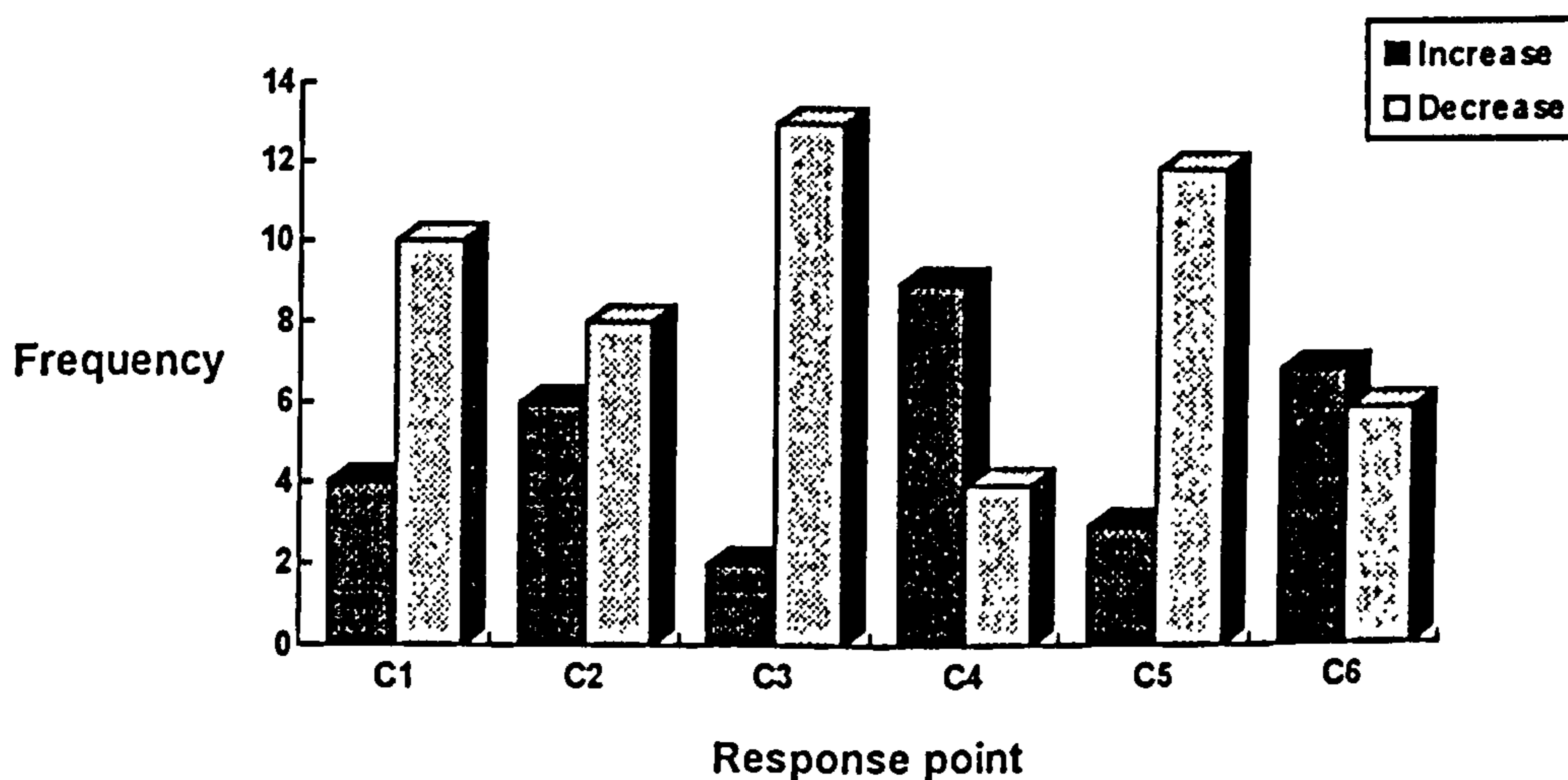
	C1	C2	C3*	C4	C5*	C6	N
Increase	4	6	2	9	3	7	31
Decrease	10	8	13	4	12	6	53
Same	1	1	0	2	0	2	6
N	15	15	15	15	15	15	90

**Table 4.10: Frequencies of children who chose to increase, decrease or stay at the same level at each of the response points (\*=significantly different)**

Similar to previous analyses, when "Same" choices were included, the chi-squared analysis performed on these data was invalid as more than 20% of the expected frequency counts were less than 5. Therefore the "Same" choices were excluded and chi-squared analyses were carried out only on the "Increase" and "Decrease" categories. A graphical representation of these frequencies is displayed by figure 4.7.

The chi-squared analysis subsequently performed on these data revealed significant differences between the frequencies of children found in the two response categories,  $\chi^2(5) = 13.5111, p < 0.05$ . Follow-up one-sample chi-squared analyses were then carried out to determine at which response points these significant differences were located. Table 4.11 displays the results of these one-sample analyses.

**Figure 4.7: Frequencies of directional choices at C1-C6 when outcomes are made salient.**



LEVEL CHOICE POINT	DF	CHI-SQUARED	P
1	1	2.57	>0.05
2	1	0.29	>0.05
3	1	8.07	<0.01
4	1	1.92	>0.05
5	1	5.40	<0.05
6	1	0.08	>0.05

**Table 4.11: Results of one-sample chi-squared analyses**

These follow-up analyses indicated that, at C3 and C5, significantly more subjects elected to decrease than to increase the difficulty level. No other significant differences were found. In phase one, where they received performance information which suggested enhanced levels of success, more children chose to decrease than to increase the level of difficulty, although this result was not statistically significant.

#### **4.12.1. Discussion**

In support of predictions, the present study has indicated that young children's behaviour exhibits changes when performance outcomes are made salient to the child (see Hudson, Fazey & Fazey, 1994b, results presented in this publication and the present thesis differ as the data were re-analysed subsequent to publication). In comparison with group one in the previous experiment, when outcomes were made salient to children, they displayed distinctly different patterns of behaviour following performance information which was designed to indicate enhanced levels of success. Although the behaviour of neither group resulted in statistically significant differences between the frequencies of children who elected to increase and decrease the level of difficulty, a comparison between figures 4.4 and 4.7 reveals that the two samples displayed directly opposing patterns of behaviour. When performance outcomes were made salient, and children were presented with information which indicated success, they nevertheless elected to decrease the difficulty of their playing level. Irrespective of

the fact that performance feedback indicated that success was easily obtained, their behaviour infers the belief that it is not worth risking the reward offered by playing at more difficult levels of the game. In the remaining two phases, similar behaviour was exhibited by the two groups. However, when performance outcomes were increased in saliency, statistical levels of significance were reached between the frequencies of children in the two response categories at C3 and C5.

These findings suggest that as expected, increasing outcome saliency results in changes in young children's behaviour. Their behavioural profile can be modified to more closely approximate that displayed by children in group two. It is likely that, under normal circumstances, their behaviour is only partially based on received performance outcome information. This perhaps indicates that children in group two and the outcome saliency group focused on preventing failure rather than challenging themselves with their chosen levels of difficulty. Other factors, which cannot be identified by the present research, may be involved and therefore warrant further investigation. Factors which could be examined include: the child's perception of their effort input and how this affects their behaviour; the child's interpretation of the performance information which they receive (the child may in fact base their decisions on performance information but may not interpret this information in the same way that older individuals would); the child's perception of what constitutes a successful performance attempt, and, the child's method of assessing their own ability. It seems that these children must possess some understanding of the level of competence required to successfully complete different levels of task difficulty. This is suggested by their reluctance to perform difficult levels of the task in an apparent attempt to gain as much reward as possible. An understanding of the competence required to successfully master different difficulty levels must be accompanied by the knowledge of whether or not personal competence matches this required level, as evaluation of the difficulty of the task involves an assessment of the personal resources available to meet its demands. It seems that young children may possess accurate perceptions of their own competence in relation to the level of the task. Chapter Five discusses previous research which has investigated the accuracy of children's perceptions of their own competence and Chapter Seven describes an experiment which addresses issues which are raised by this discussion.

Results of the present study also provide an initial insight into the nature of young children's risk taking behaviour. When a reward is made available for successful performances, young children are unwilling to risk losing this reward, and subsequently ignore performance information which indicates that success on the task can be easily gained. Therefore, these children appeared unwilling to challenge themselves. When no rewards were offered in the previous experiment, young children appeared to demonstrate a tendency to select tasks which did provide a greater personal challenge. Hence, support is offered for Heckhausen's (1984) proposal that in a task-choice setting involving a task of varying degrees of difficulty, children between 4 and 6 years of age are likely to select easy tasks to avoid experiencing failure. The tasks which the children were asked to perform in Heckhausen's (1984) study were a cognitively oriented maze task and a physically oriented elevator task, which are described in more detail in Chapter Six. The younger the child, the less likely they are to tackle difficult tasks. They only do so if the task possesses features which are attractive to them (Heckhausen, 1984). It appears that young children will only take risks if the task presents sufficient incentive to undertake such a risk. These results suggest that young children perhaps possess an inherent desire to challenge themselves but when personal challenge presents a risk of losing a desired incentive, the desire to be challenged is superseded by the desire to receive the offered incentive. The present findings also offer strong support for the hypothesis that young children do possess the capacity to evaluate their competence in relation to task demands.

Following a review of the relevant literature in Chapter Six, Chapter Seven describes an experiment which further examined young children's risk taking behaviour in a motor task setting involving tasks which varied in their degree of attractiveness to the child.

**CHAPTER FIVE.**

***YOUNG CHILDREN'S  
COMPETENCE  
PERCEPTIONS.***



### **5.1.1. Introduction**

The experiment described in Chapter Four raised the question of how accurate young children's perceptions of their competence can be. Experiment four revealed that when material gain was used to increase children's awareness of the outcomes of their previous performance attempts, they effectively employed this information following performance attempts which resulted in failure to select levels of task difficulty which would ensure success. They did this by selecting easy task levels which did not present a challenge and therefore optimised their chances of obtaining material gain. Following performance attempts which resulted in success these children also elected to play on easy levels of the present task. It is suggested that this behaviour does not reflect an error of judgement on the part of these children. Rather, it indicates the complete opposite. The study described in Chapter Four presented children with a fixed payoff system so that the amount of reward received was fixed regardless of the difficulty level of the task on which a successful outcome was achieved. This behaviour, that is, a preference for easy tasks even when successful outcomes were indicated on more difficult levels, reflects the child's recognition of the competence required for successful completion of different levels of task difficulty. These children appeared to understand that it was a waste of their effort and resources to attempt difficult levels of the task as these levels require greater competence to achieve success than easier levels but only offer the same levels of reward as these easier levels. They therefore attempted easier levels of the task in order that they might maximise their amount of material gain. As is suggested by their behaviour, these children appear to understand the level of competence required to achieve success on different levels of task difficulty. It is likely that if they possess this knowledge they also possess fairly accurate knowledge about their own competence levels in relation to level of task difficulty. The preference demonstrated for easy tasks was presumably attributable to the children's inclination to gain as much reward as they possibly could. However, this result contradicts the findings of previous research (to be discussed in due course) which indicate that very young children tend to overestimate their own ability level and select tasks which are inappropriately high for this level. The following discussion will demonstrate that children's beliefs can be determined through an investigation of their behaviour and anticipates that children's beliefs about their competence on a particular task can be inferred from an assessment of their behaviour on this task. It appears that a material incentive serves to make young children's perceptions of their competence more realistic, revealing them to be less exaggerated than previous research (for example, Harter & Pike, 1984) would indicate. As a result of this,

Chapter Five considers research which has investigated the accuracy of young children's competence perceptions. Suggestions are provided why exaggerated competence perceptions have dominated research findings in the past and how accurate perceptions of competence can possibly be obtained from young children.

### **5.2.1. Young children's exaggerated competence perceptions**

A number of studies have revealed that very young children verbalise and thus are presumed to possess high and exaggerated perceptions of their own competence, for example, Stipek (1981) and Harter & Pike (1984). In other words, these children's beliefs about their competence are overestimations of their actual competence level. The majority of research has focused on children's perceptions of their competence in the academic domain, and, research which has examined these perceptions in the physical domain has produced compatible results. Some examples of relevant studies are provided below.

In the course of an investigation into the self-evaluations and inter group attitudes of children aged between three and nine, Yee & Brown (1992) discovered that five year old children's self-evaluations were particularly positive in comparison with those made by other age groups. Similarly, their levels of self-regard were found to demonstrate this positive bias. Stipek & Hoffman (1980) asked children to estimate both their own chances of success on a specific task and those of another child. Although their expectations for the other child's success reflected this child's previous levels of success, they nevertheless overestimated their own chances of succeeding. Even at seven years of age, children have been shown to persist in overestimating their academic self attainment (Tizard, Blatchford, Burke, Farquhar & Plewis, 1988). In the physical domain, young children demonstrate overestimates of the extent of their physical toughness (Freedman, 1975) and their running ability (Morris & Nemcek, 1982). Furthermore, Ruble, Boggiano, Feldman & Loebel (1980) revealed that even when feedback related to performance on a basketball shooting task was manipulated to indicate low levels of success, kindergarteners' self-ratings of ability were higher than those of second and fourth graders and were not related to the performance feedback which they received.

### **5.2.2. Explanations for exaggerated competence perceptions**

Previous research has approached this issue from two perspectives. The first of these examines influences within the child's external environment and the second, those factors which are related to the child's internal environment.

A great deal of attention has been directed towards the feedback which young children receive, proposing that their interpretation and the nature of this feedback create an overestimation of self perceived competence. Blumenfeld, Wessels, Pintrich & Meece (1981) claim that children receive more positive feedback and less negative feedback in the early school years than in later grades. Frey & Ruble (1985) also state that in the early grades, children are not encouraged to compare their own success levels with others' in order to assess their progress and achievement. Blumenfeld et al (1982) further state that the feedback generally given to young children refers to neatness, adherence to rules, and, improvement, rather than normative comparison. This sentiment is echoed by Stipek (1981) and Stipek & Tannatt (1984) who claim that early self-appraisals tend to focus more on social reinforcement and encouragement than objective feedback. They also suggest that, before five years of age, competence judgements are based on task mastery criteria, for example, task completion, or feedback from significant adults. It appears that the feedback which young children receive, with its focus on improvement and task completion and its more positive content in comparison with that received by older children, could contribute towards their exaggerated competence perceptions. Not only is the nature of this feedback likely to effect exaggerated competence perceptions, but also the child's own treatment of this feedback is likely to influence these judgements. Stipek & Tannatt (1984) suggest that young children may ignore feedback which indicates personal incompetence. This statement is supported by Harter & Pike's (1984) finding that young children's competence perceptions remain high, irrespective of the outcomes of previous mastery attempts (see also, Ruble et al, 1980) and that by disregarding failure information, young children can maintain their overestimated perceptions of their personal competence.

When social comparison information is presented to young children, they do not necessarily use it for the same purpose as do older individuals. Ruble et al (1980)

demonstrated that until the fourth grade, young children's self-evaluations are relatively unaffected by such information. However, more recently, Butler (1990) has suggested that young children do make use of social comparison information. They do not use it to assess their ability but to confirm their already high perceptions of their own ability, to assess the needs of the task, and to improve their own task mastery. Used in this way, it is apparent that social comparison information can consistently be employed to infer high personal ability, regardless of whether this information indicates relative competence or incompetence.

The child's beliefs about effort and ability are regarded as influential determinants of the exaggerated perceptions of competence which have been exhibited by young children. The extent to which these perceptions are influenced by the belief that effort is a determinant of ability, or that it is ability, as discussed in Chapter One, is yet to be revealed (Heckhausen, 1982). Nicholls (1989) suggests that the young child's inability to perceive ability as a capacity and to differentiate between "cannot" from "not trying" as causal explanations for outcomes (Nicholls, 1978) results in the maintenance of their exaggerated competence perceptions, and places success under the control of the individual. As a result of their understanding of effort and ability, Stipek & Daniels (1988) claim that, regardless of their actual competence level, all children experience opportunities to receive positive feedback.

It was proposed in Chapters One and Three that individuals may interpret the same construct in different ways. Stipek & Tannatt (1984) discuss this issue in relation to how young children interpret the construct of "smartness". Unlike the adult's understanding of "smartness", they revealed that young children believe that smartness is an entity which is largely determined by the individual. In this study, kindergarteners were asked to provide explanations for their own stated levels of smartness. These explanations inferred their belief that anyone can be smart if they so desire. Such a belief would no doubt facilitate overestimations of personal competence level in relation to actual ability. Therefore, as Piaget (1930) suggests, young children appear to believe their desire to be, and perception of being, smart as sufficient justification for their smartness. This phenomenon has been referred to as the "wishful thinking hypothesis" which is based on an

approach employed in some areas of social psychology. This approach proposes that an individual's desires intrude upon their cognitive judgements. Subsequently, judgements of competence reflect the individual's desire to be competent rather than their actual success expectancies. Stipek et al (1984) demonstrated that wishful thinking was in operation when young children made judgements concerning expected levels of their own and another's success. They asked 60 four year old children to decide how they expected both themselves and another child to perform on the same physical task. The children were offered a reward if the other child about whom they were making such judgements performed well on the task. Contrary to findings from situations where such an incentive is not offered on the basis of another's success, subjects' expectations for this other child's success were raised to closely approximate their expectations for their own success level. It is apparent that their desire for the other child to succeed in order that they themselves might receive reinforcement intruded upon their judgement about the level of success which they expected this child to achieve. As Stipek et al (1984) suggest, this study provides evidence that young children do not differentiate between their desires and their expectations. That is, they expect to achieve what they desire to achieve. Therefore the young child's inability to differentiate between their expectations and their desires could provide another factor which contributes towards their exaggerated perceptions of personal competence.

Butler (1990) proposed that the wishful thinking hypothesis could be employed to explain findings from her study which compared the accuracy of young children's competence perceptions in competitive and mastery oriented contexts. She revealed that five year olds who performed a task in a competitive environment possessed exaggerated perceptions of their own competence. Five year olds who performed this task in a mastery oriented environment did not however display similarly exaggerated perceptions of their competence on this task (the characteristics of these two types of environment will be explained more fully in the following section). She suggests that the child's desire to succeed may have been greater in the competitive than in the mastery oriented environment. Therefore this increased desire was likely to have affected the children's beliefs about their competence on the task. Furthermore, because the children in the competitive condition wanted to win it is possible that they perceived their effort input to be high (Butler, 1990). At this age, the child's beliefs about effort and

ability (according to Nicholls, 1978) would allow them to infer high personal competence from their high perceived effort expenditure.

Stipek & Hoffman (1980) found that kindergarten and first graders' ratings of their own ability were not related to peers' and teachers' ratings of the child's ability and were overexaggerates of their actual competence levels. Ratings from significant others of an individual's competence level provide a fairly accurate estimate of this individual's actual competence level (Linford & Fazey, unpublished). Stipek & Hoffman (1980) attributed this finding to a combination of internal and external factors. They suggest that these overestimated perceptions of competence are influenced by the young child's belief that effort expenditure, task completion, and ability to follow directions are indicators of personal ability level. Stipek & Hoffman (1980) also proposed that young children engage in critically assessing their peers' work before they examine their own work from a critical perspective. Whilst young children base their perceptions of their peers' ability on the feedback they see these children receive in the classroom, they base their perceptions of their own ability on their belief, deriving from their egocentric sense of self, that they possess all encompassing powers. Consequently, Stipek & Hoffman (1980) claim that combined, these factors could lead to the exaggerated perceptions of their own competence demonstrated by these young children.

### **5.3.1. Research and discussions suggesting that young children can accurately assess their own competence**

In the previous section, statements by Nicholls (1978; 1989) were considered which suggested that young children's inability to perceive ability as a capacity and to distinguish effort from ability allow them to maintain their exaggerated competence perceptions. However, findings from the present research, presented in Chapter Two, indicate that young children may see effort and ability as distinct concepts, at least where academic ability is concerned. If this is the case, then it appears that young children's beliefs about effort and ability may not limit their capacity to make accurate self-evaluative judgements. Butler (1990) suggests that young children are capable of accurately assessing their competence as they do not select, or persist at, tasks which are beyond their ability level. Moreover, that young children must possess accurate beliefs about their physical competence

otherwise school playgrounds would be overrun with casualties as a result of children attempting physical feats which they have little or no chance of performing successfully. Similarly, Nicholls (1984) claims that if young children did not possess accurate estimates of their own ability, they would never be able to improve their personal task mastery.

Although a large body of research has indicated that young children commonly possess exaggerated perceptions of their own competence level, another body of research exists which questions the validity of this finding. For example, Stipek & Tannatt (1984) revealed that from kindergarten to third grade, children's perceptions of their academic standing in the class were significantly related to their teachers' rating of their standing. Therefore these children's assessments of their academic standing were accurate in relation to a reliable measure of their actual ability. Similar results were found by Crocker & Cheeseman (1988) who examined the self-assessments of children between five and seven years of age.

Other research findings, for example, Stipek & Hoffman (1980) have demonstrated that pre-schoolers can accurately predict success levels but do not employ this reasoning when making judgements about their expectations for their own success. They revealed that children at this age used performance information gained from observing the previous performances of other children to adjust their expectations for this child's success, but not to make similar predictions about their own success. As Nicholls & Miller (1984) suggest, it appears that young children display self-enhancing tendencies. That is, they possess the capacity to accurately assess competence but do not apply this knowledge when it is in their interests not to, for example, when assessing their own competence. Therefore, although children display less mature reasoning when judging their own competence than when making similar judgements about others, this is most probably a result of their self-enhancing tendencies rather than inadequate cognitions required for this process. This hypothesis is supported by research which has investigated moral reasoning. Keasey (1977) found that young children's reasoning about their own morals was more advanced than their reasoning about hypothetical others'. A number of researchers have demonstrated that under certain circumstances young children's competence perceptions are

more accurate than generally presumed. This research examines the accuracy of young children's competence perceptions when: past failures are made salient (for example, Stipek et al, 1984); objective task difficulty is emphasised (for example, Schneider, 1984); the environment stresses normative evaluation (for example, Stipek & Daniels, 1988); children perform tasks in mastery oriented environments (for example, Butler, 1990), and, children are asked to provide active, rather than verbal, indications of their perceived competence (for example, Majeres & Timmer, 1981).

Stipek et al (1984) manipulated children's performance levels and emphasised the children's experimentally induced failures. As a result, children's expectations for their own success decreased as they now based their own success predictions on performance information rather than their desire for success. Schneider (1984) also demonstrated that children's exaggerated expectations for their own success were lowered when the objective difficulty of the task was made salient. Ordinarily therefore it appears that young children ignore past failure information and objective task difficulty which helps them to maintain their exaggerated expectations for success.

The influence of the environment on perceptions of competence was examined by Stipek & Daniels (1988). They measured levels of academic perceived competence in four groups of children including two kindergarten classes and two fourth grade classes. In one class from each grade an emphasis was placed on normative evaluation whilst this emphasis was not evident in the remaining two classes. Level of perceived competence was found to be related to saliency of normative evaluation in the classroom environment for the kindergarteners but not the fourth graders. Kindergarten children in the class where normative evaluation was made salient rated their competence lower than kindergarten children in the class where normative evaluation was not made salient. Moreover, in the former of these kindergarten classes, competence ratings were no higher than those made by fourth graders. Environments which place an emphasis on normative evaluation which would not normally be observed seem therefore to stimulate young children to make accurate assessments of their competence.



Environmental influences were also the subject of an investigation carried out by Butler (1990). Children aged either five, seven or ten years performed a task in either a task mastery oriented environment or a competitive environment. The task in both environments was to produce a flower made out of stickers based on a standard which the children were required to copy. In the task mastery oriented environment, the children were encouraged to produce a drawing which matched the standard demonstrated as closely as possible. However, in the competitive environment, they were encouraged to try and produce the best drawing in their immediate group. Butler (1990) then asked the children to judge their own copy and found that five year olds' competence perceptions in the task mastery condition were more realistic than those of five year olds in the competitive condition. These competence perceptions were not only realistic but were as accurate as the competence perceptions of the seven and ten year old children who performed the task in the mastery condition. Asking young children to assess their competence perceptions in a mastery oriented environment seems to result in accurate perceptions of competence. As was previously mentioned, the exaggerated competence perceptions found in the competitive condition were most likely associated with the child's beliefs about effort and ability and their inability to differentiate between their desires and their expectations for personal success.

At first reading it appears that the findings of Stipek & Daniels (1988) and Butler (1990) are in direct opposition, although both studies did demonstrate that in some situations young children are able to provide accurate assessments of their own competence. However, further consideration of these two sets of results reveals that, although they are not directly comparable, neither are they directly conflicting. Butler (1990) found that young children's competence perceptions were more realistic when these judgements were made in a mastery oriented environment than when they were made in a competitive environment. Stipek & Daniels (1988) discovered that kindergarteners whose classroom environment emphasised normative evaluation provided more accurate perceptions of their competence than kindergarteners whose classroom environment did not demonstrate a similar emphasis. An initial assessment of these findings would presumably lead to the conclusion that application of Butler's (1990) results to Stipek & Daniels' (1988) study would result in more realistic competence perceptions in the environment which did not stress normative evaluation.

Conversely, applying Stipek & Daniels' (1988) results to Butler's (1990) study would reveal that children in the competitive environment would display the most realistic perceptions of their own competence. Obviously this was not the case and such conclusions are not warranted, as important distinctions can be made between the contexts investigated in these two studies.

A competitive context, as employed by Butler (1990), requires normative comparison but a normative context, as employed by Stipek & Daniels (1988), is not necessarily competitive. Butler (1990) emphasised competition by encouraging the children to produce the best copy of the standard within their group. This competitive emphasis required the children to make normative comparisons in relation to the other members within their group. Children in the classes which emphasised normative evaluation in the Stipek & Daniels (1988) study, although encouraged to assess their standing relative to peers, were not necessarily encouraged to compete with them. As does competition, normative evaluation provides opportunities to assess personal competence in comparison with that of others' but normative evaluation does not stress that performance should be superior to others' in the same way that competitive environments do. The differential emphasis placed on competition may have been the factor which resulted in differences in accuracy of competence perceptions between the two contexts discussed. It could be possible that an environment which stresses both competition and normative evaluation would result in accurate self assessment of competence by young children. Furthermore, although normative evaluation was encouraged in Butler's (1990) competitive condition she noted that the children did not use this information appropriately. As mentioned previously, they used this information to confirm their belief that their own drawing was the best, and not to assess the quality of their drawing. Butler (1990) cites an example of a girl who gave her drawing the maximum possible score, for which her explanation was that her flower had more petals than another child's. However, she failed to consider that, in comparison with the standard which the children were required to copy, her flower had too many petals. The main emphasis of this condition was winning. This emphasis appears to have stimulated children's self-enhancing tendencies as a result of their desire to win. It seems then, that competition stimulates wishful thinking and the exaggeration of personal competence in these children rather than the accurate assessment of personal competence. Therefore, although normative evaluation was encouraged in Butler's (1990) competitive

condition, wishful thinking demonstrated a more powerful influence on children's perceptions of competence. As a result, the exaggerated competence perceptions demonstrated by children in Butler's (1990) competitive condition are not unexpected, nor are the more accurate perceptions of competence found in the classroom which emphasises normative evaluation in the Stipek & Daniels (1988) study.

Majeres & Timmer (1981) used a behavioural measure to assess young children's perceptions of their physical competence and revealed that even children as young as two could accurately assess their own competence level. Sixty children aged between two and four years were presented with video sequences of physical tasks. Each sequence included tasks which were appropriate for children who have achieved different levels of motor competence. Therefore the children observed models performing tasks which reflected a range of developmental levels. The children were asked to imitate one task from each sequence which they wanted to perform, and which they believed they were capable of performing. Children's perceptions of their competence were indicated by the developmental level of the skill which they chose to perform. Actual competence level was measured by administering the gross motor section of the Denver Developmental Screening Test. By comparing these two measures, the authors were able to determine the accuracy of the children's perceptions of competence. A preference for novel or vigorous tasks was demonstrated, however, Majeres & Timmer (1981) claimed that if such tasks are not offered for imitation, children will choose to perform tasks which are at, or just above, their own developmental level of motor competence. Although this study did not provide conclusive evidence in support of young children's ability to accurately assess their own competence, the results did suggest that the more competent children selected more advanced tasks whilst the less competent children were unlikely to imitate tasks which were above their level of motor development. Majeres & Timmer (1981) suggest that the children's task selections were not based on an assessment of relative task difficulty in relation to their level of task mastery. Instead, these judgements resulted from their recognition of similarities in the modelled activity to their own, as yet, incomplete schema for that activity, as Parton (1976) proposes. This study provides some indication that when young children are required to actively demonstrate their competence, unlike when verbal assessment

procedures are employed, they do display accurate assessments of their own competence.

Fazey & Evans (1994) demonstrated similar levels of accuracy of perceived physical competence in children aged between 3 and 5 years. The children and their mothers watched a videotaped model perform four potentially dangerous tasks at each of three difficulty levels. Both the child and their mother stated the difficulty level which they believed the child could achieve and then the child was asked to demonstrate this level of competence. On two of the tasks, both the mothers and their children provided accurate perceptions of the child's competence. However, on the remaining tasks, the mothers underestimated the child's competence whilst the children overestimated their competence. Fazey & Evans (1994) concluded that by presenting the children with potentially dangerous tasks and therefore increasing the saliency of the child's outcome on this task, accurate perceptions of competence were mediated on some, but not all of the tasks involved. However, the children's behaviour indicated that they possessed an understanding of their mastery level on the tasks with which they were presented.

#### **5.4.1. Methodological concerns when measuring perceptions of competence**

Having considered conflicting evidence concerning the accuracy of young children's competence perceptions, a possible explanation for these conflicting findings is now examined.

The child's cognitive limitations are offered as a possible explanation for attempts to measure elements of self-worth in young children which have been unsuccessful (Harter, 1990). Other research has demonstrated that young children do possess the cognitive capacity to accurately assess competence (for example, Stipek & Hoffman, 1980; Stipek et al, 1984) but, as a result of their self-enhancing tendencies (Nicholls & Miller, 1984) young children do not choose to accurately report their own competence. Cognitive limitation does not appear to be a satisfactory explanation for the lack of success in assessing young children's self-worth using self-report measures.

As discussed in the previous section, research has indicated that in some instances, for example, when children's performance outcomes are made salient, or when they assess their competence in mastery oriented environments, perceptions of competence are accurate. It appears that some commonly used assessment procedures and the contexts in which these are administered may elicit exaggerated competence perceptions from young children. If these perceptions were assessed under different circumstances, greater accuracy might be demonstrated. This issue is examined and suggestions follow concerning a possible method of obtaining accurate competence perceptions from young children.

Marsh et al (1984) cite a number of researchers (for example, Wylie, 1979; Burns, 1979) who have criticised the quality of instruments which are employed to measure individuals' perceptions of their competence. Since these criticisms were made, new measures have been devised (for example, the Pictorial Scale of Perceived Competence and Acceptance for Young Children (PSPC), Harter & Pike, 1984). As the following discussion will make apparent, even these measures do not appear to be completely foolproof. Marsh et al (1984) propose that the exaggerated competence perceptions revealed by some studies are an artefact of the instruments employed rather than a reflection of the young child's actual beliefs. They suggest that some measures may be assessing the child's cognitive ability rather than their perceived competence or related constructs. For example, they found a tendency, which increased with decreasing age, for children to provide inappropriate responses to negatively worded items on the Self Description Questionnaire (see for example, Marsh, Parker & Smith, 1983). Rather than these items measuring aspects of self-concept (a higher order construct related to perceived competence), they appear to measure the child's cognitive ability to respond appropriately to them. According to Marsh et al (1984) a measure employed by Bridgeman & Shipman (1978) to assess young children's self-esteem levels (which again, is a higher order construct related to perceived competence, see Chapter One), demonstrated a similar function. Bridgeman & Shipman (1978) examined self-esteem levels in a group of children aged between three and a half and nine and a half years. The highest levels of self-esteem were found in children between three and a half and seven and a half years of age. However, Marsh et al (1984) found little correlation between the two different measures employed with the older and the younger children. This latter

measure demonstrated a higher correlation with academic ability, as measured in later grades, than with self-concept. Therefore support was provided for Marsh et al's (1984) claim that this measure was assessing the child's cognitive ability and not their self-concept.

Often, individuals interpret and perceive the implications of the same construct in different ways, as discussed in Chapter One. Blatchford (1992) considers this issue in relation to its possible effects on the accuracy of young children's competence perceptions. He cites Stipek's (1981) study where children were asked to rate themselves along a continuum which ranged from the "smartest person in the class" to the "dumbest person in the class". As Blatchford (1992) points out, the connotations of such labels are likely to lead children towards the more desirable of these two constructs, "smartest person in the class". As a result, children are more likely to appear to overestimate their perceptions of competence than to possess accurate or under estimates of this construct when such labels are employed. Stipek & Tannatt (1984) state that individuals at different developmental levels define words such as "smart" differently from each other. For example, when a pre-schooler declares that they are smart they are likely to be referring to the fact that they are well-behaved, whereas an adult will refer to this construct in terms of an innate capacity (see experiments two and three which support this argument). When assessing children's competence perceptions, their definitions of the constructs involved must be carefully considered and not assumed to be the same as those of an adult experimenter. This issue was addressed initially in Chapter Two. Different interpretations of the same constructs by individuals at different developmental levels present the researcher with an inherent problem when assessing the young child's beliefs about ability. When the adult examines statements obtained from young children they interpret these statements from their adult perspective. In relation to ability, they evaluate the child's verbalisations from the perspective of an individual who perceives ability as an inherent, limited capacity. When children provide statements such as "He scored more because he's bigger" then the adult is not likely to interpret this as ability-related although it is feasible that the meaning of ability to this child is "size". The interpretation of children's statements from an adult perspective may result in findings which do not fully explain the child's beliefs about this construct. Although not an insurmountable problem, this does

present inherent difficulties when adults attempt to assess young children's beliefs about constructs when these beliefs differ so greatly from their own.

Most studies employ verbal measures to assess young children's competence perceptions. One such measure which is widely used is the PSPC (Harter & Pike, 1984). This instrument is presented in a structured alternative format which is designed to offset children's tendency to produce positively biased and socially desirable responses. Rather than asking children to state how well they can perform certain tasks, children are shown pictures of two models performing the same task. One of these models demonstrates greater task competence than the other. The children are then asked which model they are most like and to what extent. Harter & Pike (1984) believe that this format conveys to children that it is acceptable to be like either child, and indeed, have produced empirical evidence to support their claims. The self-enhancing tendencies of young children have been made wholly apparent, however, (for example, Nicholls & Miller, 1984) and the likelihood remains that even when presented with a structured alternative format, these tendencies will direct them towards identifying with the most competent child, and subsequently to providing overestimates of their competence level.

Children's competence perceptions were examined in a naturalistic setting by Frey & Ruble (1987) and although they revealed exaggerated estimates of competence, their introductory discussion raises important methodological considerations. Studies which assess academic perceived competence typically employ interview based methodologies which effectively reduce the generality of the findings to the child's actual behaviour (Frey & Ruble, 1987). They further claim that children's careful consideration of interview questions may initiate a train of thought which is not typical and which may stimulate responses which the child would not normally provide. According to Korthals (1994) however, interviews do elicit the individual's preferred type of reasoning, yet, as demonstrated in previous discussion, interview contexts present interpretational problems. For instance, the interviewee and interviewer must possess similar perceptions of whether or not the class of reasoning exhibited by the interviewee is valid. Their perceptions of what constitutes a valid mode of reasoning may not be compatible as a result of developmental differences in construct interpretation. Moreover, in relation to an

issue which was mentioned previously, interviews may rely to a great extent on the child's understanding and interpretations of questions asked, and these may differ from the adult interviewer's. Frey & Ruble (1987) suggest that measures of children's behaviour on a specific task may reduce the problems encountered when verbalisations prove incongruent with actual behaviour. However, they do warn that observing behaviour on a specific task to infer perceived competence results in findings which have limited generality to other tasks within the domain under investigation. O'Sullivan (1993) has discussed the efficacy of employing behavioural indices to measure children's beliefs and cognitive processes. She discusses research which has investigated aspects of children's metamemory in which children's:

...beliefs are inferred from their behaviour. (p. 398)

This approach is adopted by the present research to assess young children's perceptions of their competence on the task in which they are currently engaged. Rather than employing verbal self-report measures, which are commonly used, the children's perceptions of their competence were inferred, as O'Sullivan (1993) suggests, from their exhibited behaviour. O'Sullivan's (1993) comments provide further support for the hypothesis that an accurate assessment of children's perceptions of their competence can be acquired when these judgements are inferred from observed behaviour. Comments from authors such as Nicholls (1984) and Butler (1990) and research using measures other than verbal self-reports (for example, Majeres & Timmer, 1981) indicate that young children do possess some understanding of their own level of capability. It seems that employing verbal self-report measures, which reflect adult terminology and an adult conceptualisation of ability, does not present the young child with an adequate opportunity to make valid judgements about this construct. Asking children to behaviourally indicate their perceptions of competence therefore removes the problems associated with their verbalisation and conceptualisation of this construct in adult-like terms.

The present chapter has so far presented both empirical evidence which indicates that young children can accurately assess their competence and methodological factors which possibly induce exaggerated competence perceptions from young children. It seems that, contrary to the assumptions of previous research, young children's exaggerated competence perceptions may not reflect limitations of their



cognitive ability to make accurate competence assessments but may reflect limitations of the instruments commonly employed to measure this construct. For instance, previous research by Stipek et al (1984) has revealed that when children are asked to predict the outcomes of other children's performance attempts, they consider this child's previous successes and failures when making such judgements. It appears that these young children are capable of using past experience to form accurate assessments of competence in others even when they did not do so when reporting their own competence. Lack of realism in reporting their own competence has been attributed to the wishful thinking hypothesis, whereby young children's expectations are determined by their desires. Previous research has indicated that for accurate competence assessments to be obtained from young children, the context in which this construct is assessed should incorporate one or more of the following elements: increased saliency of previous performance attempts or objective task difficulty (Stipek et al, 1984; Fazey & Evans, 1994); a task mastery oriented environment (Butler, 1990); a context in which it is in the interest of the child to make accurate assessments of their ability, and, a behavioural measure of perceived competence on a specific task (Majeres & Timmer, 1981; Frey & Ruble, 1987). Two of these studies investigated children's perceptions of their academic or cognitive competence (Butler, 1990; Frey & Ruble, 1987) whilst the remainder examined children's perceptions of their physical or motor competence.

The experiment which is described in Chapter Seven explored whether inclusion of a number of these factors in the testing environment would elicit accurate competence perceptions from young children. The factors which were included are as follows: increasing the saliency of objective task difficulty and outcomes of performance attempts; providing the child with an incentive to accurately judge their competence; inferring perceived competence from behaviour on a specific task. The most salient of these factors are: the behavioural index, which, it is expected, will elicit more accurate perceptions of competence from the children than are normally obtained when verbal self-report measures are employed; and the presence of an incentive for children to accurately assess their own competence. The rationale behind this hypothesis includes issues such as developmental differences in construct interpretation, which were discussed earlier in this chapter and in Chapter Two. The task which was used in the present experiment is the computer game which was used in experiment four but without

any manipulated performance information. Two groups of young children were employed, one which was offered a reward for successful performances and one which was not offered a reward. The amount of reward available increased in parallel with increases in task difficulty, therefore a variable payoff system was in operation. The children were required to reach a standard of performance on the level attempted, which did not vary between levels, to enable them to receive the reward appropriate for that level. For instance, if the required standard of performance was reached on level one, the child received one smartie, on level two, two smarties, and so on until level nine where they received nine smarties. Actual competence was indicated by the child's baseline level which was assessed using the method employed in experiment four. Children's perceived competence on the game was inferred from their level choice on their final trial. Comparison of these two measures (actual and perceived competence) indicated the accuracy of the children's perceived competence.

It was anticipated that the conditions imposed in the reward group would elicit more accurate competence perceptions than were found in the non reward group. That is, their final level choices would demonstrate less deviation from baseline levels than the choices made by children in the non reward group. This result was anticipated because the variable payoff system administered was designed to increase the saliency of the difficulty of each level, as a higher reward will indicate that greater skill is required to achieve this reward. It was expected that this system would encourage children to make accurate, rather than inaccurate, assessments of their competence. In order to maximise the level of reward they receive the children had to select a difficulty level which was appropriate for their own level of competence. By choosing a level which is too difficult, the children are limiting their chances of success whilst choosing a level which is too easy means that they are losing out on the amount of reward they could achieve. To choose a level which is appropriate for their own competence would both maximise their chances of success and minimise their chances of failure, resulting in the gain of the optimum amount of reward available. Furthermore, measuring behaviour on a specific task overcomes the problems inherent in verbal measures, such as: differing construct interpretations by the experimenter and child; their reliance on cognitive developmental level, and, the likelihood that unnatural responses may be elicited by verbal questioning. It was hypothesised that in a comparison group which was not offered similar rewards for successful task

performance, children's behavioural indications of their competence would not exhibit the same degree of accuracy.

**CHAPTER SIX.**

***YOUNG CHILDREN'S  
RISK TAKING  
BEHAVIOUR.***

### **6.1.1. Introduction**

Findings from the final experiment reported in Chapter Four provided some indication of young children's challenging, or risk taking, behaviour on a physical task. Although increasing outcome saliency heightened children's awareness of their previous performance outcomes, demonstrated by changes in their behaviour in comparison with the behaviour exhibited when previous performance outcomes were not made salient, the pattern of behaviour they displayed in response to performance information which was manipulated to suggest enhanced levels of success was somewhat unexpected. When offered a reward for successful task performance, even when these children were presented with high levels of success, they appeared unwilling to risk losing this reward by attempting tasks which would challenge them. This behaviour was in direct opposition to that exhibited when rewards were not offered. The present finding could be attributed to the fact that the children were offered a fixed payoff system which provided the same level of reward regardless of the difficulty of the task attempted. As Heckhausen (1984) suggests, it appears that the children selected easy tasks to ensure success, as success on more difficult tasks was not sufficiently attractive (in terms of potential reward) to result in their selection. This also suggests that children possess a far more sophisticated understanding of the relationships between task difficulty, motivation and competence than has been proposed previously.

These findings reflect those of research which has investigated intrinsic and extrinsic factors in achievement motivation. Previous research has indicated that young children possess an innate desire to challenge themselves and improve upon their present level of mastery. For instance, Harter & Connell (1984) suggest that children have a desire to acquire feelings of competence and derive intrinsic pleasure and joy from mastery attempts which have resulted in success. Deci (1975) claims that individuals are motivated to feel personally competent which engenders the search for challenge to assess personal ability and increase this level of capability. Watson (1976), in a study of Little League baseball players, discovered that the children played baseball for the sake of the game and the enjoyment they derived from it rather than any adult rewards which were offered. However, when extrinsic rewards are offered, although they may increase short term learning and performance, they are likely to have a detrimental influence on long term interest in sporting activities (Singer & Gerson, 1980). It seems that

when young children are not offered rewards for performance or participation, they demonstrate a natural desire to succeed at the activity and attain success on challenging levels of that activity. It appears that extrinsic reward decreases the desire to meet challenges as the attainment of the reward becomes more motivating than the activity itself. The behaviour displayed by the children in experiment four supports these findings. The young child's natural desire to attempt challenging tasks seemed to be dampened by the presence of the fixed payoff reward system which was offered to them. It is possible however, that if young children were offered variable payoffs where the amount of reward available increases in proportion to increase in the level of task difficulty, their behaviour would differ from that revealed in experiment four. By observing children's behaviour when they are offered variable payoffs as rewards for successful performances on a physical task, various issues can be examined: the levels of personal challenge which young children prefer to choose; their understanding of the success-incentive function, which is described more fully later on in this chapter, and their knowledge about the relationship between task difficulty level, the competence required for successful task completion and the level of their own competence. Further support is also expected for suggestions made in Chapter Four that young children can employ information about their previous performance attempts to make decisions about their future behaviour. In Chapter Six an examination of research into risk taking behaviour is reported, discussed first from the perspective of achievement motivation theory. Following this general overview of the theoretical basis of risk taking, the discussion then focuses on empirical investigations into risk taking behaviour. Of particular interest is the literature relating to children's risk taking behaviour when they are offered variable payoff systems. Research which examines the effects of this type of reward system on children's risk taking behaviour when performing physical tasks appears to be relatively scarce with most of the empirical work cited concentrating on children's risk taking behaviour when they are asked to perform academic tasks. The theoretical proposals and empirical findings presented in this chapter are then employed to formulate hypotheses about young children's risk taking behaviour on a motor task when they are offered variable payoffs for successful task performance.

### **6.2.1. Theoretical approaches to risk taking behaviour**

The phenomenon of risk taking has been approached from a number of perspectives, for instance, the cognitive perspective, which describes risk taking as a conscious decision to engage in an action. The individual's resultant desire to perform this action is based on a mental calculation of the value and probability of achieving the outcome of the action (Streufert, 1986). Eysenck & Eysenck (1977) view risk taking as a phenomenon which is generated by impulsivity and Zuckerman (1979), by sensation seeking. More pertinent to the present discussion is the motivational approach to risk taking which mainly considers adults' risk taking behaviour (for example, Atkinson, 1957). Atkinson (1957) defines two problems concerned with behaviour which achievement motivation theories must address. The first is to ascertain how an individual arrives at their particular task choice from a number of alternative courses of action. Once the individual has selected a particular course of action, achievement motivation theories must provide an explanation for the intensity with which the action is performed and the individual's demonstrated task persistence. Heckhausen (1984) sees the expectancy-value theory, which approaches these two problems of behaviour, as the fundamental basis of the risk taking model. The first of these problems is encountered in risk taking contexts, which present the individual with a task choice from a number of task alternatives representing a range of difficulty levels. Heckhausen & Schulz (1993), when discussing adults' risk taking behaviour, claim that for development to occur, individuals must select novel tasks or behaviours which present them with an intermediate level of task difficulty. This recommendation is made by other authors such as Atkinson (1957) and is discussed further in this section. Tasks of medium difficulty optimise learning and skill acquisition by providing the individual with the maximum amount of information pertinent to aid learning. The same level of information would not be available by performing easy or very difficult tasks which would effectively be a waste of the individual's time, effort and resources (Heckhausen & Schulz, 1993). Although intermediate tasks provide the individual with maximum opportunities for learning and skill development, these tasks also incur a 50% chance of failure with which the individual must deal. Majeres & Timmer (1981) provided some evidence that even pre-school children will tend to select tasks which are at, or just above, the level of development which they have currently achieved. This task selection presents the child with maximum opportunities to improve upon their current levels of mastery.

The adult risk taking model which Atkinson (1957) discusses presents three variables: expectancy; incentive, and, motive. Expectancy he defines as a cognitive anticipation that a particular consequence will result from following a particular course of action. Expectancy is most often based on the success or failure of previous performance attempts (Kelley, 1967), sometimes on different task properties, and only occasionally on social comparison information (Heckhausen, 1984). Incentive reflects the relative attractiveness of a goal, or the relative unattractiveness of a consequence which follows a particular action. Although incentives are often externally imposed material gains, incentive is also defined by intrinsic task properties, such as task difficulty, and the individual's own affective reactions to task success or failure. For instance, Heckhausen (1984) describes the incentive value of a task as the emotional reaction to success or failure which is anticipated by the individual. Motive is described by Atkinson (1957) as an inclination towards gaining a particular type of satisfaction, through the achievement of a certain class of personal incentives. For example, for one individual satisfaction can be derived by attaining power, whereas for another, satisfaction is gained by achieving affiliation to a particular membership.

The two main assumptions of expectancy-value theory are concerned with the incentive value of success on a task and the task expectancy, that is, the probability of achieving a successful outcome on this task (Heckhausen, 1984). Its first assumption is that as the difficulty of the task increases, so does the incentive value of succeeding at that task. Secondly, that the individual's willingness to perform a task is a product of the incentive value and the expectancy value of this task. When the probability of success is low, for example, on a difficult task, incentive is high. Incentive is low however, on easy tasks, where the probability of success is high. Therefore an inverse relationship is apparent between the probability of succeeding on a task and the incentive value of success on this task. However, when the prospect of failure on a task is considered, there is evidence of a linear relationship between the probability of success and the humiliation which is experienced following failure on that task. For example, if there is a high probability that success can be attained but this success is not achieved, then the individual will experience a high degree of humiliation as a result of their task failure. Conversely, if the probability of achieving success on a task is low, very little humiliation is experienced if failure on this task follows. Therefore task



attractiveness demonstrates a positive relationship with task difficulty, whereas the unattractiveness of performance failure is a negative function of task difficulty (Escalona & Festinger, 1944).

Under circumstances which present external constraints on the individual to perform a task, adults will perform tasks at which their outcome is of greatest uncertainty and the probability of achieving success is 0.50. Although Atkinson (1957) discusses this behaviour mainly in relation to adults, he does cite research by McClelland (1958) which has provided evidence of these tendencies in kindergarten and third grade children. The individual's selection of tasks on which their probability of success is 0.50 represents a moderate risk and is believed to indicate their optimal level of challenge (Clifford & Chou, 1991). Clifford & Chou (1991) list a number of theories which advocate the performance and motivational advantages of moderate risk taking. For example, achievement motivation theory (Atkinson, 1957); attribution theory (Weiner, 1980), and, intrinsic motivation theory (Deci & Porac, 1978). The advantages of moderate risk taking include: maximising task satisfaction (Harter, 1978); increasing perceptions of competence (Deci & Porac, 1978); providing information about personal ability (Trope & Brickman, 1975), and, encouraging positive responses to errors and failure experiences (Kim & Clifford, 1988). Cognitive developmental psychologists also claim that maximum cognitive development is gained by attempting tasks which are congruent with, or just above, individual ability level (Clifford & Chou, 1991). When an individual engages in moderate risk taking, ability and task difficulty are approximately matched and the skills and knowledge required to achieve success are optimally employed by the individual. Therefore, by engaging in moderate risk taking, according to some cognitive developmental psychologists, maximum cognitive gain can be achieved.

By defining challenging goals, the individual raises their motivation and performance attainment levels (Mento, Steel & Karren, 1987). However, challenging goals will only be set when the individual sees ability as an acquirable skill, and not when it is viewed as relatively fixed and unchanging (Bandura, 1977). When individuals do set themselves challenging goals, disequilibrium results. As was discussed in Chapter Three, disequilibrium is viewed by a number

of theorists (for example, Fogel & Thelen, 1987: Self-organising Systems Theory) as a necessary factor for change to occur. In the present context, this disequilibrium could be seen as an opportunity for the individual to assess both personal ability and task difficulty. This assessment may be an indication of uncertainties raised about ability and task difficulty by this state of disequilibrium.

The assessment of personal ability is one of the main functions of risk taking, which can be predicted from a number of theories such as diagnostic and cognitive evaluation theory (Clifford & Chou, 1991). These authors further suggest that, considering this function of risk taking, these theories would support the proposal that higher levels of metacognitive skill will benefit the individual in risk taking contexts. Unsuccessful risk taking attempts can be mainly attributed to cognitive errors about task difficulty and ability (Streufert, Streufert & Denson, 1983). Streufert et al (1983) claim that when young children's risk taking efforts are unsuccessful, they can be partially explained by this cognitive error. Young children are more likely to make such risk taking errors as they have less experience of risk taking and less metacognitive skill or knowledge than older individuals. However, Clifford, Chou, Mao, Lan & Kuo (1990) suggest that the administration of item by item feedback can ameliorate the effect which limited metacognitive skill has on the success of children's risk taking attempts. This feedback regime will partially eliminate the influence of metacognitive skill on risk taking error as it provides the individual with immediate information about the degree of compatibility evident between the difficulty level of their task choice and their personal ability. Therefore in a context which offers item by item feedback, the child's behaviour is more likely to reflect their willingness to take risks rather than their misjudgements about task difficulty and personal ability (Clifford et al, 1990).

### **6.3.1. Risk taking and variable payoff systems**

Despite the theoretical attention which has been paid to the advantages of moderate risk taking, Clifford et al (1990) claim that the risk taking phenomenon has received relatively little empirical consideration, particularly in relation to academic tasks. A similar conclusion can be drawn concerning empirical investigations of young children's risk taking behaviour on physical or motor

tasks. One aspect of risk taking which Clifford and her colleagues have invested a great deal of effort into investigating is the effect of variable payoffs on children's academic risk taking. A variable payoff system is one in which the amount of reward offered increases in parallel with increasing task difficulty. Fixed payoffs on the other hand offer the same amount of reward regardless of the level of task difficulty on which success is achieved. Clifford (1988) noted that when fixed payoffs are offered, a developmental decrease in children's academic risk taking is observed. However, when children are offered variable payoffs for success on academic tasks, a developmental increase in risk taking is apparent (Clifford et al, 1990). When external constraints (such as pressure exerted on the individual by significant others to achieve) are removed, Clifford et al (1990) suggest that variable payoffs may serve to completely eliminate the developmental decrease in risk taking manifest when fixed payoff systems are employed.

The discussion now turns to the research evidence pertaining to risk taking in academic contexts which has been produced by Clifford and colleagues. In 1988, Clifford demonstrated that fourth, fifth and sixth graders, who were presumably anticipating a fixed payoff system, elected to perform items which were, on average, 6-18 months below their objectively measured achievement levels. In a later study (Clifford, Lan, Chou & Qi, 1989), third, fourth and fifth grade children who were offered variable payoffs selected tasks which were more or less congruent with their achievement levels, as defined by standardised test scores. Some evidence of a developmental increase in risk taking was observed, which Clifford et al (1989) attributed to the variable payoff system which was in operation. Clifford et al (1990) cite a number of theories which would support the proposal that under variable payoff conditions, an increase in risk taking will be exhibited. These include: diagnostic theory (Trope, 1975); cognitive evaluation theory (Deci & Porac, 1978), and, self-efficacy theory (Bandura, 1977). Clifford et al (1989) suggest that a simple explanation for this finding can be obtained from Meyer's (1973) information-maximisation principle. Meyer (1973) proposes that individuals can gain a maximum amount of information about their ability when they perform tasks on which their outcome is at its most uncertain. As variable payoff systems maximise the availability of information relevant to assessing personal ability, such payoff systems may induce an increase in risk taking by effecting the information-maximisation principle in subjects. Following this, Clifford et al (1990) went on to investigate academic risk taking in fourth, sixth

and eighth graders when a variable payoff system was offered to the children. Generally, results from this study were inconclusive. However, Clifford et al (1990) did reveal that subjects at all ages took more risks on the less familiar, spatial tasks they performed than on the quantitative tasks administered, with which they were more familiar. A further investigation which examined academic risk taking in only fourth grade students showed that, as was demonstrated in earlier studies, these children were unwilling to take moderate risks (Clifford & Chou, 1991).

It appears that, irrespective of the advantages of moderate risk taking which are described by various motivation theories, this behaviour is relatively rare. Risk taking behaviour did increase in the Clifford & Chou (1991) study, when children selected and performed tasks in a non evaluative, game playing context compared to when they performed tasks in a context which was going to be evaluated.

Not only do variable payoffs increase the individual's desire to increase their level of skill, they also result in increased metacognitive knowledge. As risk taking increases under such conditions, this implies that academic risk taking requires an application of metacognitive skill (Clifford et al, 1990). Under normal circumstances, it is presumed that children choose to perform tasks which they "know they know". However, when offered variable payoffs, children are encouraged to select tasks which they are capable of performing without any errors. In other words, under variable payoff systems, children demonstrate a tendency to perform at the highest level of risk possible which will not result in error. According to Clifford et al (1990), the variable payoff effect should be examined over a range of developmental levels, cultures and task types to explore the magnitude of its influence on risk taking behaviour.

#### **6.4.1. Young children's risk taking behaviour**

The previous discussion has mainly considered the risk taking behaviour of adults and older children, however, the following discussion focuses on this behaviour in very young children. Heckhausen (1984) states that risk taking contexts present

the individual with a dilemma. They have to decide whether to maximise success through the selection of very easy tasks or whether to maximise their incentive by electing to perform difficult tasks. As the risk taking model would predict, Heckhausen (1984) proposes that adults solve this dilemma by choosing tasks on which they have intermediate probabilities of success but that children employ different strategies to adults to maximise success depending on the context (task-choice or goal setting) in which they are asked to perform. Heckhausen (1984) does not discuss the risk taking behaviour of adults in relation to task choice and goal setting contexts. Previous research (for example, Atkinson, 1957) indicates that adults will select tasks of intermediate difficulty although their task selection depends more on whether the motive to succeed or to avoid failure is strongest in the individual.

In a task choice context, children are faced with a number of tasks which are ordered in degrees of difficulty, one of which the child must choose to perform. For example, Heckhausen (1984) describes one such task which he used in his own experiments. The children were presented with a number of elevators, the first with two levels, the second with three, the third with four, and so on. The children were required to push a cushion to raise a figure on the elevator as far up the elevator as they possibly could. Heckhausen (1984) manipulated the levels to which the figure could be moved by the child. On the easier tasks which had fewer levels, the figure could be elevated to the top level, whereas on the more difficult tasks which had more levels, the figure could only be elevated a certain distance up the elevator. Therefore, in task choice contexts, the child is presented with a number of discrete alternatives of the same task which differ in their level of difficulty. In repetition choice, which is a particular type of task choice context, the children perform the whole range of tasks and are then required to select the task which they want to perform next. In this repetition choice context, children focus on the probability of success or failure and the majority of pre-schoolers, who do not yet understand the success-incentive function, demonstrate a preference for easy tasks (Ruhland & Feld, 1977). The success-incentive function refers to the individual's anticipated emotional reaction to the success or failure of a performance attempt (Heckhausen, 1984) (see page 166). Knowledge of the relationship between success and incentive requires antecedent knowledge about related factors: an understanding that degrees of task difficulty exist; an appreciation of personal competence level; the realisation that outcome can be

attributed to personal competence; an understanding of the relationship between competence and outcome which is based on task difficulty; the generation of positively self-evaluated affect following success based on the knowledge that the outcome attempt was attributable to personal competence (Heckhausen, 1984). Ruhland & Feld's (1977) findings were replicated by Heckhausen (1984) with children aged between four and six years who did not yet understand the success-incentive function but had mastered the expectancy function. Expectancy refers to the probability of succeeding on a particular task and is based mainly on information about the relative success or failure of previous performance attempts (Kelley, 1967). Eighty percent of the children in Heckhausen's (1984) study initially performed easy tasks. They only selected difficult tasks when task features were salient. However, when both functions were understood (the success-incentive and expectancy functions), only between fifty and sixty percent of these children selected easy tasks. By the second trial of testing, the children who did not understand both functions persisted in their preference for easy tasks. On this trial, almost eighty percent of the children who did understand both of these functions also demonstrated a similar preference for easy tasks. Therefore an understanding of the success-incentive function creates higher levels of risk taking in young children. Following feedback which indicates failure, these children, like the less cognitively mature children (with respect to the success-incentive function) ensure success by engaging in low risk behaviour. Results from the experiment which examined young children's behaviour when the outcomes of their previous performance attempts were made salient to them and which is described in the previous chapter support these findings. The present study indicated that when young children were offered extrinsic rewards for achieving success which did not vary in relation to the difficulty level of the task attempted, they modified their behaviour and demonstrated a preference for easy tasks. This seems to suggest that these children understand that more difficult tasks require greater competence for their successful completion. The children also appeared to base their task choice on the possibility of receiving extrinsic reward rather than on achieving success on the most difficult task on which success was likely. The intrinsic reward of succeeding on difficult tasks seemed to be overshadowed by the children's desire to receive material gain.

In the other context in which risk taking is less commonly examined, the goal-setting context, a different pattern of behaviour is exhibited by young children. In

this context, task difficulty varies along a continuum and children are asked to select the difficulty level which they wish to attempt to achieve within this continuum. Heckhausen (1984) also presented children with the elevator task in a goal setting paradigm. In this context, the children were presented with only one elevator, comprising a number of different levels. The children were then asked to choose a level to aim for within this one elevator rather than choosing one elevator from a number on offer which explicitly represented different levels of difficulty. Under goal-setting circumstances, Heckhausen (1984) has demonstrated that children focus on the incentive value of success, unlike in task choice settings where they focus on the relative success or failure of previous performance attempts. He attributes this to the fact that the goal-setting context presents a continuum of task difficulty and discrete easier alternatives are not explicitly offered to the children. Subsequently they direct their attention to the most difficult level as this task provides the greatest incentive value of success. An alternative explanation is that young children are unable to judge task difficulty and ability correctly, as both children who did and did not understand the success-incentive function preferred to perform challenging tasks on their first trial of testing. It is possible that increased experience on the task then allows them to judge more accurately what level of difficulty is appropriate for their own level of ability, manifest in their more adult like risk taking behaviour as discussed below. In goal-setting contexts, children between the ages of four and six years initially chose difficult tasks which represented a high level of risk (Heckhausen, 1984). However, by the second trial, Heckhausen (1984) observed that fifty percent of the children demonstrated a preference for easier tasks, setting their targets below their attained level on the task. According to Heckhausen (1984), in goal-setting contexts, where children tend to focus on the incentive value of success, they solve the expectancy-incentive dilemma in a similar manner to adults, by selecting tasks on which they have an intermediate probability of success. In summary, Heckhausen (1984) proposes that in task choice contexts, pre-schoolers will initially select easy tasks whereas in goal-setting contexts they will initially select difficult tasks.

However, in a study by Fazey & Evans (1994) which presented pre-school children with real physical risk on four different gross motor tasks, the children elected to perform levels of task difficulty which were congruent with or above their mothers' assessments, or expectations, of their competence. On one of the

tasks the children did overestimate the level which they chose to perform and were unable to successfully complete this level of difficulty. In this context, the incentive to take risks appeared to be internalised as the children were not encouraged in any way to take risks. Results of this study indicate that when real physical risk is involved, pre-school children will tend to select levels of difficulty which offer them realistic levels of personal challenge. According to Heckhausen (1984), an understanding of the competence level required for successful task completion appears to be the mediating connection between expectancy and incentive values of success; in other words, the understanding that more difficult tasks require greater competence to produce a successful performance, and that such tasks present higher levels of success incentive. Higher success incentive results from the greater positive affect which is experienced on successful completion of difficult tasks compared with success on easier tasks. This positive affect presumably derives from the knowledge that high levels of competence were required to achieve success on difficult tasks and that this success can be attributed to personal ability. Harter (1985b) and Phillips (1984) have discussed how the accuracy with which children judge their own competence influences their preference for challenging tasks. Harter (1985b) has demonstrated that when children underestimate their own competence level, they prefer to participate in relatively easy tasks rather than those tasks which would present them with an intellectual challenge. Of greater concern is Phillips' (1984) finding that even when children's academic competence has been objectively assessed as high, those with low perceptions of their competence define lower achievement standards for themselves and possess low expectations for their own success. However, it is probable that overestimated perceptions of personal competence are equally dangerous. Individuals who overestimate their own competence are likely to select tasks which are beyond their level of achievement from which failure is likely to result.

Pre-schoolers do exhibit a developing tendency to base the incentive value of a task on their perception of the task's level of difficulty (Heckhausen, 1984). For instance, Heckhausen (1984) has demonstrated that these children experience more positive affect following success on difficult than on easy tasks. However, the understanding that failure incentive increases with decreasing task difficulty develops at a later date. Contrary to expectations, when this function is understood, Heckhausen (1984) found that the majority of six year olds displayed



greater negative affect following failure on difficult tasks than on easy ones. Valid judgements about the incentive value of a task require accurate assessments of task difficulty and personal competence by the individual as these two factors are determinants of both expectancy and successful task completion (Heckhausen, 1984). Heckhausen (1984) does claim however that young children are capable of defining personal goals which reflect the maximum product of incentive value and expectancy. This implies that, as the risk taking model would predict, young children can employ their knowledge to take moderate risks, just as older individuals would do. Further research is required to ascertain when an understanding of the success-incentive function first develops. As Heckhausen (1984, p. 29) states, this research should examine:

...at what age and under what conditions children co-ordinate expectancy and incentive to reliably arrive at a realistic risk taking....

Furthermore, that empirical investigation should explore whether the removal of a material incentive offered for successful task completion affects the pattern of risk taking behaviour revealed when such incentives are offered.

The level of children's success expectancies is the central focus of a phenomenon known as maximising which Kreidler & Zigler (1990) investigated in relation to children's risk taking behaviour. Examining children's maximising behaviour commonly involves presenting them with a task choice from three options which are offered. Selection of only one of these tasks results in intermittent reinforcement. Therefore sometimes when this option is chosen, the child receives reinforcement, yet at other times, selecting this task does not lead to reinforcement. If children are to receive the maximum amount of reinforcement available, it follows that they must always select the option which provides them with partial reinforcement. This strategy is referred to as maximising. A motivational approach, which focuses on the child's expectancy of success, has been adopted to explain this phenomenon. Success expectancies are related to the child's willingness to accept a relatively small payoff rather than attempting to gain a higher level of reinforcement. The motivational perspective would predict that children who have low success expectancies will be prepared to accept a smaller payoff and subsequently demonstrate more maximising behaviour than children whose expectancies of success are high. Empirical support for this proposal has been provided by Ollendick, Balla & Zigler (1971), who manipulated

the success and failure of children's performance attempts. When children experienced manipulated task failure, greater maximising behaviour was evident than when they experienced outcomes which had been manipulated to result in success. It can be presumed that previous success experiences raised the child's expectancy for future success and less maximising was demonstrated by these children as they were not willing to accept partial reinforcement. They therefore selected tasks other than the partially reinforced one, in an attempt to gain near maximum reinforcement. However, failure outcomes lowered children's success expectancies and resulted in a willingness to accept partial reinforcement, manifest by their greater tendency to opt for the task which provided only partial reinforcement.

It is apparent that maximising behaviour is an indication of both conservatism and low success expectancies. In accordance with this, Kreitler & Zigler (1990) hypothesised that, when the relationship between risk taking and expectancy of success is considered, risk taking is likely to demonstrate a negative relationship with maximising behaviour. They investigated this hypothesis with two groups of children, one aged between 5 and 6 years and one aged between 11 and 12 years. To assess their risk taking, the children performed a mirror-drawing task which involved drawing a line within the boundaries of a convoluted path. The children had to perform the task under three conditions, and each time they had to make a choice of whether to opt for task parameters which would make the task more difficult, resulting in greater reward, or to opt for the parameter which would make the task easier but offered less reward. The three conditions were as follows, the children had to choose between: drawing the line between the borders when they were 4 mm (difficult option) or 8 mm (easy option) apart; using a pen or a brush to draw the line, and, performing the task in an allotted time of either two or four minutes. Maximising was measured by asking the children to select one of three knobs in order to gain marbles as reinforcement. One of these knobs provided reinforcement two thirds of the time it was chosen whereas no reinforcement was provided whenever the child chose either of the remaining two knobs. Their results indicated that the older children took more risks than the younger age group. However, as Kreitler and Zigler (1990) predicted, for both age groups, risk taking was negatively related to maximising. They concluded that this result effectively demonstrated the relationship between risk taking and success expectancy. In short, the higher the child's success expectancy, the more

likely they were to take risks and subsequently engage in less maximising behaviour than children whose success expectancies were lower and were less willing to take risks.

Although research which investigates young children's risk taking behaviour on physical or motor tasks appears to be fairly scarce, to date, examinations of children's general risk taking have revealed that patterns of risk taking behaviour vary depending on the context in which they are assessed. When children are asked to select tasks in a goal-setting context, they initially opt for the most difficult task from the continuum presented, a choice which subsequently incurs a high risk of failure. However, when children are asked to choose from tasks which are presented in a task choice context, their behaviour displays a different pattern. The pattern of behaviour displayed by children in task choice contexts further depends on their understanding of the success-incentive function. Once this understanding has developed, children are aware that greater incentive is attached to success on difficult tasks than to success gained on easier tasks. Subsequently, children who understand this function initially select difficult tasks in the task choice situation, a choice which reflects high risk behaviour (Heckhausen, 1984). Following the receipt of failure information about this performance, on the second trial of testing, the majority of these children then select easier tasks which involve less risk and increased chances of success. Before an understanding of the success-incentive function has developed, children display a somewhat different pattern of risk taking behaviour in task choice contexts. They do not initially select difficult tasks but opt for easy tasks from the start, a preference which has been shown to endure throughout their choice of task on the second trial of testing (Heckhausen, 1984). It appears therefore that in a task choice setting, the pattern of risk taking behaviour exhibited by young children depends to a large extent on their understanding of the success-incentive function.

After presenting this research evidence, Heckhausen (1984) outlines two related issues which require further investigation. He states firstly that the conditions under which children combine the expectancy and success-incentive functions to reach a level of realistic risk taking behaviour should be determined. Secondly, that research should consider the effects on children's risk taking behaviour of

removing material incentives which are normally offered for successful performances. In the present experiment (described in the following chapter), one group of children was offered such an incentive whilst another group was not. This second group provided a comparison group which enabled children's risk taking behaviour to be assessed when they were offered no material incentive to succeed on the present task and provides information about children's risk taking behaviour when the incentive to succeed is intrinsic. The former issue which Heckhausen (1984) discusses was addressed in relation to children's risk taking behaviour when a variable payoff system was in operation in a task choice context. It was anticipated that under these conditions, young children would display a pattern of behaviour which indicated that they have successfully combined the expectancy and success-incentive functions to eventually result in behaviour which reflects a realistic level of risk taking. The pattern of behaviour which was predicted for the reward, but not the non-reward group is similar to that exhibited in task choice contexts by children who understand the success-incentive function. This hypothesis was based on the assumption that the variable payoff system offered to these children would increase their awareness of the success-incentive function, regardless of whether their normal cognitive development allows them to understand this function. By offering the children more reward for successful performances on difficult than on easy levels of the computer game, they should then associate greater incentive value with success on difficult levels than on easier ones. As Heckhausen (1984) revealed, when children understand the success-incentive function, these children are initially expected to select very difficult tasks which present them with a challenge beyond their own level of capability. As a consequence of information which indicates failure on this performance attempt, the children are then expected to select very easy tasks, which are below their level of capability. These tasks present the child with very little challenge yet ensure that a small amount of reinforcement will be achieved. With continued performance attempts, the children are expected to reach the realistic level of risk taking which Heckhausen (1984) believes should be demonstrated. Realistic risk taking behaviour will be indicated by the children's selection of difficulty levels which are compatible with their own ability level on the final trial of testing. Selection of this level presents the child with an optimal level of challenge and the opportunity to receive the maximum amount of reinforcement if successful. The present research hypothesised that, when presented with a variable payoff system, young children are capable of employing both the expectancy and success-incentive functions to exhibit behaviour which indicates a realistic risk taking strategy. That is, they possess a sufficiently

accurate understanding of their competence to gain reward by choosing appropriately-challenging levels of the task.

The issues which have been discussed in this and the preceding chapter, although afforded separate consideration, do in fact demonstrate a relationship. Previous research by Kreitler & Zigler (1990) has revealed that an individual's willingness to engage in high risk behaviour is related to their level of expectancy for their future success. They observed less maximising behaviour, which provides an indication of high levels of success expectancy, in children who demonstrated a preference for challenging tasks which involved a high level of risk of failing. Therefore children whose success expectations were high attempted more challenging tasks as these tasks offered greater potential reward than less challenging ones. Presumably, their high expectations for success, indicated by less maximising behaviour, led them to believe that they were capable of achieving success on these difficult tasks. Similarly, an individual's perception of their own competence is logically related to the level of their expectation for their own future success. The higher the individual's perception of competence, the more likely they are to expect to achieve success in the future. Conversely, the lower the individual's perception of competence, the more likely they are to expect that failure will result from future performance attempts.

Bandura (1989) discusses the relationship between an individual's perceived self-efficacy (a situational variant of perceived competence) and their willingness to attempt tasks which present them with a personal challenge. Perceived self-efficacy affects motivation in several forms (Bandura, 1989). Individuals base their adopted levels of challenge, how much effort they expend into achieving their goals and how long they are prepared to persevere when faced with failure partially on their perceived level of self-efficacy (Bandura, 1986). Cervone (1989) has demonstrated that the higher the individual's perceived self-efficacy, the longer they will persevere on difficult and unsolvable problems. Similarly, Bandura & Wood (1989) revealed that individuals with high self-efficacy set themselves more challenging goals than comparison others whose self-efficacy was relatively low. The high self-efficacy individual is also more committed to achieving these goals than their low self-efficacy counterparts. Therefore it is

presumed that realistic risk taking and the adoption of realistic levels of challenge, indicated by the selection of tasks which present the individual with an optimum level of challenge and the opportunity to receive the maximum amount of reward they are capable of, reflects a realistic perception of personal competence. Further support for this proposal is provided by Heckhausen (1984). He claims that the mediating connection between the expectancy and success-incentive functions is an understanding of the competence required for successful task completion. In other words, to develop an awareness of both the probability of success on a task and the incentive value of this task, the individual must firstly be aware of the competence required for successful completion of this task. An understanding of these two functions is likely to result in realistic risk taking behaviour. This behaviour is manifest in the selection of tasks which present the individual with maximum challenge and the opportunity to gain the maximum amount of reward they are capable of achieving. Consequently, if realistic risk taking behaviour is exhibited, this implies that the individual is capable of employing both the expectancy and success-incentive functions and subsequently, of assessing the competence required for successful task completion. Furthermore, if individuals do display realistic risk taking behaviour, by selecting tasks appropriate to their own ability level and which present them with maximum uncertainty of whether they will fail or succeed, this will indicate to some extent that they are capable of accurately assessing their own competence.

In the present experiment the nature of children's risk taking behaviour is therefore expected to provide information not only related to this issue but support for the hypothesis, stated in Chapter Five that young children are capable of accurately assessing their competence. As outlined earlier, children who were offered variable payoffs for successful task performances were expected initially to choose difficult tasks, which present a high level of risk and personal challenge. On the second trial, they were expected to select very easy tasks which presented them with both low levels of risk and challenge. This pattern of behaviour on the first two trials was anticipated because the variable payoff system was expected to heighten the children's awareness of the success-incentive function, and such awareness ordinarily results in this pattern of risk taking behaviour in task-choice contexts. As children continued to select different levels of difficulty, it was hypothesised that their final level choice would closely approximate their own ability level. In so doing, these children would be displaying what Heckhausen

(1984, p. 29) refers to as, “realistic” risk taking behaviour. Behaviour of this nature requires an understanding of the success-incentive and expectancy functions, for which an understanding of the competence necessary for successful task performance is a prerequisite. Therefore, if on the final level choice, realistic risk taking behaviour is observed, this will provide further support for the hypothesis that young children are capable of making accurate judgements of their personal competence.

**CHAPTER SEVEN.**

***EXPERIMENT 5 - AN EXAMINATION OF  
YOUNG CHILDREN'S RISK TAKING  
BEHAVIOUR AND THE ACCURACY OF  
THEIR BEHAVIOURALLY INDICATED  
PERCEPTIONS OF COMPETENCE ON A  
MOTOR TASK.***



### **7.1.1. Introduction**

Chapters Five and Six discussed research pertaining respectively to the accuracy of children's perceptions of their own competence and the nature of their risk taking behaviour. The present chapter describes an experiment which investigated both these issues in a motor task context. Hypotheses concerning the first issue, the accuracy of children's perceived competence, will be dealt with first. This will be followed by a consideration of the pattern of risk taking behaviour which young children are expected to exhibit and finally, how children's risk taking behaviour can support hypotheses made about the accuracy of young children's perceived competence. In the experiment which is described below, children aged between 4 and 6 years were asked to play the computer game used previously but with only accurate performance information provided. Their actual competence was measured by their baseline level on the game. This was an objective measure indicating the level of difficulty most appropriate for the child's own competence. Their perceived competence was measured by their choice of difficulty level on trial five (the final trial in the session). Accuracy of perceived competence could then be assessed by measuring the absolute deviation between these two measures.

The children were randomly divided into two groups- a reward group and a non reward group. The children in the reward group received variable payoffs for successful performances whereas those in the non reward group received no rewards for performance. A performance was designated as successful when the child scored five or less errors on any one trial. This criterion error level was applied regardless of the difficulty of the current level on which the child played. The reward system provided increasing levels of reward for success as the difficulty level of the task attempted increased. It was hypothesised that on trial five, children's level choices in the reward group would demonstrate less deviation from their baseline levels than that exhibited by children's final level choices in the non reward group. The deviation between these two measures can provide an indication of how realistic the child's perceived competence is, in relation to their objectively measured level of competence. This hypothesis was based on the findings of previous research which are discussed in Chapter Five and which indicate that, contrary to widespread assumption, under certain conditions, young children are capable of providing accurate assessments of their own level of competence.

Certain factors have been shown to be effective in eliciting accurate perceptions of competence from young children. These factors include: increasing the saliency of objective task difficulty and performance outcomes, and employing a behavioural measure to assess perceived competence on a specific task. By offering variable payoffs for successful performance attempts, it is anticipated that the salience of objective task difficulty will be increased. This reward system is expected to increase the children's awareness of the outcomes of their performance attempts. Tangible rewards which are received following success but not failure are expected to increase the saliency of the children's performance outcomes by directing their attention to the relative success and failure of previous performance attempts. The children are then able to determine whether these attempts were successful or not by the amount of reward they have gained. Previous research has shown that tangible rewards for successful performance attempts increase the saliency of these outcomes and subsequently, children base their future behaviour on previous performance outcomes (for example, Stipek et al, 1984). Employing a behavioural index to measure perceived competence on a specific task is expected to result in more accurate perceptions of competence by reducing the limitations presented by the use of verbal measures (see Chapter Five for a discussion).

The task and conditions which are described above were used in the present examination of children's risk taking behaviour when they were offered variable payoffs for successful task performance. Two aspects were investigated, as suggested by Heckhausen (1984). The first of these was an examination of the conditions under which children combine the expectancy and success-incentive functions to result in realistic risk taking behaviour. The second issue which was addressed was the nature of children's risk taking behaviour when material incentives were not offered for successful performance attempts. It was anticipated that the children in the reward group would display realistic risk taking behaviour when they were offered variable payoffs for task success, increasing awareness that greater incentive value of success is associated with more difficult levels of the task than with easier ones. Children in the reward group were not expected to immediately display realistic risk taking behaviour. Based on the

findings of previous research, as discussed in Chapter Five (see Heckhausen, 1984), a pattern of behaviour was expected to be displayed by subjects in the present study which is as follows: initially, as a result of the variable payoff system increasing the children's awareness of the success-incentive function, they were expected to select very difficult levels of the game; following failure on these levels, which does not result in the receipt of reward, on their second trial, these children were then expected to select very easy tasks; with continued performance attempts, by the fifth and final trial the variable payoff system was expected to stimulate these children to choose levels which approximate their own level of competence and to arrive at what Heckhausen (1984) describes as realistic risk taking behaviour. More realistic risk taking behaviour will be indicated by lesser deviation of final level choices from baseline levels in the reward group than that expected to be exhibited by the children in the non reward group. Predictions differed however concerning the nature of the behaviour which children in the non reward group would display. Because they were not offered variable payoffs for successful task performance they were not expected to demonstrate the same awareness of the success-incentive function as children in the reward group. As a result, they were expected to select easy tasks on both their first and second trials, as Heckhausen (1984) suggests. On their fifth trial their level choices were expected to deviate more from their baseline levels than those of children's in the reward group. If, as hypothesised, this is the case, it would provide an indication that, as was expected, these children did not display realistic risk taking behaviour. In comparison to the children in the reward group, those in the non reward group were expected to select relatively easier levels on their first trial and on their fifth trial they were expected to demonstrate relatively less realistic risk taking behaviour.

At the beginning of this introduction it was suggested that when children are offered variable payoffs for successful performance attempts, the nature of their risk taking behaviour can provide additional information about the accuracy of their perceived competence. A possible relationship exists between risk taking behaviour and perceived competence on a particular task, as suggested by Bandura (1989) and Weiss & Horn (1990). For example, these latter authors revealed that girls who underestimated their physical competence demonstrated a preference for tasks which did not present them with a challenge. It seems that if risk taking behaviour is realistic then levels will be chosen which present the

individual with optimal levels of challenge and are most appropriate for the individual's competence level on that task. Heckhausen (1984) states that for an individual to engage in realistic risk taking they must have developed an understanding of both the expectancy and success-incentive functions and that the mediating connection between these two functions is an understanding of the competence required for successful task completion. If the individual can assess the level of competence required for successful task completion and demonstrates realistic risk taking behaviour, they must also be capable of accurately assessing their own level of competence. Thus if realistic risk taking behaviour is displayed by children in the reward group, as is expected, this finding will provide further support for the hypothesis that under the conditions imposed, children can provide accurate assessments of their own competence if the conditions encourage them to do so. Despite having the capacity, if task conditions do not encourage accuracy (as in the non-reward group) then young children may not display behaviours congruent with their abilities.

### **7.2.1. Subjects**

Thirty one children from two primary schools were employed as subjects in this experiment. The children were randomly selected for participation and randomly allocated to one of two groups- a reward group, or a non reward group. There were ten boys and six girls in the reward group. They ranged in age from 4 years & 3 months to 6 years & 2 months with a mean age of 5 years & 4 months. The non reward group comprised of seven girls and eight boys whose mean age was 4 years & 9 months. Their age range was 4 years & 3 months to 5 years & 9 months.

### **7.2.2. Experimental procedure**

Both groups of children played the computer game used in experiment four. The performance information which they received provided accurate information about the child's performance on the game. Children were firstly familiarised with the game through verbal instruction and two practice trials on level two. Once children's understanding of the aims of the game had been established, their baseline performance levels were obtained, as described in Chapter Four.

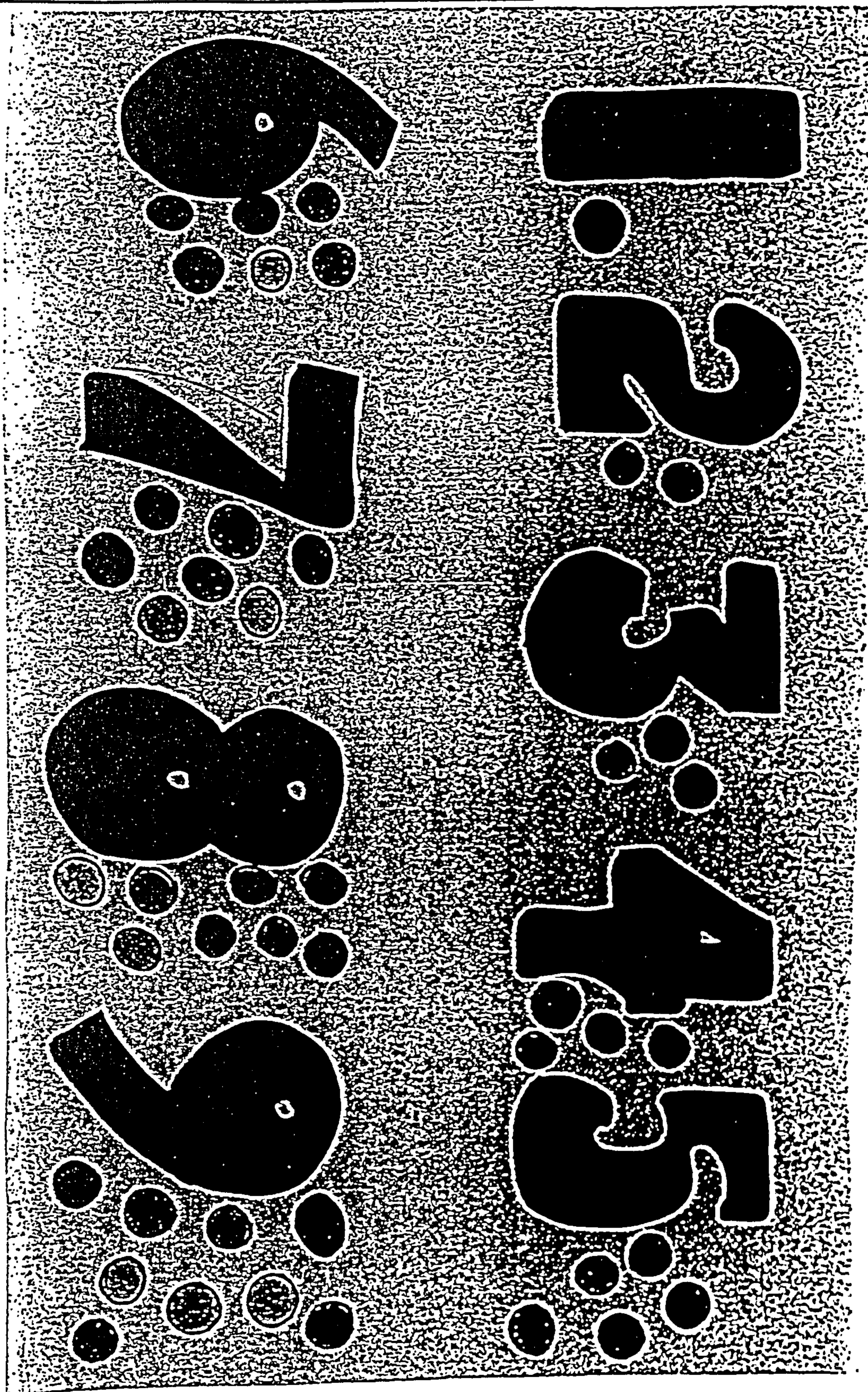
The two groups then performed five trials on the game, the difficulty levels of which they chose themselves. The children were asked to choose the level of difficulty which they wanted to play on next before each trial. The child's understanding of the relative difficulty of this chosen level was then checked. The children were asked whether they wanted to move to an easier or a more difficult level, and to identify this level. They were then asked to show the experimenter this difficulty level on one of two scales. The non reward group used the sliding arrow scale described in experiment four and the reward group used the scale which is shown in figure 7.1 (the rationale for employing different scales will shortly be made apparent). The non reward group simply played five trials on the game and only received feedback generated by the game. However, the reward group was given smarties for a successful performance on a trial, immediately following that trial. They were told that if they reached a required standard of performance, which did not vary between levels and which allowed the subjects to make no more than five errors, they would receive a number of smarties as a reward. The amount of reward available was in direct proportion to the difficulty of the level attempted. If the required standard was met at level one, the child would receive one smartie, at level two, two smarties, and so on, until level nine when they would receive nine smarties. Following each level choice, children were questioned to check whether they understood how many smarties they would receive following success on their chosen level. As figure 7.1 shows, smarties were drawn next to the different difficulty levels to aid the children's understanding of how many smarties they would receive if they successfully completed this level. Some children's initial difficulties with this system necessitated that actual smarties be placed on top of those drawn on the scale to ensure that all subjects understood the nature of this variable payoff system.

### **7.3.1. Expected results concerning risk taking behaviour**

With the presence of a variable payoff incentive children in the reward group were initially expected to challenge themselves by selecting levels which were too difficult for them and higher than their baseline. Following almost inevitable failure on this level, they were then expected to display relatively cautious behaviour on trial two and play on levels which were much easier than the levels attempted on their first trial. By the final trial, trial five, these subjects were

expected to have learnt to play on a level which maximises their chances of success and does not deviate greatly from their baseline level. Children in the non reward group were not expected to display this pattern of behaviour. Therefore their initial level choices were not expected to deviate greatly above their baseline and such a drastic reduction in level choice on trial two, comparative to the level chosen on trial one, was not anticipated. Similarly, their level choices on trial five were expected to display greater deviation from their baseline levels than that exhibited in the reward group.

Figure 7.1: Scale used with the reward group



### **7.3.2. Expected results concerning the accuracy of perceived competence**

It was hypothesised that the conditions under which children in the reward group played the game (that is, an incentive to accurately assess competence; increased saliency of performance outcomes and objective task difficulty, and, behaviourally indicating their perceived competence on a specific task) would elicit accurate perceptions of personal competence. Only the latter condition was a feature of the task for children in the non reward group. Therefore they were expected to provide less accurate estimates of their own competence on the game than did children in the reward group.

### **7.3.3. Dependent measures**

Only subjects' behaviour on trials one, two and five was of interest, therefore their behaviour on trials three and four was excluded from any analysis. It was not possible to use actual level choice as the dependent measure as this procedure would not control for individual differences in baseline levels. Therefore the following procedure was employed to determine the dependent measures to be used in statistical analyses. As no trials had been previously performed, the dependent measure on trial one was calculated by subtracting the child's baseline level from their level choice on trial one. This score could be either negative or positive and therefore provided an indication of whether subjects chose a level which was easier or more difficult than their baseline, and to what extent these two levels differed. On trial two, the dependent measure was calculated by subtracting the child's level choice on this trial from their choice on trial one. Again, this indicated the direction of their choice on trial two, in relation to the level played on trial one, and how much these two levels differed from each other. However, on trial five, the dependent measure was obtained by calculating the absolute difference between children's level choices on this trial and their baseline level. This measure provided an indication of the degree to which level choices on trial five deviated from baseline levels but not in which direction this deviation occurred. This method was employed to obtain an indication of both the accuracy of the child's perceived competence and how realistic their risk taking behaviour was. Baseline levels, as discussed earlier, were used to indicate the level of difficulty appropriate for the individual. Therefore, the amount by which the child's final level choice deviated from their individual baseline level would



provide an indication of whether they selected levels which were compatible with their ability level and presented them with an appropriate level of personal challenge. The direction of this deviation was also calculated to examine if differences existed between the two groups' preferences for levels above or below their baseline levels.

#### **7.4.1. Results**

An initial analysis was carried out to assess whether gender influenced children's behaviour. A two-way ANOVA (gender by choice) with repeated measures on the second factor was performed on the dependent measure, deviation score, as described previously. Gender had two levels and choice had three (trials one, two, and, five). Neither the gender main effect nor gender by choice interaction were significant,  $F(1,87)=1.394$ ,  $p>0.05$ , and  $F(2,87)=0.098$ ,  $p>0.05$ , respectively. Although the choice main effect was found to be significant,  $F(2,87)=5.105$ ,  $p<0.05$ , this result was not followed up at present as it was subject to further investigation in subsequent analyses. Based on these results, gender was not included as a factor in the analyses which follow. This finding supports those of Arenson (1978) and Clifford et al (1990) which revealed that gender does not affect risk taking behaviour.

#### **7.4.2. Examining risk taking behaviour over trials one and two**

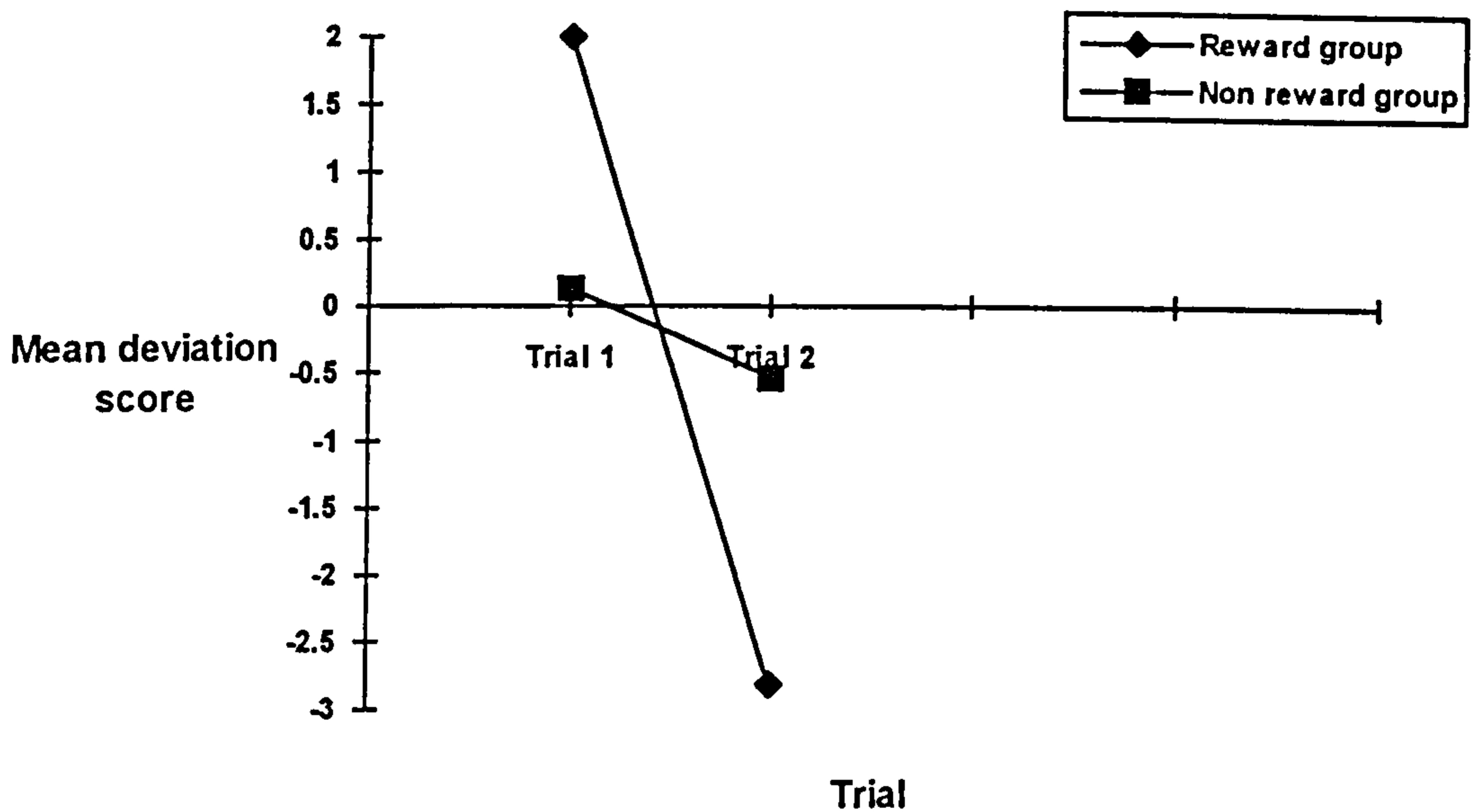
A 2 x 2 two factor ANOVA (group by trial) with repeated measures on the last factor was performed on the dependent measure, deviation, described above. Both factors had two levels, reward group and non reward group, and trials one and two, in the first and second factors, respectively. This analysis revealed a nonsignificant group main effect ( $F(1,29) = 0.10$ ,  $p>0.05$ ), however, as table 7.1 demonstrates, both the trial main effect and the group by trial interaction were significant.

SOURCE OF VARIATION	SS	DF	MS	F	SIG. OF F
WITHIN CELLS	449.89	29	15.51		
TRIAL	116.21	1	116.21	7.49	0.010
GROUP BY TRIAL	66.53	1	66.53	4.29	0.047

**Table 7.1: Results of two-way ANOVA performed on deviation scores at trials 1 & 2**

Scheffé's follow-up test was used to further examine this significant interaction and it revealed that for the reward group the mean deviation score on trial one was significantly greater than the mean deviation score on trial two ( $p < 0.05$ ). There were no other significant differences. Table 7.2 provides the means and standard deviations of the deviation scores for each group at trials one, two and five. Figure 7.2 shows a plot of these mean values to demonstrate clearly the group by trial interaction which was revealed. An examination of the mean deviation scores (see table 7.2) indicates that the trial main effect resulted from significantly greater deviation scores on trial one than on trial two. This result appears to reflect children's awareness of performance feedback in both experimental groups. Having, on average, selected levels above their individual baselines, the children received relative failure feedback and subsequently, on trial two, selected levels on which success was significantly easier to achieve.

Figure 7.2: Plot of mean deviation scores of reward and non reward groups over trials one and two.



GROUP	TRIAL 1		TRIAL 2		TRIAL 5	
	mean	sd	mean	sd	mean	sd
REWARD	2.000	3.367	-2.813	3.331	2.000	1.5492
NON REWARD	0.133	3.889	-0.533	2.669	3.333	2.1931

Table 7.2: Deviation means and standard deviation of the mean for both groups at trials 1, 2 & 5

Unlike subjects' deviation scores on trials one and two, their scores on trial five represented the absolute number of units which their final level choice deviated from individual baseline levels. Therefore a separate analysis was performed on the deviation scores recorded at trial five. A one-way ANOVA (group by deviation) was carried out, the first factor comprising of two levels (reward group and non reward group). This analysis revealed differences between the groups at a probability level which closely approached traditionally employed significance levels, as table 7.3 shows. The reward group deviated less from baseline levels than the non reward group as can be seen in table 7.2. Conventionally, probability

levels which are greater than either 5% or 1% result in the rejection of the alternative hypothesis in favour of the null hypothesis. If these conventional levels are strictly adhered to then the present findings would report no significant differences as  $p > 0.05$ . However, the author is of the opinion that this straightforward rejection of a probability level of 0.059, simply because it falls 0.9% short of conventional criteria, would be foolhardy. This belief is supported by early writings on the subject of statistical significance by Rozeboom (1960). Rozeboom (1960, p. 416) discusses the traditionally adopted levels of 5% and 1% as so steeped in tradition that they have developed,

...the status of a religious conviction.

This convention, although widely employed, is, however, based, in Rozeboom's (1960) opinion, on levels of significance which were originally determined in an arbitrary manner. The steadfast adoption of these levels leaves the researcher with very little room for manoeuvre, as the procedure allows only disconfirmation or confirmation of the hypothesis with no continuum of alternatives available in between. As a result, based on this procedure, the matter becomes one of all or nothing rejection or acceptance of the null hypothesis. This seems a short-sighted method to adopt if, for example, a probability level of 0.04 will indicate significant differences whereas one of 0.06 will indicate no significant differences, when the very small difference between these two values is considered. Rozeboom (1960) supports this belief and states that hypothesis testing should involve determining the extent to which the individual believes in their propositions and not an all or nothing approach to acceptance of this proposition. Rozeboom (1960) further suggests, amongst other things, that actual probability levels should be reported. It appears that to reject a probability level of 0.059 would result in ignoring a result of some significance. Therefore, the present study will accept the probability level of 0.059 as one which indicates a result which is of statistical significance.

SOURCE	DF	SUM OF SQUARES	MEAN SQUARES	F RATIO	F PROB.
BETWEEN GROUPS	1	13.7634	13.7634	3.8626	0.0590
WITHIN GROUPS	29	103.3333	3.5632		
TOTAL	30	117.0968			

**Table 7.3: Results of one-way ANOVA performed on the deviation scores of both groups on trial 5**

An examination of the mean deviation scores (see table 7.2) indicates that as expected the deviation of level choices from baseline levels at trial five was significantly greater in the non reward than the reward group. It appears that when offered variable payoffs, young children will initially challenge themselves and subsequently risk gaining no reward at all in order to obtain the maximum amount of reward available. However, following failure on this challenging level their behaviour changes drastically, becoming overly cautious, to ensure that some reinforcement is received, however small. Only five subjects in the reward group did not experience failure on trial one, and all of these subjects had elected to play on a level lower than their designated baseline. The variable payoff system did not encourage them initially to present themselves with a challenge which could have jeopardised their chances of receiving a reward. However, having received reinforcement for their performance on trial one, unlike the other subjects, these five children logically attempted a more challenging level on trial two. By trial five, the children in the reward group, having experienced the effects of both risky and cautious behaviour on the amount of reinforcement received, appear to have learnt to maximise their chances of success. The children's behaviour on trial five infers that they realise that in order to maximise gain and minimise loss they must play on a level which presents neither too great nor too little of a challenge. That is, one which is close to their own baseline level and which demonstrates their realistic risk taking behaviour.

### 7.5.1. Examining the accuracy of children's perceptions of competence

The one-way ANOVA performed on deviation scores on trial five was used to address this issue. Actual competence was measured by the child's baseline level and their perceived competence was indicated by their level choice on trial five. The discrepancy (measured in absolute units) between these two measures, that is, the child's deviation score, provided an indication of the accuracy of their perceived competence, in relation to their actual competence, on the game. As expected, the mean deviation from baseline level on trial five was greater in the non reward group than the reward group (see table 7.3). Therefore it appears that the conditions under which the reward group played the game resulted in more accurate task level choice, in comparison to that displayed by children in the non reward group. A chi-squared analysis was performed on the frequencies of children in the two groups (shown in table 7.4) who selected levels above, at, and below their own baseline levels. This analysis revealed no significant differences between the two groups,  $\chi^2 (1) = 1.5511, p > 0.05$ , indicating that the direction of deviation did not differ between the two groups. The deviations which occurred were no more likely to be above or below baseline levels in the reward than the non-reward group, and *vice-versa*.

	Above/at baseline	Below baseline	Total
Reward group	11	5	16
Non-reward group	7	8	15
Total	18	13	31

Table 7.4: Frequencies of children in the reward and non reward groups who selected difficulty levels above/at or below their baseline levels on trial five

### 7.6.1. Discussion

#### Children's risk taking behaviour on trials one and two

In the reward group, children demonstrated an initial preference for difficult levels which presented them with a challenge, but on their second trial they selected easy levels which did not represent similar levels of personal challenge. With their first

two level choices, these children have therefore demonstrated the pattern of risk taking behaviour which Heckhausen (1984) predicts will be demonstrated in task choice contexts by children who understand the success-incentive function. An examination of children's behaviour in the non reward group provides a suitable method of addressing the nature of children's risk taking behaviour when material incentives are not provided for successful performance attempts and the only possible incentive to succeed can be intrinsic. The behaviour of these children provided only partial support for predictions *a priori*. As expected, in relation to children in the reward group, those in the non reward group selected relatively easier levels on their first trial. Contrary to predictions, although these levels were relatively easier than those chosen by children in the reward group, children in the non reward group selected levels which were above their baseline levels.

However, the extent of this deviation was not as great as that demonstrated by the reward group (compare the reward group's mean deviation of 2.000 with the non reward group's of 0.133). In relation to their first trial choice, on their second trial, children in the non reward group demonstrated a preference for relatively easier levels. However, the decrease in level choice between trials one and two was not as great as that demonstrated in the reward group and did not yield statistically significant results.

These findings indicate that in a task choice setting, the pattern of behaviour exhibited by children who are not offered material incentives is the same as that exhibited by children who are. Seemingly, intrinsic incentives mediate the same pattern of risk taking behaviour as do material ones. However, one significant difference does exist between the nature of children's risk taking behaviour in these two contexts. It appears that when material incentives are not offered, compared with when they are, young children are less likely to display behaviour which indicates extreme risk followed by extreme caution. One explanation for the similarity in behaviour exhibited by children in the two groups could be that the children in the non reward group did understand the success-incentive function. This suggestion echoes that made (see Chapter Five) in relation to the proposed incongruence between children's capacity to accurately assess their own competence and their capacity to verbalise these judgements. Results from the present experiment indicate that both groups of young children possess the capacity to understand the success-incentive function. The variable payoff system offered to children in the reward group appeared to heighten their awareness, and

use, of their knowledge of this function to select appropriate levels of challenge, in comparison with the behaviour displayed by children in the non reward group. However, the variable payoff system did appear to stimulate the children in the reward group to run the gamut of risk taking behaviour, moving from levels which present high levels of risk to those which present virtually none. The more extreme risk taking behaviour which was exhibited by the children in the reward group can therefore be attributed to the variable payoff system which they were offered for successful task performances. These results infer that the variable payoff system employed in the reward group increased the children's awareness of the success-incentive function, resulting in extremes of risk taking behaviour.

### **7.6.2. Children's risk taking behaviour on trial five**

On their final trial, in comparison with those of children in the non reward group, children's level choices in the reward group demonstrated significantly less deviation from their baseline levels. Through the selection of levels which approximated their competence level and which presented them with optimal levels of both challenge and potential reward, children in the reward group eventually demonstrated realistic risk taking behaviour. Again, it can be inferred that this realistic risk taking behaviour was elicited by the variable payoff system which was offered to children in the reward, but not the non reward, group. It appears that by offering children variable payoffs for successful task performance, they can successfully combine the success-incentive and expectancy functions to arrive at realistic risk taking behaviour. Considering the motivational and performance advantages (for example, Atkinson, 1957) of realistic risk taking behaviour, these results have implications for educational practices such as the reinforcement schedules which are employed in these contexts. This issue will be discussed in greater detail in the discussion which follows this chapter.

### **7.6.3. The accuracy of children's perceptions of their own competence**

Children in the reward group chose more realistic levels of task difficulty than did those children in the non reward group. These level choices were used as a behavioural index of children's perceptions of their competence on the motor task used in the present study (see Chapter Five for justification of the suitability of this measure). Findings indicated that the children in the reward group provided



more accurate perceptions of their task competence than those in the non reward group. The variable payoff system was employed to increase the salience of both objective task difficulty and the outcomes of children's previous performance attempts. Previous research has demonstrated these as factors which stimulate young children to demonstrate that they can accurately assess their own competence. Moreover, variable payoff systems encourage children to choose tasks appropriate to their individual ability (Clifford & Chou, 1991). This finding contradicts those of studies (for example, Stipek, 1981) which employed verbal measures of perceived competence and revealed that young children tended to overestimate their own competence levels. Having revealed that young children are capable of accurately assessing their own competence, the present study lends support to studies by Majeres & Timmer (1981) and Fazey & Evans (1994). Majeres & Timmer (1981) revealed that, when asked to choose a task appropriate to their developmental level, young children do demonstrate accurate perceptions of their motor competence. Similarly, Fazey & Evans (1994) demonstrated that when faced with potentially dangerous tasks, young children behaved in a manner which suggested that they can accurately assess their own level of physical competence. The present findings also support claims made by Nicholls (1984) and Butler (1990) that young children must be capable of accurately assessing their own competence if they are to improve upon their current level of mastery and prevent injury in physical settings.

It seems that young children possess more accurate perceptions of their competence than the findings of studies which have employed verbal measures would suggest. The exaggerated perceptions of competence revealed by such studies could be attributed to the verbal measures which they used rather than the child's actual beliefs about their personal ability. However, it was not the behavioural measure alone which elicited accurate perceptions of competence in the present study, as children's behaviourally indicated competence perceptions in the non reward group were not as accurate as those exhibited by children in the reward group, but also the task conditions. Realistic risk taking requires that the individual understands the competence required for successful task completion. Knowledge of this prerequisite to realistic risk taking behaviour therefore infers knowledge of one's own level of competence in relation to the difficulty of the task attempted. These results are in conflict with suggestions made by previous authors, for example, Harter (1990). She suggested that young children's

exaggerated perceptions of their own competence can be attributed to their limited cognitive capacity to comprehend the relationship between their own resources and the demands of the task. The present findings infer instead that these exaggerated competence perceptions may be a product of the limitations of the verbal measures which are commonly employed to assess this construct and of the nature of the tasks presented to young children.

Results of this study can be presented in support of findings from experiment two and points which are raised in this thesis. Experiment two revealed that the young child's equation of effort and ability may not accurately reflect their beliefs about these constructs but instead may represent an artefact of the methodology used to assess this conceptual development. Additionally, that young children's capacity to verbalise ability and ability related factors may be limited when they are discussing outcomes on physical tasks. Moreover, a number of interview responses from experiment one indicated that when asked about ability, young children may interpret these questions differently from adults. Considering these findings, it appears that verbal measures may not represent the most appropriate methodology for assessing young children's beliefs about personal competence and the construct of ability. It seems that a behavioural index will provide a more reliable method of measuring young children's perceptions of their competence.

When personal reward is contingent upon the accurate assessment of competence, children will apply their understanding of their personal competence and select levels of task difficulty which are appropriate for them. However, considering the findings of experiment two, it cannot be inferred from the results of experiment five that young children understand ability in the sense of an inherent capacity. Ability is unlikely even to exist as a separate entity for the young child. As mentioned previously, they appear to understand that individual limits of achievement exist but not that these limits are defined by an inherent capacity which defines ability in the adult sense. The limited capacity to verbalise ability is likely to have led to the exaggerated competence perceptions found by previous research which has commonly employed verbal measures to assess perceived competence. It appears that unless behavioural measures are employed in conjunction with appropriate tasks, then young children's competence perceptions

cannot be adequately assessed and research findings may not accurately reflect the child's beliefs. The present findings suggest that under certain circumstances, for instance, the presence of a variable payoff system, very young children do demonstrate an understanding of the following: the relationship between success and incentive on different levels of task difficulty; the competence required to achieve success on these different levels, and, whether or not their competence matches this required level. Although the efficacy of employing behavioural indices to measure young children's conceptualisations has been previously discussed in Chapter Five, the disadvantages of such methods must also be noted. Frey & Ruble (1987) suggest that, whilst observing behaviour on a specific task may reduce the problems of incongruence between verbalised and actual behaviour, this method reduces the generality of experimental findings. The present results can only indicate that in this context, involving a motor task, young children appear to possess the capacity to provide accurate assessments of their own competence and to engage in realistic levels of risk taking behaviour. Future research should examine the generality of these findings to children's perceptions of their competence in other areas within the physical domain and in other domains of competence.

**CHAPTER EIGHT.**

***DISCUSSION,  
IMPLICATIONS AND  
FUTURE RESEARCH  
DIRECTIONS***

### **8.1.1. Introduction**

This thesis was primarily concerned with the developmental changes involved in children's understanding of the relationship between effort, ability and outcome in assessing competence in the physical domain. An examination was made of the qualitative changes displayed by children's reasoning and whether or not this conceptual understanding exhibits alternate periods of stability and instability which a number of developmental theorists have proposed are characteristic of developmental change. Experiments were conducted to explore: young children's use of effort and ability as explanations for performance outcomes and their understanding of these concepts; how increases in outcome saliency affect young children's choices of task difficulty; whether or not young children can accurately assess their own competence on a motor task, and their capacity to utilise task difficulty, personal competence and the incentive value of success on different levels of the task to select appropriate levels of personal challenge. The research work used behavioural measures rather than self-report, following concerns about the use of verbal measures of self-perceived competence with young children. A number of observations which resulted from this empirical work prompted a discussion of methodological issues which are involved in the measurement of young children's conceptual understanding.

### **8.1.2. The Theoretical Perspective**

Instead of adopting a single theoretical basis to underpin the research carried out in this thesis, an eclectic approach has been adopted. This draws upon salient and convergent aspects of different developmental theories which were discussed in Chapter Three. Whilst the distinctions between these theoretical perspectives have been previously acknowledged, this section will clarify how the current thesis has used pertinent features of these different theories to provide a particular perspective on developmental change. An examination is then made concerning the extent to which current empirical findings have provided support for this integrated approach to developmental change.

Most research employs only one or a limited number of theoretical frameworks as its underpinning basis. Adopting such an exclusive theoretical approach may

ignore the valuable contributions which other theoretical approaches can offer the research and may lead to the conclusion that different theoretical perspectives offer mutually exclusive positions on the nature of developmental change. In so doing, this may limit the extent to which proponents of theoretical approaches other than that employed in a particular piece of research feel they are able to accept empirical findings which are underpinned by a school of thought different from their own. In this thesis, a number of approaches to developmental change have been integrated based on the premise that each approach has an integral contribution to make to understanding developmental change and no one of these theories can provide an adequate explanation in and of itself. Whilst the theoretical approaches adopted in this thesis employ a variety of different descriptors for developmental change, they all suggest common patterns and mechanisms of developmental change. These have been merged in the present thesis to provide what appears to be a plausible explanation for developmental change.

Salient aspects of these theories which require consideration here are as follows: developmental change involves alternating periods of stability and instability; instability is required to effect movement to a higher developmental state, and, behavioural variability can be employed as an index of developmental stage stability. The developmental theories which provide the main basis for this integrative approach are: Self-organising Systems Theory (Fogel & Thelen, 1987); Piaget's Equilibration Model (see Boden, 1979), and, Erikson's Psychosocial Theory of Development (see Newman & Newman, 1991).

Regardless of the developmental phenomenon under consideration, for instance, movement or conceptual development, all these theories describe fluctuation in the stability of the particular phenomenon, resulting in a pattern of developmental change which exhibits alternating periods of stability and instability (see Chapter Three for more detailed discussion of these proposals). For Fogel & Thelen (1987), this fluctuation occurs when excessive perturbations from the norm shift the attractor state away from its current, stable location towards a more unstable position and then on to further stability at a higher developmental state. Piaget (see Boden, 1979) describes this fluctuation in relation to the equilibrium and

disequilibrium which is experienced during different developmental stages. During movement between stages, the individual experiences disequilibrium, which, through the process of equilibration is restored to equilibrium. This procedure occurs numerous times during developmental change and results in the manifestation of alternate equilibrium and disequilibrium. From Erikson's perspective (see Newman & Newman, 1991), similar fluctuations in stability are demonstrated when the individual, having resolved an experienced conflict at one lifecycle stage, encounters a different conflict which creates a period of disequilibrium before movement into a further state of equilibrium is achieved on the resolution of this conflict.

Whilst all these theorists recognise the organism's inherent desire for stability, equilibrium or the tendency to reduce dissonance and conflict, indicated by lack of dissonance, conflict or congruence between internal and external information, they also recognise the essential role which periods of instability play in the process of developmental change. That instability is a mechanism involved in developmental change is a feature of all the theories discussed here. Fogel & Thelen (1987) see the amplification of natural fluctuations which moves the system away from its stable attractor state as a necessary component of developmental change, moving the system towards a higher developmental state. For Piaget (see Boden, 1979), this required instability is manifest in the discrepancies which occur between internal and external information creating instability and the need to reduce these discrepancies to effect developmental change. Erikson's Psychosocial Theory (see Newman & Newman, 1991) offers a similar interpretation in that experienced conflict between bipolar constructs is required to initiate their resolution and subsequent movement to a higher developmental state. Hence, this alternating pattern serves a central purpose to the process of developmental change. It is the periods of instability, or disequilibrium, or conflict, described above which effect the system's movement to a higher developmental state. If the system did not encounter this period of instability then it would remain at the previous stable, but lower, state of development and more advanced states of greater stability could not be achieved.

Behavioural responses to unexpected or extreme perturbations from the norm can be used as an index of the stability of the organism's current developmental state (Thelen (1989) and Piaget (see Boden, 1979)). During stable developmental states, due to the stability of the attractor state or the fact that no discrepancies exist between internal and external information, the individual is expected to display invariant behaviour in relation to others from the same developmental level. However, when experiencing unstable developmental states, the individual is expected to display behaviour which varies in relation to that displayed by individuals experiencing stable developmental states. This is accountable to the relative instability of the attractor state and the discrepancies which exist between internal information and information received from external sources. Thelen (1989) also proposes that empirical investigations can employ this relationship between behaviour variability and stage stability to identify the relative stability of developmental phenomena throughout different stages of their development.

Having integrated these proposals to derive the perspective on developmental change which has been adopted in this thesis, it was then suggested that this approach can be employed to describe one of the issues investigated in this thesis. That is, whether or not acknowledged stable and unstable phases of this developing conceptual understanding would be mirrored in behavioural outputs measured at these different phases of development. Behaviour in this context was identified as choice of task difficulty level on a motoric task on which performance feedback information was manipulated. If assumptions made from this integrative approach are correct, then relative stability of conceptual understanding would be evidenced by similar levels of relative stability of behaviour.

These proposals were examined in an empirical investigation described in Chapter Four. Thelen's (1989) method of assessing stage stability in relation to behavioural variability by administering an appropriate context manipulation was employed in this investigation. Results of this study can be used as an index of whether or not this integrative approach is suitable to describe developmental change, in relation to this particular phenomenon, and whether or not assessing behavioural variability is an appropriate method of assessing the stability of conceptual development.



Considering the limited support which was revealed for these proposals it seems that, although appealing from a theoretical perspective, adopting such an integrated approach to development is more difficult to demonstrate empirically. The difficulties encountered could be attributed to the inherent problems incurred in attempting to link conceptual, or cognitive, stability with behavioural variability. It is possible that the inconclusive findings encountered in this thesis are attributable to these methodological difficulties, instead, they could be attributable to the problems, experienced on a theoretical level, of integrating different theoretical approaches. Although the different theories which contributed to this integrative approach do demonstrate convergence on issues salient to the present thesis, it is feasible that their differences are too great to accommodate an integrative approach of this nature. What is evident from the results of both theoretical discourse and empirical investigation presented in this thesis is the need to further explore the efficacy of this approach as a means of describing developmental change.

### **8.2.1. Discussion of findings**

Empirical investigations revealed that young children's achievement related behaviours and their understanding of various achievement related constructs may be more advanced than was previously presumed. Various findings from the present thesis can be presented in support of this claim, which seem also to suggest that the context in which both behaviour and understanding are assessed influences the young child's capacity to verbalise, or apply their knowledge of, the constructs involved. When young children are offered variable payoffs for successful task completion, they seem capable of adopting levels of challenge which are appropriate for their own level of task competence. This behaviour suggests that they are able to accurately assess personal competence, the competence required to achieve success on different levels of task difficulty, and the relationship between these two factors. In addition, young children's capacity to verbalise ability demonstrated a level of sophistication which is not normally associated with such young children (for example, Nicholls, 1978). In an academic context from which all effort cues had been removed, children between the ages of 4 and 6 years employed ability related explanations for performance outcomes.

This finding appears to infer that very young children must possess an understanding of ability, not in the same way as do adults, but as a construct which is distinct from effort. Findings from a number of investigations raised concerns about methodologies which are employed to examine young children's conceptual understanding. These empirical observations suggest that researchers may need to revise the suitability of verbal measures which are used for this purpose and examine their own assumptions about the child's understanding which may influence the experimental designs which they employ. This thesis also indicated that children's understanding of the relative contributions of effort and ability to performance outcomes on physical tasks demonstrates the same developmental pattern which was revealed by Nicholls (1978). Although proposals were made in this thesis that this conceptual understanding demonstrates alternate periods of stability and instability, only limited empirical support was provided for these suggestions.

### **8.2.2. Young children's use, and understanding, of ability as an explanation for performance outcomes**

Hypotheses were made which suggested that the young child's synonymous use of effort and ability (for example, Nicholls, 1978) may not reflect their actual understanding of these concepts but may be an artefact of the tangible and explicit effort cues which children are presented with when their understanding of these concepts is assessed, and developmental differences in construct interpretation. Previous research (for example, Stipek & MacIver, 1989) has demonstrated that significant others emphasise the importance of effort to the young child and tend to reward children for the amount of effort they have expended to achieve an outcome, rather than the success level of this outcome attempt. Particularly where physical tasks are concerned, during which the effort expenditure of the actors is wholly apparent to the subjects, it is likely that the young child will focus their attention on these tangible effort cues. Young children are also unlikely to interpret "ability" and "being good at something" in the same way that the adult does. When discussing this issue, the adult experimenter is referring to an inherent capacity which determines level of ability. However, young children are more likely to be referring to "being good" in the sense of exhibiting good behaviour and following instructions. This results in the belief that an individual who is seen to work continuously at a task is "good" or is the "best" at this task. It appears that the child is not referring to ability in the way that the adult does when they

state that someone is good at something, but more probable that the young child is referring to socially acceptable behaviour. It is possible that this developmental difference in construct interpretation, rather than the child's actual understanding of the concepts involved, results in the young child's use of effort and ability as interchangeable concepts. In support of this hypothesis, both Kelly (1955) and more recently, Korthals (1994) discuss the fact that individuals at different developmental levels interpret the same events and constructs in different ways. Similarly, Harter (1983), Stipek et al (1984), and Stipek & MacIver (1989) have all suggested that the young child's perception of ability may differ widely from the adult's. Based on the proposal that the effort cues shown in the methodology used to assess effort and ability understanding may falsely become the focus of the child's attention and result in developmental differences in construct interpretation, children were asked to discuss performance outcomes in the absence of any effort cues whatsoever. They were shown pictures of two children performing physical tasks in experiment two and academic ones in experiment three. All effort cues had been removed and one child was shown to achieve a higher level of success than the other. The subjects were then asked to explain these performance differences.

When verbal and visual effort cues were removed, young children did not provide any effort-related explanations for performance differences on either academic or physical tasks but they did provide some explanations which were interpreted as ability-related in the academic domain. This was unexpected. When asked to explain performance differences on physical tasks, no explanations which could be construed as ability-related were provided, although some children did employ ability-related explanations when asked to discuss performance differences on academic tasks. With the exception of two of these children, the remainder were unable to substantiate their explanations in terms of ability, for example, "Because she's clever". The child's understanding of the concept of ability therefore requires clarification. Although it seems that young children can conceptualise the existence of ability independently from effort (at least in relation to academic tasks), their capacity to verbalise their understanding of this construct does appear to be limited. They do not seem to use ability synonymously with effort, yet the domain which they are asked to consider appears to affect their statements about cause of outcome. When discussing physical tasks, young children do not verbalise their ideas about cause of outcome in a way which can be interpreted

from an adult's perspective of ability, although this seems to be more easily achieved by the child when they are discussing academic tasks. It may be that the young child focuses on readily available, concrete constructs rather than more abstract ones which are not directly observable and are more difficult for them to understand. Their interpretation of ability appears to be based more on behavioural conduct than on ability as a capacity. Effort is the only factor available on which children's judgements about behavioural conduct can be based in the methodology employed to assess effort and ability understanding. It seems that as a result of this, young children appear to equate effort and ability in their verbalisations, although present findings indicate that they may actually use effort and ability independently from each other. This suggestion is supported by claims made by Blumenfeld et al (1981) (discussed in greater detail in Chapter Two) that the young child bases effort judgements on behavioural conduct and ability judgements on effort expenditure.

It is evident from the current findings that young children can use ability in their verbal explanations for performance outcomes on academic tasks. However, the extent to which this finding can provide information about the young child's understanding of ability in relation to effort and outcome is unclear. It was suggested in Chapter Two that verbal responses can provide some indication about the individual's understanding of the concepts they are discussing. However, an examination of this nature cannot produce conclusive evidence about the child's understanding and future investigations are required which directly address the nature of this understanding, rather than making inferences from verbalised reasoning. If children's verbalised reasoning can be employed to some extent to make inferences about their conceptual understanding, the present results perhaps suggest that the young child's understanding about effort and ability differ from those revealed by previous research. The absence of effort related explanations in general and the young child's limited use of ability related explanations for performance differences on academic tasks indicate that they may not believe effort and ability to be synonymous with each other. They may perceive ability as a concept which is distinct from effort, suggesting that their ideas about these concepts could be more advanced than was previously presumed. Children at this level of conceptual development would not normally be expected to employ abstract constructs such as ability in their verbal responses (for example, Nicholls, 1978). This finding supports Harter's (1986) statement

that although young children possess a general feeling of self-worth (a construct of a similar abstract nature to ability), they are unable to verbalise these beliefs in a manner which can be interpreted from an adult perspective. In summary, these experiments have provided direct evidence of children's use of effort and ability in their explanations for performance outcomes but this research does not do more than suggest that although they may perceive these as discrete constructs, their capacity to differentiate clearly between these outcome attributions does appear to be limited. Further research is required into this area.

The children's verbalised responses did demonstrate some domain specificity. It seems that young children do not employ effort or ability when explaining performance outcomes on physical tasks in the absence of effort cues. However, although effort was not employed as a referent in relation to academic tasks, young children did use ability as an explanation in this context. This domain specificity was unexpected when one considers that the developmental continuum of effort and ability understanding demonstrated between the ages of 4 and 13 years at the start of the present research, and discussed in the following section, did not reveal any differences between the physical and academic domains. Recent studies by Smith & Whitehead (1994) and Walling & Duda (1994) also explored developing conceptualisations of effort and ability in the physical domain with similar results. Future research is necessary to fully explain how the young child uses effort and ability as explanations for performance outcomes, their understanding of these concepts and how and why their perceptions and use of these constructs appear to differ between the academic and physical domains. One factor which could have contributed towards this finding is task familiarity. The academic task which children were shown was one with which they were very familiar. Using such a task was advantageous in that all the children possessed a good understanding of its characteristics and how success could be achieved on this task. It is unlikely that the physical task which was shown to the children represented the same level of task familiarity. The children who were shown pictures of the academic task may have been more capable of formulating and verbalising their ideas about ability in relation to this task as a result of their greater task familiarity. The extent to which task familiarity affected these results does however, appear to be limited. Responses from children who were shown the physical task indicated that they possessed a comprehensive understanding of the nature of this task (for instance, suggesting that one model scored more than

the other because they had a bigger hoop to aim for). This indicates that they understood which variables would increase or decrease the difficulty level of the game and a full understanding of the task and its requirements. The effects of task familiarity on the child's use of ability in their verbal responses should be examined to eliminate this as a possible source of the domain specificity which was revealed by the present research. Similarly, a more powerful research design would be to use the same group of children to discuss performance outcomes on both academic and physical tasks. This was overlooked in the present research and remains a major criticism of this study.

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Administering a test-retest methodology may support present proposals that children's beliefs can be inferred from their verbal responses. If children are asked to explain differences in performance outcomes on two separate occasions, the consistency of their responses may indicate whether or not these responses reflect their understanding of the concepts involved. If these responses are consistent, then it is likely that they reflect the child's beliefs rather than situationally specific explanations which are unrelated to their understanding of these concepts. It was suggested in Chapter Two that young children provide statements which, although not ability-related from the perspective of an adult who perceives this construct as a capacity, may represent the child's understanding of ability. It seems that future research should investigate whether or not children's explanations for performance outcomes which relate, for example, to size, reflect their understanding of ability.

### **8.2.3. Developmental changes in effort and ability understanding in the physical domain**

Based on the assumptions of multidimensionality (for example, Baltes, 1987) and domain specificity (for example, Harter, 1985a), research findings from one domain of competence cannot be directly extrapolated and applied to other competency domains as developmental changes in one domain may not mirror those demonstrated in others. Prior to conducting this research, empirical investigation had only explored developmental changes in effort and ability understanding when children were asked to apply this knowledge to academic tasks (see Nicholls, 1978). The first experiment carried out in this thesis examined

the developmental changes involved in effort and ability understanding when children were asked to apply their conceptual knowledge to physical tasks. The developmental pattern which was revealed was then compared with that demonstrated previously by Nicholls (1978) when children were asked to discuss performance outcomes on academic tasks. Results of this investigation indicated that this conceptual understanding progresses through the same four hierarchically ordered levels, regardless of whether children are asked to apply their knowledge to academic or physical tasks. Similar to Nicholls' (1978) finding, different levels dominated between certain age ranges. For instance, the majority of children tested who displayed level one reasoning, located at the base of the hierarchy, were between four and six years of age. Considerable support was provided for Nicholls' (1978) suggestion that chronological age can indicate only the approximate level of conceptual development which has been achieved. This was demonstrated by variation in the levels of conceptual understanding achieved by children of the same chronological age. For example, one nine year old child had already achieved level three reasoning, some were still found to reason at level one, whereas the majority of nine year olds were found to reason at level two of this continuum.

Findings of recent research which explored children's effort and ability understanding in the physical domain (see Smith & Whitehead, 1994; Walling & Duda, 1994) are congruent with those in this study. Smith & Whitehead (1994) examined conceptual development in 31 boys aged between 8 and 13 years. The subjects were shown videos of two children taking basketball shots whilst expending different amounts of effort. As in Nicholls' (1978) study, both models were shown to score the same or the model who expended the least effort was shown to score more than the model who displayed the greatest effort input. Children's responses to interviews about the videos indicated that their reasoning about effort and ability demonstrated the same developmental trajectory which was revealed previously when children were asked to apply their knowledge to academic tasks (see Nicholls, 1978). Their results revealed that the different levels of understanding dominated the same age ranges, whether reasoning is applied to academic or physical tasks. The present research has extended this study to include both younger subjects and female subjects. Smith & Whitehead (1994) did suggest that future research should examine younger children's understanding of these concepts and that children should be asked not only to discuss performance

outcomes on either physical or academic tasks but on both academic and physical tasks. The present author also makes this recommendation following the investigation into children's effort and ability understanding in relation to physical tasks which is described in Chapter Two. Walling & Duda (1994) did adopt this approach in their recent study of the developmental changes which are involved in this conceptual understanding. They asked 144 male and female subjects aged between 5 and 13 years to discuss performance outcomes on both academic and physical tasks. In both contexts the children were shown films of two children applying unequal effort whilst scoring the same, or during which the child applying less effort scored higher than the harder working one. In the academic context the children were seen performing maths problems and in the physical context the task involved throwing beanbags at a target. Walling & Duda (1994) then compared the children's responses to interview questions about the two sets of films. As did Smith & Whitehead (1994) and findings from the present research, they revealed that children's understanding about effort and ability concepts progresses through the same four levels of reasoning, regardless of whether they are asked to apply their reasoning to academic or physical tasks.

Walling & Duda (1994) also revealed a fifth level of this understanding which precedes the original four levels and which included children who did not recognise who was the hardest working child in the films which they were shown and who did not refer to effort or ability in their verbal responses. The present study did not identify a similar level of understanding but the proposal that such a level exists does seem valid, although further investigation is obviously required into this issue. The present study would support a proposal of this nature as some children who were questioned, whilst they did refer to ability and effort, attributed higher effort input to the wrong child in the films. It does appear likely that some children may be experiencing a level of conceptual development during which effort and ability understanding is even less sophisticated than that demonstrated by children at level one, as Walling & Duda (1994) suggest. Although their study does extend that of Smith & Whitehead (1994) by the inclusion of children of both genders and those below the age of 8 years, and by asking children to discuss outcomes on both academic and physical tasks, an American subject group was presumably employed. Therefore, the present investigation, which employed British children as subjects provided support for the cross-cultural validity of these findings.



As development is seen by many theorists (for example, Baltes, 1987) as a life-long process, it is unlikely that the development of effort and ability understanding ceases with the achievement of level four reasoning. An interesting question to address would be whether, as can be suggested from the theoretical approaches adopted by, for instance, Baltes (1987), this conceptual development continues beyond adolescence when, in Piagetian terms, the final stage of cognitive structuring is achieved.

#### **8.2.4. Young children's beliefs about various achievement-related constructs and their achievement-related behaviour**

Young children's behaviour on a motor task was examined to assess the levels of personal challenge which they prefer to adopt. The present research hypothesised that when children were offered variable payoffs for successful performances on a motor task, they would demonstrate realistic levels of challenging, or, risk taking behaviour. This hypothesis was based on the following properties of variable payoff systems which: emphasise task difficulty level; associate higher incentive levels with difficult tasks; increase opportunities to assess personal competence, and offer opportunities for the individual to demonstrate their competence. It was proposed that variable payoffs would allow young children to effectively combine the success-incentive and expectancy functions to select levels of task difficulty which presented them with appropriate levels of personal challenge. In experiment five, two groups (reward and no reward) of young children performed a motor task. The risk taking behaviour of these two groups of children was compared, and, as expected, by the final trial of testing, children who were offered variable payoffs exhibited more realistic risk taking behaviour than those who were not. It was concluded that children appear able to combine the success-incentive and expectancy functions to employ realistic risk taking strategies and select appropriate levels of personal challenge when they are offered variable payoffs for successful task performances. These have generally been considered to be sophisticated cognitive operations which are beyond the capabilities of young children.

Children's ability to accurately assess their own competence was also investigated using this risk taking paradigm. The experiment described in Chapter Four which examined young children's behavioural responses to manipulated performance information when the outcomes of their performance attempts were made salient, provided some indication that young children possess fairly accurate knowledge of the level of their own competence in relation to different levels of task difficulty. These young children, when offered rewards for successful performance attempts to increase the salience of their performance outcomes, appeared to be reluctant to challenge themselves, even when performance information indicated that success on the task could be easily achieved. The nature of the reward system was such that the reward available was fixed, regardless of the level of difficulty on which success was achieved. By selecting easy levels of task difficulty, these children appeared to recognise that performing easier levels would increase their chances of receiving reinforcement as these levels require relatively less competence for their successful completion than more difficult levels of the game. If young children possess an understanding of the competence required to result in success on different levels of task difficulty, as these results suggest, it is possible that they understand whether or not their own competence level matches that required by the level of task difficulty attempted. "Easy" and "difficult" task definitions require an assessment of resources available, therefore suggesting that the individual possesses the capacity to accurately assess their competence in relation to task requirements. These results support previous evidence produced by Stipek & Tannatt (1984) concerning the child's knowledge about variables such as relative task difficulty and the criteria they employ to evaluate ability. They revealed that, unlike conclusions from previous research (for example, Nicholls, 1978), kindergarten and first grade children did compare performance levels and consider task difficulty when making judgements about individuals' levels of achievement. Many of the pre-school children also employed task difficulty criteria and social norms when substantiating their judgements. In accordance with the present findings, these results indicate that young children do possess some understanding that greater ability is required to succeed on difficult than on easy tasks. Stipek & Tannatt (1984) do comment however, that their results are not directly comparable with those of previous research, for instance, Nicholls (1978). Stipek & Tannatt (1984) used a qualitative interview based methodology whereas previous research has mainly employed quantitative methodologies. Differences in methodology also limit the extent to which the present findings and those of Stipek & Tannatt (1984) are directly comparable.

Findings from the present research which provide information about young children's knowledge of relative task difficulty are based mainly on measurement of their behaviour, which reflects a more quantitative approach. Stipek & Tannatt (1984) also suggest that the mature beliefs which the children in their study exhibited could be attributed to the strong academic orientation of the school which the subjects attended and to the fact that these children provided ratings about classmates with whom they were very familiar whereas other studies have asked children to make their evaluative judgements about unfamiliar children.

By examining young children's level choices in the absence and presence of a variable payoff reward system, further support was provided for suggestions made previously that young children possess the capacity to accurately assess their own competence. With the incentive of a variable payoff system, young children selected task difficulty levels which presented them with optimal levels of challenge in relation to their own task competence, unlike those who were not offered similar rewards. The realistic risk taking behaviour demonstrated by children in the reward group simultaneously provides further support for the proposal that young children are capable of accurately assessing their personal competence. To engage in realistic risk taking behaviour requires knowledge of the competence needed for successful task completion (Heckhausen, 1984). If an individual possesses this knowledge it can be logically inferred that they recognise whether or not their competence matches the level required to achieve success on the task. Hence, it appears that, given the present circumstances, young children are capable of providing accurate assessments of their personal competence on a motor task. Their behaviour indicates an understanding of the competence required to successfully complete different levels of task difficulty and whether or not their own competence level matches that required by the level of task difficulty attempted. This behaviour also suggests that young children possess the capacity, which they can effectively employ in the presence of a variable payoff system, to understand the association between incentive value of success and level of task difficulty.

### **8.2.5. Methodological concerns when assessing young children's conceptual understanding**

Previous discussion suggested that young children possess only a limited capacity to verbalise their understanding about abstract constructs such as ability in a form which can be interpreted from an adult perspective. It was also proposed that developmental differences in construct interpretation influence the way in which subjects', particularly young children's, responses to interview questions are interpreted, and the conclusions which are drawn from their responses. The present research findings seem to suggest that in an appropriate environment, young children can demonstrate developmentally-advanced achievement-related understanding and behaviour. In order to yield findings which accurately reflect young children's achievement-related understanding and behaviour, revision of both commonly employed methodologies and assumptions is required.

Considering children's limited capacity to verbalise their beliefs and the problems associated with developmental differences in construct interpretation, it seems that verbal interview-based methodologies may not be the most suitable for assessing young children's beliefs about ability and related constructs, however carefully they are conducted.

Based on the findings of previous research which are discussed in Chapter Five, it was suggested that observing children's behaviour may represent a more suitable method of investigation than verbal interview-based methodologies as this method does not rely on the child's language development and developmental differences in construct interpretation are not encountered. The efficacy of this proposal was examined in an experiment which is described in Chapter Seven in relation to young children's perceptions of their own competence on a motor task and their understanding of relative task difficulty and the incentive value of succeeding at these different levels. Research which has employed behavioural measures of perceived competence has indicated that young children are capable of assessing their own competence, for example, Majeres & Timmer (1981) and Fazey & Evans (1994). Other empirical investigations, for example, Stipek et al (1984) have indicated that providing the child with an incentive to accurately assess competence produces a context in which accurate competence estimates can be obtained. Verbal measures taken in a context which does not provide the child with an incentive to accurately assess their competence may not elicit responses from children which accurately reflect their beliefs about their own competence.

This study used a behavioural measure in a context in which it was in the child's own interest to judge their competence accurately, enabling young children to provide accurate assessments of their own competence on a motor task. It appears that the inaccurate competence perceptions revealed by previous research may reflect the verbal measures which they have employed and the lack of incentive for the child to make accurate judgements of their own competence rather than the child's cognitive limitations. This result supports the findings of studies conducted by Fazey & Evans (1994) and Majeres & Timmer (1981) and statements made by authors such as Nicholls (1984) and Butler (1990) who suggest that young children can provide accurate estimates of their own competence.

Children's behaviour also indicated that they can, given the correct circumstances, demonstrate fairly advanced understanding of task difficulty and the incentive value of success on different levels of task difficulty. Results of the present experiment would perhaps have received further support if an additional group had been included to provide verbal assessments of their competence on the task. The accuracy of this group's competence perceptions could then be compared directly with the accuracy of those provided by children in the remaining two groups. Further empirical evidence is required to support the proposal made in this thesis that behavioural measures can be employed to accurately assess young children's conceptual understanding.

The researcher's assumptions about the results they will find also need to be acknowledged in this revision of methodology. These assumptions are likely to affect both the experimental design which is employed and the manner in which the researcher subsequently interprets their findings. For example, by presenting individuals with explicit effort cues when assessing their understanding of effort and ability, it seems that the researcher is imposing their own assumptions about how individuals at different developmental levels will use this construct as an explanation for performance outcomes. This thesis underlines the importance of not unquestioningly accepting the assumptions made by other researchers or even the assumptions which determine our own research design. The finding that effort is not the predominant explanation for outcome chosen by young children was a

surprising result in experiment three and calls into question inferences drawn from work which has investigated the effort/ability concept development. In situations where young children have been offered (and expected to use) explicit effort cues in a task performance, they have complied. This research suggests that the young child's use of effort may not reflect their actual understanding of this construct, but instead, the focus of their attention, as defined by the experimenter's own assumptions. Experimental designs would demonstrate greater validity if they were constructed to disprove rather than prove the experimenter's assumptions. The way in which verbal responses are interpreted also depends on the experimenter's assumptions about how an individual at a particular developmental level construes the concepts they are discussing. Interpretations and subsequent conclusions may reflect these assumptions and may not accurately reflect the individual's, young children's in particular, understanding of the concepts under discussion. The fact that the adult experimenter possesses an understanding of ability which differs from the child's also confounds this issue. The adult experimenter bases their conclusions about the nature of children's statements on their own criteria for judging this construct. This can provide information about the child's capacity to verbalise their understanding in a form which is interpretable from an adult perspective of ability but makes assessment of the child's capacity to verbalise their beliefs about ability based on their own criteria more difficult. The problems with *a priori* assumptions are exemplified by the present thesis in the experiment which is described in Chapter Four. The criteria which were employed to allocate children to their different experimental groups, although initially appearing appropriate for this purpose were subsequently questioned. Basing criteria for group allocation on previous research findings may perhaps have been erroneous and may have contributed towards the non significant findings which were produced by this investigation.

#### **8.2.6. The stability and instability of different developmental periods of effort and ability understanding**

The second approach to developmental changes in effort and ability understanding assessed whether or not this conceptual understanding demonstrated a pattern of developmental change which is described by a number of theorists. Such theorists include Fogel & Thelen (1987), Piaget, Gesell, Kelly (1955) and Erikson. All these theorists share a common view on one aspect of the nature of developmental change, describing this as a process which involves alternate

periods of stability and instability. This approach to development provided the theoretical basis for examining developmental changes in effort and ability understanding. Chapter Four described an experiment which examined whether or not this theoretical approach could be applied to the developmental continuum demonstrated by the child's changing beliefs about effort and ability. It was suggested that levels one and four of effort and ability understanding represent stable periods of this conceptual development whilst levels two and three represent unstable periods.

Findings from this experiment provided only limited support for the hypotheses. Although children at levels one and four exhibited behaviour which could be more easily predicted than that exhibited by children who had achieved levels two and three, statistical analyses did not demonstrate conclusive evidence in support of the proposals made. Although an appealing suggestion that theoretical proposals about stability and instability can be employed to describe the developmental changes involved in effort and ability understanding, the method which was used does not appear to be sufficiently sensitive to detect these possibly small, transitory and bi-directional shifts in stability. Explanations for this limited support and possible directions for future research which explores this issue are discussed below.

It may be that present proposals concerning the stability and instability of the different levels of this conceptual development are incorrect. It could prove more fruitful to examine the behaviour of children who have achieved levels two and three independently from each other. This would enable an assessment of the stability of each individual level of this understanding which may indicate that levels two and three demonstrate differential levels of stability. Treating children who have reached these two levels as the same group in the experiment described in Chapter Four may have obscured any differences which exist between the stability of these two levels of understanding.

As was discussed previously in Chapter Three, many developmental theorists suggest that a period of disequilibrium is required for developmental change to occur. During this period, the organism must reduce the dissonance experienced between internal and external information to restore equilibrium and achieve a higher developmental state. Piaget discusses cognitive development involving a shift from stability at a lower developmental state to an unstable transition period during which internal and external information are no longer congruent, to a stable period at a more advanced developmental level where experienced conflicts between internal and external information are now resolved. Other theoretical perspectives, for example, Dynamic Systems Theory (Fogel & Thelen, 1987) also view deviation from a stable to an unstable state as a prerequisite for change. Considering the instability which individuals experience between different developmental states, it seems likely that these transition points represent periods of instability whereas stable periods are experienced during different levels of this conceptual understanding. In dynamic systems theory terms, the control parameter which effects this movement from stability to instability and through to further stability can be either internal or external to the individual. Stipek & Tannatt (1984) state that the nature of feedback provided to children in their educational environment changes quite markedly from one grade to another. They also claim that changes in the child's cognitive processing abilities which occur between four and eight years of age should influence how they process and interpret this feedback. The nature of received feedback and the way in which it is processed by young children represents a possible control parameter which is involved in developmental changes in children's understanding of effort and ability. It is possible that identifying periods of effort and ability understanding which demonstrate differential stability requires an examination of the transition points experienced between two adjacent levels. The four levels of effort and ability understanding may represent stable stages of this conceptual development whereas unstable stages may be experienced during the transition points between different levels. Future research should identify children who are currently experiencing these transition periods in addition to different levels of this conceptual understanding. The behavioural predictability of these children can then be examined to determine whether or not effort and ability understanding does demonstrate alternate periods of stability and instability, during levels of understanding and transition points between these levels, respectively.



It is possible that children who have achieved levels one and four of the continuum of effort and ability understanding, although at relatively more stable levels than those experiencing levels two and three, may not have reached sufficiently stable levels of this conceptual development to demonstrate behaviour which would support the predictions made. Adults may represent a group which has reached a sufficiently stable level of this conceptual understanding to exhibit behaviour which more closely matches the present predictions. An examination of the behavioural predictability of adults in response to context manipulations could be carried out to examine the validity of this proposal.

Although the children's levels of effort and ability understanding were assessed empirically and using a procedure which has previously been validated in current investigations, the possibility remains that some of the children were classified at the wrong level of conceptual development. This comment is particularly apt in the light of findings discussed in Chapter Two which indicated that, in some circumstances, children do use ability-related statements as explanations for performance outcomes at an early age. The inclusion of children who were perhaps wrongly classified could have obscured any effects resulting from the behaviour of children who were allocated to their correct experimental group.

Children were allocated to their experimental groups on the basis of the proposed stability of their conceptual schemata. These proposals were based on criteria suggested by both Nicholls' research (1978) and results of the initial experiment conducted in this thesis. Although these criteria did appear to be suitable, considering the findings from experiments two and three, these classification criteria may not have been wholly appropriate. For instance, experiment two examined young children's use of effort and ability in their verbal explanations for performance outcomes on physical tasks. Suggestions were made on the basis of their verbalisations about how these young children perceived the meaning of ability in relation to effort. It was proposed that very young children may not perceive effort and ability as interrelated concepts but instead as distinct from each other. Therefore, basing proposals about schema stability at different levels of effort and ability understanding on the findings of previous research may have resulted in incorrect proposals. Considering the findings of experiments two and

three, the child's schema about effort and ability requires further investigation to clarify exactly how young children perceive these concepts and the relationships between them. The proposals made about schema stability may have been erroneous and behavioural predictability may not have matched *a priori* proposals as a result of employing incorrect criteria as the bases for proposals about schema stability.

However, children's use of effort and ability in their verbal explanations for performance outcomes did demonstrate domain specificity. Results of experiments two and three revealed that they appear to be capable of employing ability in their verbal explanations for performance outcomes on academic but not on physical tasks. In the light of this domain specificity, if the relative stability of different levels of effort and ability were re-examined, the criteria for classifying children into their experimental groups may need to be re-assessed. If future research was to examine the stability of effort and ability understanding concerning academic tasks, different criteria may be required to both classify children to their experimental groups and to make proposals about the stability of their schemata. As young children have been shown to be able to verbalise their ideas about academic ability, their schema may not be as stable as was previously suggested. A different method to that which was based on Nicholls' (1978) procedure to assess effort and ability understanding and which presented the children with explicit effort cues may prove more appropriate for allocating children to their experimental groups. The above proposals relate at present only to research which examines the stability of effort and ability understanding in the academic domain. Research which investigates this issue in relation to children's understanding of these concepts in the physical domain does not necessitate the adoption of different criteria on which to base group allocation and proposals about schema stability as no ability-related explanations were provided in relation to performance outcomes on physical tasks. It seems that if the domain specificity of these beliefs can be resolved then this will indicate whether or not these criteria require alteration to investigate the stability of children's effort and ability understanding in the physical domain.

As mentioned previously in Chapter Two, a fairly common occurrence was that children exhibited characteristics of two adjacent levels of reasoning but that they were then classified according to which one appeared to dominate their reasoning. It is likely therefore that a child undergoing a transition phase between levels three and four could have been classified as experiencing level four. Therefore the instability of their behaviour may have confounded the results if transition periods do represent periods of instability, as is suggested above.

Generally, this thesis has revealed that young children's conceptions of achievement-related constructs are more sophisticated than has been previously presumed. Young children appear to be capable of: employing academic ability as a referent in their verbal explanations for performance outcomes; accurately assessing their own competence under certain circumstances, and adopting challenges which are appropriate for their skill level by utilising accurate judgements about task difficulty level and the probability of success on different tasks. It has also demonstrated that, as is well known, methodological concerns are particularly salient in research with young children and researchers must be prepared to challenge both their own and others' assumptions.

### **8.3.1. Implications for practice**

Experiment one demonstrated the developmental changes which are involved when children apply their knowledge of effort and ability to physical tasks. Similar age boundaries to those suggested by Nicholls (1978) were observed between the four levels. However, considerable variation was demonstrated in the level of understanding achieved by individuals of the same chronological age suggesting that chronological age, is not an accurate predictor of level of conceptual development. These individual differences in conceptual understanding must be recognised in instances where the child's beliefs about effort and ability may influence their motivation to participate and achieve, for example, when providing children with feedback about their performance attempts in terms of effort expenditure and ability level. Feedback received from significant others is a major influence on the individual's subsequent participation in an activity (Vallerand & Reid, 1984), particularly where young children are concerned (Horn & Weiss, 1989). Practitioners working with children should therefore provide the child with

feedback information which is congruent with the child's own schema of beliefs about effort and ability to facilitate their continued participation and motivation. Identifying developmental level is not an easy task, as has been demonstrated in this thesis, but a sensitivity to both behavioural and verbal cues is important.

Findings from experiments two and three raised concerns about the suitability of different methodologies for assessing the nature of young children's conceptual understanding. The developmental differences in construct interpretation and verbalisation which were revealed by these studies indicated that using verbal measures may not be the most appropriate method of assessing young children's understanding. Verbal measures rely on construct interpretation and a capacity to verbalise the constructs under investigation. To obtain an accurate assessment of the young child's understanding there must be congruence between the adult experimenter's and the child subject's interpretations of the constructs involved. As behavioural indices ameliorate the problems associated with verbal measures they may represent a more suitable method of assessing young children's conceptual understanding. Results of experiment five supported the suggested efficacy of behavioural measures for assessing young children's beliefs about their own level of motor competence. When a behavioural measure was employed in conjunction with an incentive for the child to accurately assess their own motor competence, young children did provide accurate estimates of this measure. It appears that the overestimated competence perceptions revealed by previous research may be attributable to limitations of the methodologies which these studies have employed rather than limitations of the child's cognitive capacity.

Domain specificity of young children's beliefs about ability in relation to effort and their capacity to verbalise these beliefs was also revealed by current investigations. This finding demonstrates the multidimensional nature of developmental change and supports previous claims, for example, Duda (1987), that achievement-related beliefs in one domain may not always mirror those exhibited in other competency domains. As a result, further evidence is provided to support previous statements that empirical investigations which examine children's conceptual understanding must consider each domain separately.

Experiment five also investigated the present proposals that a variable payoff system would encourage young children to demonstrate realistic risk taking strategies and adopt appropriate levels of personal challenge. As predicted, more realistic risk taking behaviour was exhibited by children who were offered variable payoffs for successful task performances than by those who were not. This finding has implications for the type of reinforcement schedules which should be offered to young children. The motivational and performance advantages of realistic risk taking have been demonstrated (for example, Atkinson, 1957), and the present study has indicated that variable payoff systems will stimulate children to choose task levels which represent levels of challenge and risk appropriate for their ability level. If, in educational settings, children were offered variable rather than fixed payoffs they may be more likely to select tasks which present them with appropriate levels of personal challenge. The fixed payoff system which was employed in the experiment described in Chapter Four reduced the children's willingness to take risks. This suggests that such a reward system, which is commonly employed in educational settings, may not be the most effective method of encouraging children to attempt tasks which present them with optimal levels of personal challenge. Perhaps this could be offered as an explanation for the declines in positive self-evaluations which are commonly observed during the early school grades (for example, Stipek, 1984). If young children receive the same amount of reward for successfully completing tasks of different levels of difficulty, it is likely that they will select tasks which do not present a challenge, when extrinsic rewards are involved, as these tasks present the highest likelihood of obtaining reinforcement. By attempting tasks which do not present them with a challenge, the children are then effectively reducing their chances of improving upon their present level of mastery. This lack of skill improvement could then contribute towards the child's declining perceptions of competence and positive self-evaluations.

#### **8.4.1. Conclusion**

This research has provided information about issues concerned with young children's achievement-related understanding and behaviour and has highlighted various problems associated with research which investigates very young children's conceptual development. Experiments which explored the

developmental changes involved in effort and ability understanding demonstrated that knowledge of these concepts can be generalised from the physical to the academic domain (lending support to recent research which explored this issue by Smith & Whitehead, 1994 and Walling & Duda, 1994), but in some instances this conceptual understanding does display domain specificity. Although the progression of this conceptual development which was revealed when children were asked to apply their understanding to physical tasks mirrored that previously demonstrated when they were asked to discuss academic tasks (Nicholls, 1978), domain specificity of young children's use, and possibly their understanding of, ability as a cause of outcomes was revealed. These findings underline the need for separate consideration of different competency domains and for future research to examine the domain specificity of children's use, and their understanding, of ability in relation to performance outcomes. Explorations of young children's use, and their understanding, of ability, their perceptions of their own competence and their risk taking behaviour suggested that they may possess fairly advanced knowledge about the following: personal competence and its relationship with task difficulty; the incentive value of success on different levels of task difficulty; how to optimise success levels through appropriate task selection, and the existence of the concept of ability. However, these same experiments also highlighted the limitations involved when investigating young children's conceptual development. These appear to derive mainly from developmental differences in construct interpretation and reflect the limitations of the child subject, the adult experimenter and the methodologies which are commonly employed in this research. The child has difficulties verbalising their understanding of abstract constructs in forms which are interpretable from an adult perspective. This is exacerbated by employing methods to investigate this understanding which require the child to verbalise their beliefs and by the adult's interpretation of the child's responses from their own developmental perspective and the imposition of their *a priori* assumptions on the experimental design. Although providing encouraging information about the level of understanding which young children appear to have achieved, findings from this thesis also indicate that caution is required to avoid the inherent complications involved in attempts to further understand young children's conceptual understanding.

## **Appendix**

### **Film 1:**

I'm going to show you a film of two children playing a game. The film will show you how they both play this game. What they have to do is stand behind this line and throw beanbags into this hoop. They have a minute to see how many beanbags they can throw into the hoop.

[Questions were then asked to assess whether the subject understood the requirements of the game]

Now, I'll put these cards here to show you that they both threw 10 beanbags into the hoop. This is a pretty good score.

[The subjects were then asked whether the children scored the same or differently and whether they'd done well or not]

Now, let's watch the film where they both got 10 beanbags in the hoop. You look and see if you think one is better at this game and if one tries harder or not. Think about two things. Does one try harder and is one better at this game?

### **Film 2:**

Let's watch another film of the same children playing a different game. This time they have to stand behind the line and throw beanbags into this bin. They have to see how many beanbags they can throw into the bin in a minute.

[Questions were then asked to assess whether the subject understood the requirements of the game]

I'll put these cards here again to show you that this time they both scored 2, they both got 2 beanbags in the bin, which is a pretty poor score.

[The subjects were then asked whether the children scored the same or differently and whether they'd done well or not]

Now, let's watch the film where they both got 2 beanbags in the bin. You look and see if you think one is better at *this* game, forget about the other one, and if one tries harder or not. Think about two things. Does one try harder and is one better at this game?

### **Film 3:**

The last game is a bit more complicated so listen carefully, then we'll watch the film of how the two children play this game. Again, they have to stand behind the line and throw beanbags at this target. If the beanbag lands in the middle of the target they score 3 points, if the beanbag lands in the next circle, they score 2 points, and if it lands on the outside circle they score 1 point. They have to score as many points as they can in a minute.

[Questions were then asked to assess whether the subject understood the requirements of the game]

I'll put these cards here again to show you what they scored on this game. This girl/boy scored 24 which is a really good score. This girl/boy only scored 6 which is not a very good score.

[The subjects were then asked whether the children scored the same or differently and whether they'd done well or not]

Now, let's watch the film where she/he scored 24 and she/he only scored 6. You look and see if you think one is better at *this* game, forget about what happened in the other games, and if one tries harder or not. Think about two things. Does one try harder and is one better at this game?



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### Reference note

1. Personal communication from Nicholls (July, 1992)

developmental changes involved in effort and ability understanding demonstrated that knowledge of these concepts can be generalised from the physical to the academic domain (lending support to recent research which explored this issue by Smith & Whitehead, 1994 and Walling & Duda, 1994), but in some instances this conceptual understanding does display domain specificity. Although the progression of this conceptual development which was revealed when children were asked to apply their understanding to physical tasks mirrored that previously demonstrated when they were asked to discuss academic tasks (Nicholls, 1978), domain specificity of young children's use, and possibly their understanding of, ability as a cause of outcomes was revealed. These findings underline the need for separate consideration of different competency domains and for future research to examine the domain specificity of children's use, and their understanding, of ability in relation to performance outcomes. Explorations of young children's use, and their understanding, of ability, their perceptions of their own competence and their risk taking behaviour suggested that they may possess fairly advanced knowledge about the following: personal competence and its relationship with task difficulty; the incentive value of success on different levels of task difficulty; how to optimise success levels through appropriate task selection, and the existence of the concept of ability. However, these same experiments also highlighted the limitations involved when investigating young children's conceptual development. These appear to derive mainly from developmental differences in construct interpretation and reflect the limitations of the child subject, the adult experimenter and the methodologies which are commonly employed in this research. The child has difficulties verbalising their understanding of abstract constructs in forms which are interpretable from an adult perspective. This is exacerbated by employing methods to investigate this understanding which require the child to verbalise their beliefs and by the adult's interpretation of the child's responses from their own developmental perspective and the imposition of their *a priori* assumptions on the experimental design. Although providing encouraging information about the level of understanding which young children appear to have achieved, findings from this thesis also indicate that caution is required to avoid the inherent complications involved in attempts to further understand young children's conceptual understanding.