Age-related differences in young children's understanding of ability in achievement situations.

Peter J. Gantous
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AGE-RELATED DIFFERENCES IN YOUNG CHILDREN'S UNDERSTANDING OF
ABILITY IN ACHIEVEMENT SITUATIONS

by

Peter J. Gantous

B. Sc. McGill University, 1984

A Thesis
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ABSTRACT

The present study was concerned with age-related differences in young children's understanding of ability in achievement situations. A mature concept of ability was assumed to be demonstrated by the inverse compensation of ability ratings with effort information for a given outcome. Specifically, a child was considered as utilizing a mature concept of ability if she/he, viewing equally successful performance by two people, rated the one trying less hard as possessing greater ability. For this purpose, 20 boys and 20 girls from each of kindergarten and grade 2 were presented with information about sets of two actors similar in age and sex to the subject, one described as having exerted high effort and the other low effort on a competitive task. Test stimuli were varied along combinations of three variables: success, both actors or only the low-effort actor succeeding; presentation-type, verbal or pictorial with instructions to not consider the viewed experience as having increased ability; task, academic (math) or physical (ring toss). Children were asked to rate actor-pairs for ability on a 5-point scale and to offer explanations for the observed relative effort and outcome. The effects of inferred ability on actor preference and inferred actor satisfaction were also investigated.

Results with regard to ability estimates were not unequivocal. Kindergarten and grade 2 children in the equal condition and kindergarten children in the verbal condition were found to rate the high-effort actor significantly higher in ability. A non-significant trend in the opposite direction was found for grade 2 children in the pictorial condition. When ability estimates were analyzed simply with respect to the frequencies of the directions of difference between actors' ratings, however, the majority
(68.8%) of grade 2 children in the pictorial condition were found to rate the low-effort actor higher in ability. In a competitive situation under conditions aimed at reducing memory demands, children as young as in the second grade may be able to approach achievement situations in terms of maximizing perceived self-competence and not simply effort. The highest proportion (33.8%) of explanations making reference to inverse compensation were also offered by grade 2 children in the pictorial condition, and almost all of these children (92.6%) rated the low-effort actor higher in ability. Grade 2 children in the pictorial condition displayed the greatest consistent preference (65.0%) for the low-effort actor. The majority of these children (71.2%) also rated the low-effort actor higher in ability. With regard to inferred actor satisfaction, kindergarten and grade 2 children in the verbal condition and kindergarten children in the pictorial condition rated the high-effort actor as happier. In contrast, grade 2 children in the pictorial condition rated the low-effort actor as significantly happier. In addition, substantial positive correlations (averaging $r = .623$) were found between emotion and ability estimates across grade, condition and direction of difference of ability ratings. Emotion ratings appeared to parallel ability estimates more closely than actor-effort. Subject's sex and the type of task viewed had little effect on any analyses.
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Finally, I would like to dedicate this study to my dearest friend and wife, Kathy. Her patience, support, understanding and humour have been, and continue to be, a source of joy during the best of times and strength during the worst. I would also like to thank my parents for their interest and constant encouragement and support in my studies.
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CHAPTER I
INTRODUCTION

The present study was concerned with age-related differences in young children's understanding of the concept of ability. A large body of research involving achievement behaviour has emerged over the past decade attempting to establish the developmental progression of children's differentiation of the concept of ability with varying results (Surber, 1984). Several authors (e.g., Dweck and Elliot, 1983; Jagacinski and Nicholls, 1984) have proposed that one's understanding of ability as it relates to effort and outcome is crucial to achievement motivation and behaviour. Most researchers have proceeded from the point of view of ability consistent with that of Heider (1958). Specifically, a mature concept of ability would be demonstrated by the capacity to understand outcome as a function of the proportional combination of ability and effort data, namely Outcome = f(Ability x Effort). As such, given a consistent outcome, the facilitative causes of ability and effort would follow a schema of compensatory, or inverse, covariation (Heckhausen, 1982). For example a child would be considered to have a mature concept of ability available if, in viewing equally successful performance by two persons, she/he judged that the one having to try less hard possesses greater ability on the given task. Ability is thus seen as capacity, not observed directly, but inferred, and also differentiated, from performance level. A more detailed discussion of the development of the role of attribution in achievement behaviour can be seen in a review of the literature in Appendix A.

A central goal of the study of achievement behaviour with children has been constructing learning environments in which each child is most likely to
maximize his or her potential. The characteristics of the learning environment, however, may need to vary as a function of the level of ability children are utilizing. For example, if high effort implied high ability to one child, then focusing on the child’s high effort would tend to be reinforcing. Conversely, if high effort implied low ability, then focusing on high effort might tend to be considered negative feedback. The present study attempted to clarify whether young children were able to utilize a mature concept of ability and, if so, under what conditions.

Several investigators, most notably Nicholls (1978) and Kun (1977), have proposed progressive levels of development of ability judgement which culminate in a mature conceptualization of ability between 10 and 12 years of age (Heckhausen et al., 1985). Surber (1984) has suggested that these estimates are unduly high due to methodology requiring memory demands which may have interfered with younger children’s performance.

To demonstrate the effect of differing memory demands on ability judgements, Surber (1984) compared the methods and results of studies by Kun (1977), Surber (1980) and Karabenick and Heller (1976). In each case, children were presented with outcome and effort data and asked to make ability inferences. Their methods differed in terms of the memory demands placed on the children. Different proportions of a mature concept of ability were found across the studies, however, no differences were found between the proportions used by kindergarten to fifth grade children within each. Kun (1977, Study 1) presented first, third and fifth grade children with line drawings of characters described verbally in nine graded situations varying with respect to three levels each of performance and effort and asked them to rate the characters for ability. The children tended to vary ability positively with effort. Surber (1980) employed procedures similar to Kun's
(1977), showing line drawings. Surber's drawings, however, depicted relevant effort and performance, requiring less memory for the data from subjects, while Kun's did not. Surber found a higher proportion of kindergarten, third and fifth grade children utilizing the inverse compensation rule than Kun. Finally, Karabenick and Heller's procedure was proposed to carry least memory demands. They had subjects in the first, third and fifth grades and college students make judgements of ability regarding pairs of line-drawn characters, one described as having exerted high effort, the other as low-effort, with both having succeeded at a puzzle task. All age groups made a significantly greater proportion of total inverse compensation choices than chance with 72%, 79%, 69% and 94% of the first grade through college students choosing the low-effort actor respectively. Furthermore, 60.4% of the children chose the low-effort actor as having higher ability across two identical trials of the experiment.

In summary, Surber (1984) suggested that young children are more likely to judge ability from effort and outcome data consistently with a schema of inverse compensation when the memory demands of the task are limited. Surber added that part of the difficulty in determining developmental levels of inverse compensation is that its use varies within age groups. Therefore, combining ability estimates within an age or grade level, those children rating ability positively and negatively with effort would be averaged, thus obscuring results.

In contrast to the above studies, Nicholls (1978) has proposed a developmental progression of ability inferences through the grade school years which is well accepted in the literature (Heckhausen, 1984). The procedure employed by Nicholls is somewhat different than that of the other researchers mentioned previously. In an attempt to provide an unambiguous
and natural display of effort and performance cues with which children could infer ability, Nicholls presented subjects with filmed episodes of pairs of children engaging in a mathematical task. In one instance, the children were equally successful with differing effort, in the other, the hard worker obtained a lower score. The hard worker was shown to spend all of a 90-second film time working on the task while the other child engaged in non-task behaviour for 50 of the 90 seconds. Dependent measures included questions as to which child tried harder, which was better at the task, and why the child who tried harder did not do better (or as well). Nicholls attempted to maximize the likelihood of children displaying inverse compensation by portraying conditions such that a belief that effort and ability covary positively would be directly contradicted. Nicholls found that 68.8% of 6-year-olds’ explanations fell in Level 1 of his hierarchic model (effort and ability not distinguished, the person trying harder is better regardless of success) and the remaining 31.2% fell in Level 2 (effort is seen as the sole cause of outcome). By eight years of age, children’s responses were categorized as follows: Level 1 - 12.5%, Level 2 - 87.3%, Level 3 - 18.8% (ability begins to be seen as a separate cause of outcome) and Level 4 - 6.3% (mature concept of ability). Children did not offer mature judgements 50% of the time until age 12.

Conclusions from Nicholls’ procedure are limited on three counts. First, the lack of specific information about effort allowed the children to adjust the relative strength of this variable for the actors. Second, introduction of the additional variable of non-task behaviour does not have predictable effects on children’s judgements. The child who does not spend the entire film performing the task may be inferred to have lower ability not because the actor showed lower effort, but because non-task behaviour may signify lack
of interest which a child may correlate with lack of ability. Once this type of judgement is made, a questioned child may seek to justify his or her reply using the most salient variable, i.e. effort. The third criticism centers on the fact that judgements were asked for solely on an academic task. Early grade-school children's unfamiliarity with academic tasks may interfere with optimal information processing of variables involved in ability judgements.

An additional factor which has been found to affect ability judgements in adults is the context within which it is set. It has been shown (e.g. Karabenick and Heller, 1976; Surber, 1980) that, while adults possess the most differentiated concept of ability, this does not guarantee its use. Jagacinski and Nicholls (1984) found that college students in a competitive situation (ego-involved) tended to use judgements based on this most differentiated concept. In self-referenced learning situations (task-involved), for example when evaluation against another was not encouraged, however, a less differentiated form of ability was utilized in which high effort implied greater eventual performance due to a greater increase in ability. If children's estimates of ability are affected in ways similar to that of adults, it would appear that framing the achievement situation in competitive context would be required.

The present research attempted to establish whether children as young as in kindergarten and grade 2 are capable of utilizing inverse compensation reasoning in achievement situations when judging ability from effort and outcome data. Factors addressed in the present investigation which have been found to influence children's ability ratings in past research include: the reduction of memory demands through the presentation of pictorial stimuli portraying effort and outcome data, no portrayal of non-task behaviour by the subjects requiring less effort to complete the task, informing children of
the actual level of effort exerted by each actor and presenting actors engaged in both an academic and physical task in a competitive situation. In addition, in order to avoid children considering the extra effort employed by actors during the competition as having increased ability, they were asked, in one condition, to estimate actors' ability before the competition began.

Subjects were comprised of an equal number of grade 2 and kindergarten boys and girls. They were asked to make judgements about two types of tasks: i) a ring toss game, and ii) age-appropriate arithmetic problems, under two presentation-types: 1) verbal, and 2) pictorial. In the verbal condition, outcome and effort were verbally presented, as in Kun (1977), with pictures of the actors' faces presented. The pictorial condition had performance and effort levels displayed photographically as well as verbally. Within each condition, subjects made two judgements about each of the following effort-outcome configurations: a) both actors able to complete the task successfully, but with one showing more effort; and b) only the actor showing less effort being able to complete the task successfully. Actors were described as each attempting to win a star for successful performance in front of their teacher and classmates. The pictorial condition incorporated additional controls, previously mentioned, for factors that might have detracted from the expression of children's highest level of ability judgements. Photographs displaying outcome and effort characteristics with which children were to make ability judgements were used to reduce memory demands and children were asked to estimate actors' ability before the competition began.

After viewing each set of photographs, children were asked several questions. First, subjects were asked which actor (neither, one or both) completed the task successfully. Any errors were further probed and
corrected. In addition, subjects were asked to rate each actor's effort ("How hard did X try?") and, again, errors were corrected. Following presentation of each type of effort-performance configuration, children were asked to make ability judgements for each actor (similar to Nicholls' 1978 study). They were also asked to offer an explanation for the relative effort and performance of the actors. Measurements were taken by asking children to mark their judgements on two separate 5-point physical scales of increasing size: larger circles for greater effort and larger squares for greater ability. It was expected that results would reveal that, under the pictorial conditions, second-grade children would display the ability to utilize an inverse compensation when judging ability to a greater extent than under the verbal condition. Also, it was expected that kindergarten children would show less ability to utilize inverse compensation across all conditions.

Additional data collected during the present study attempted assess the effects of inferred ability on young children’s preference of actor performance and inferred actor satisfaction. Several researchers (e.g. Brown and Weiner, 1984) have suggested that, in general, younger children tend to value high effort when judging others and would prefer to display high rather than low effort. In addition, it has been proposed (Weiner, 1974) that younger children derive the greater pleasure in achievement situations from perceptions of high effort and not high ability. By comparing children within each age-group who have demonstrated inverse compensation as opposed to those who have not, it was attempted to establish whether level of ability inferences affected these relationships. It was expected that for children who considered effort and ability positively related, the high effort actor would be chosen as more favorable and as experiencing greatest satisfaction. Since effort and ability ratings would be consistent, it would not be possible to
discern which of these was related to choice and satisfaction. For children in which low effort implied high ability, however, it would be possible to compare which, high effort or high ability, was most valued.
CHAPTER II

METHOD

Subjects

Eighty children, divided into groups of 20 males and 20 females, enrolled in each of kindergarten and the second grade participated in this study. Subjects were drawn from the English Catholic school system of Montreal, Quebec.

Materials

Test materials consisted of sets of pictures depicting kindergarten and second-grade boys and girls participating in either a ring toss or arithmetic activity, physical scales with which to measure ability, effort, and happiness with performance, and several verbally presented questions.

Pictures. A first set of pictures portrayed children engaged in a ring toss task. The ring toss set consisted of 4 solid-coloured (blue, yellow, orange and green) 6-inch (15.3 cm.) diameter rings, and a 6-inch (15.3 cm.) tall orange post and 4-inch (10.2 cm.) diameter yellow base, with all parts made of foam. Two pictures displayed each child ready to throw a coloured ring (different colour in each photograph). Remaining pictures portrayed varying results of three ring tosses (e.g. 3 misses, 2 misses and 1 on, etc.), examples of which can be seen in Appendix B.

A second set of pictures displayed grade 2 actors working on three, and kindergarten children on one, age-appropriate arithmetic problems similar to those found in their classroom textbooks. Each problem was presented in a vertical arrangement for grade 2 children and problems were placed equidistantly across a horizontal row on an 8.5 x 11-inch (21.7 x 28.1
cm.) sheet of paper. The problem was presented horizontally for kindergarten children. Five rows of the same problems were contained on each sheet to allow for a maximum of five attempts at the same problems per page. A copy of the problems can be seen in Appendix B. Two pictures portrayed each child with pencil to paper, seemingly involved in the task, on different locations of the page. As with the ring toss activity, remaining pictures showed various results of attempting the three problems (e.g. 3 wrong, 2 wrong and 1 right, etc.).

Pictures were mounted on a 22-inch (56.1 cm.) x 28-inch (71.4 cm.) cardboard sheet horizontally along the length with one set arranged across the upper half and a second across the lower half. Each picture was supported on the sides and bottom by a pouch the width of the the photograph's boarder. Pictures were rearrangeable allowing control over what performance is paired with a given child. All sets of pictures began with a face-on photograph of the particular child actor.

Physical scales. Ability and effort scales consisted of coloured, labeled, geometric forms made of construction paper. Ability was measured on a 5-point scale of increasing size squares, ranging from .75-inch (1.91 cm.) to 1.75-inch (4.46 cm.) edges at .25-inch (0.64 cm.) intervals. From smallest to largest, the squares were labeled: "Is not very good at all at it", "Is not very good at it", "Is good at it", "Is very good at it", and "Is very, very good at it". A copy of the scale can be seen in Appendix B. These squares were also differentially coloured green, blue-green, blue, indigo and violet respectively.

Effort was measured on a 5-point scale of increasing size circles, ranging from .75-inch (1.91-cm.) to 1.75-inch (4.46-cm.) diameters at .25-inch (0.64-cm.) intervals. From the smallest to the largest, circles were labeled: "Didn't have to try very much at all", "Didn't have to try very much", "
"Had to try", "Had to try very much", and "Had to try very, very much". A copy of the scale can be seen in Appendix B. The squares were differentially coloured red, red-orange, orange, yellow-orange and yellow respectively.

An additional scale, measuring subjects' estimates of actors' happiness with pictured performance, was also displayed on a 5-point scale. The scale consisted of five 3-inch-edge (7.65 cm.) white squares with 2-inch-diameter (5.1 cm.) circles drawn on each as faces. Each face contained eyes and mouth, differing only in the shape of the mouth. Mouths ranged from frowning, 1-inch and 2-inch in diameter top-half semicircles, to a horizontal line, to smiling, 2-inch and 1-inch in diameter bottom-half semicircles. Faces were labeled from most frowning to most smiling: "Feels very sad", "Feels sad", "Doesn't feel happy or sad", "Feels happy" and "Feels very happy" respectively.

A copy of the scale can be seen in Appendix B.

**Verbal questions.** In addition to rating scales dealing with ability, effort and happiness with performance, subjects were questioned about the performance of the pictured children. Questions included probes regarding ratings of ability and effort, such as, "How come they both got it if one worked harder?". In addition, children were asked "Which would you like better to have done, the top or the bottom shots?" among each portrayed pair.

**Procedure**

Subjects were given practice with the physical rating scales (ability, effort and happiness) prior to testing. Scales were presented individually with the accompanying label read. Children were asked to identify levels of each of the scales until two consecutive successful replies were given. A picture of a same-grade child was then presented with a description on all three scales. Subjects were asked to locate the pictured child on the three
scales. Pictures were shown until all three scales for a description were identified correctly. Errors were identified and clarified by the experimenter throughout the practice session.

The test procedure involved children individually viewing, and making judgements about, 8 sets of pictures presented one at a time, portraying performance of same-grade, same-sexed peers on the ring toss and arithmetic task.

Presentation of the tasks was in two stages of 4 sets of pictures. The first, verbal condition, was similar to the procedure of Kun (1977). Subjects were presented two face-on pictures along with a verbal description of performance and effort for each of the actors. Order of task presentation was alternated so that an equal number of children within each sex saw each task-type first. For each of the arithmetic and ring toss task, performance of pictured pairs of children was described as having two types of results: 1) one actor having to try very, very hard while the second did not have to try vary hard at all, yet both succeeded in the task, and 2) one actor trying very, very hard while the second did not try hard at all, and only the latter being successful. Each presentation was accompanied by new pictured actors. After description of each pair, subjects were asked to rate each actor for effort, ability and happiness with performance on the 5-point scales, which performance they would prefer to have produced and the reasons for their ratings. Identical situations were presented twice.

The second stage, pictorial condition, of testing involved a similar procedure except for the presentation of effort and performance variables. In addition to verbal descriptions, subjects compared a series of pictures portraying each of these variables. Children were also told that the actors were performing in front of their teacher and classmates for a ribbon going to
each reaching the goal. For the ring toss activity, children not having to try very hard at all were portrayed by the sequence: 1) a face-on view of the actor, 2) the actor ready to toss a ring, and 3) the post with 3 rings on the post and 0 off. Children having to try very, very hard were displayed by: 1) a face-on view of the actor, 2) the actor ready to toss a ring, 3) the post with 0 rings on and 3 off, and 4) the actor ready to toss another ring. The remaining 4 pictures showed: 5) 0 rings on and 3 off, 6) 1 ring on and 2 off, 7) 2 rings on and 1 off, and 8) 3 rings on and none off.

The arithmetic task contained sequences similar to the ring toss task. Children not having to try very hard at all were portrayed by the sequence: 1) a face-on view of the actor, 2) the actor seemingly engaged in the task, with pencil to page, and 3) the page with a checkmark beside the 3 correctly completed problems on the first line, and a score of 3 out of 3 recorded to the right. Children having to try very, very hard were shown by: 1) a face-on view of the actor, 2) the actor with pencil to page, 3) the page with an "X" beside each of the 3 incorrectly completed problems on the first line, and a score of 0 out of 3 recorded to the right, and 4) the actor with pencil to page. The remaining 4 pictures portrayed results of 5) 3 incorrect, 6) 2 incorrect, 1 correct, 7) 1 incorrect, 2 correct, and, finally, 8) 3 correct. Again, after description of each pair, subjects were asked to rate each actor for effort, ability and happiness with performance on the 5-point scales, which performance they would prefer to have produced and the reasons for their ratings. Identical situations were presented twice.
CHAPTER III
RESULTS

Findings in the present study are reported in four sections. In the first section, age-related differences in children's ratings of ability based on differential effort data and equal outcome under various conditions are examined. In the second section, further information regarding children's understanding of the interaction of ability and effort are obtained from the analysis of subjects' explanations of observed performance of actors given equal outcome. The concordance rate between ability ratings and explanations is also be examined. The third section focuses on age-related differences between children's choice of which actor they would have preferred to have performed as under the equal success condition as well as the relationship between children's ability estimates and their choice. The final section explores age-related differences in children's ratings of emotion based on differential effort data and equal outcome under various conditions. The relationship between ability and emotion ratings will also be examined.

Ability Estimates

Mean ability estimates. The major focus of the present study centered on age-related differences in children's use of effort and outcome data in making ability judgements. With outcome being equal, rating the low-effort actor higher in ability would suggest the use of a judgement schema in which effort and ability were inversely related. Means and standard deviations for children's ability estimates are displayed in Table 1, separately for kindergarten and grade 2 children, as a function of different conditions.
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<td>(1.49)</td>
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<td>(1.12)</td>
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<td></td>
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<td>(1.58)</td>
<td>(1.33)</td>
<td>(1.74)</td>
<td>(1.74)</td>
<td>(1.63)</td>
</tr>
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</table>

Note. Numbers in parentheses are standard deviations.
These data were subjected to a 2 (grade) x 2 (sex) x 2 (presentation type: verbal vs. pictorial) x 2 (task: math vs. ring toss) x 2 (success: equal, i.e. both actors succeeding, vs. unequal, i.e. only the actor showing less effort succeeding) x 2 (effort: high effort vs. low effort) ANOVA with the last four variables being within-subject ones. The significant results of this analysis are summarized in Table 2. Since the main purpose of this study was to examine the effects of varying information regarding effort on children's ability judgements, only those significant effects involving the effort variable are elaborated on. In the interest of brevity, main and interaction effects will not be discussed in detail if appearing within higher order interactions. Follow-up comparisons of mean scores were made using Tukey tests (df = 8, 120 when involving the success variable and df = 8, 60 otherwise).

The most pertinent finding to the present research was a significant grade x success x effort interaction, F (2, 152) = 12.87, p < .01. As depicted in Figure 1, this significant interaction can be explained by the fact that the pattern of the grade x effort interaction under the equal success condition was different from that under the unequal success condition. Thus, under the equal success condition (i.e. both actors seen succeeding on the task), grade 2 children's ability judgements for high-effort actors (M = 3.72) and judgements for low-effort actors (M = 3.98) did not differ reliably, although the trend was toward judging the low-effort actor as having greater ability. Kindergarten children, on the other hand, rated high effort actors (M = 4.15) as having significantly more ability than low-effort actors (M = 3.20), p < .01. Under the unequal condition (i.e., only the low effort actor was seen succeeding), grade 2 children rated low-effort actors (M = 4.18) significantly higher in ability than high-effort actors (M = 2.50), p < .01, whereas
Table 2
Repeated Measures ANOVA for Ability Estimates

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<td>.01</td>
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<td>.01</td>
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<td>Task*Succ</td>
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<td>4.04</td>
<td>.05</td>
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<td>3.88</td>
<td>.05</td>
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<td>.01</td>
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<td>15.97</td>
<td>.01</td>
</tr>
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<td>12.78</td>
<td>.01</td>
</tr>
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<td>.01</td>
</tr>
<tr>
<td>Pres<em>Task</em>Effort</td>
<td>1, 76</td>
<td>4.09</td>
<td>.05</td>
</tr>
</tbody>
</table>

Note. The Sex*Grade*Task*Succ*ess interaction is delineated in Appendix C
Figure 1. Grade x Success x Effort Interaction for Ability Estimates
kindergarten children did not differentially rate high- \( (M = 3.12) \) and low-effort actors' \( (M = 3.39) \) ability.

The analysis of ability estimates also revealed a significant presentation type x success x effort interaction, \( F(2, 152) = 25.40, p < .01 \). This significant second-order interaction emerged because, as depicted in Figure 2, a presentation-type x effort interaction was significant under the equal success condition, \( F(1, 76) = 83.37, p < .01 \), but not under the unequal success condition, \( F(1, 76) = 1.90, p > .05 \). When both actor pairs succeeded on the task (i.e. equal success condition), verbal presentation of performance resulted in children rating low-effort actors \( (M = 3.08) \) significantly lower in ability than high-effort actors \( (M = 4.43), p < .01 \). In contrast, pictorial presentation resulted in children rating the low-effort actors \( (M = 4.09) \) significantly higher than the high-effort actors \( (M = 3.44), p < .01 \). When only the low-effort actor succeeded (i.e. unequal condition), the low-effort actors were rated significantly higher than the high-effort actors across both verbal (low-effort, \( M = 3.58 \); high-effort, \( M = 2.93, p < .01 \)) and pictorial presentation (low-effort, \( M = 3.89 \); high-effort, \( M = 2.69, p < .01 \)).

Finally, a significant higher-order interaction involving presentation type, task and effort was obtained, \( F(1, 76) = 4.09, p < .05 \). This interaction is of least interest to the present study because it deals with the data with success conditions collapsed. As such, ability estimates are based on conditions in which ability may have been inferred from outcome or effort data or both. As illustrated in Figure 3, verbal presentation resulted in no significant difference between ability ratings for low effort actors as opposed to high effort actors for either the math (low-effort, \( M = 3.31 \); high-effort, \( M = 3.66 \)) or ring toss (low-effort, \( M = 3.46 \); high-effort, \( M = 3.70 \)) tasks. Pictorial presentation, on the other hand, resulted in significant differences related to
Figure 2. Presentation x Success x Effort interaction for Ability Estimates

UNEQUAL

EQUAL
Figure 3. Presentation x Task x Effort interaction for Ability Estimates.
effort. When seen engaging in the math task, low-effort actors ($M = 4.06$) were rated significantly higher than high-effort actors ($M = 2.88$), $p < .01$. A similar result occurred when the actors were seen performing the ring toss task (low-effort, $M = 3.93$; high-effort, $M = 3.25$, $p < .01$). The basis of the discrepancy in ratings between presentation types is seen in the fact that the low-effort actor was judged significantly higher in ability when presentation was pictorial as opposed to verbal for both the math ($p < .01$) and ring toss ($p < .05$) tasks. In addition the high-effort actor was rated significantly lower in ability when presented pictorially as opposed to verbally across both the math ($p < .01$) and ring toss tasks ($p < .05$).

**Relative ratings of actor-pairs.** Ability ratings were also coded with respect to which actor of a pair children rated more highly under a given condition. In this case, the magnitude of the difference between ability ratings was not important while the proportion of children rating the low-effort actor higher than the high-effort actor was. The analysis was completed only with respect to the equal success (both actors seen succeeding on the task) condition since this is where children may not use simple outcome data to judge ability consistently with one applying an inverse compensation schema. As such, the trend toward the use of inverse compensation exhibited by second grade children found under the equal success condition of the grade x success x effort interaction of the ANOVA performed on ability judgements may be further examined. On any pair of trials, children were able to rate the low-effort actor higher (+), the high-effort actor higher (-), rate the actors equal in ability (0), or state that they did not know (0). Since each condition was presented twice, it was possible for nine different outcome combinations per condition, namely: ++, +0, 0+, 00, 0-, -0, --, + and -. Results for equivalent responses were combined, i.e. +0 with 0+, -0 with 0-.
and \( + \) with \( + \). Coded data regarding children's relative ratings of ability for each condition and age group may be seen in Table 3.

The above results were analyzed by comparing those instances in which children rated the low-effort actor higher than the high-effort actor in ability consistently across both trials of a given condition (\(+\), termed "plus") with all other outcomes. Phi coefficients (\( \Phi \)) were derived for these data in order to determine the degree of relationship between the frequency of plus ratings and the grade, presentation and task variables. While there are several measures of relationship between categorical variables available, Conover (1971) has stated that the Phi coefficient was one of the most frequently used. The author suggested that this was due, in part, to the fact that this statistic preserves direction of the relationship and that it is a special case of the Pearson product moment correlation coefficient computed by representing the classes by numbers. Due to the limited number of plus responses in the verbal conditions, data were collapsed across sex in order to make this analysis more meaningful. In addition, McNemar Chi-squared comparisons were computed in order to determine whether significant differences existed in the frequency of change in children's plus ratings (plus to non-plus, or the reverse) within each grade as a function of task and/or presentation-type variables.

Significant relationships were found between grade and frequency of plus responses under both presentation-types. Under the verbal condition, being in a higher grade was related to a higher frequency of plus responses for both the math, \( \Phi = .190 \) (\( N = 80, p = .045 \)), and ring toss, \( \Phi = .229 \) (\( N = 80, p = .020 \)), tasks. Stronger relationships in the same direction were found for the pictorial condition across both math, \( \Phi = .553 \) (\( N = 80, p < .0001 \)), and ring toss, \( \Phi = .510 \) (\( N = 80, p < .0001 \)), tasks. Relationships between
<table>
<thead>
<tr>
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<th>Task</th>
<th>Grade</th>
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<th>--</th>
<th>00</th>
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<tbody>
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<td>5</td>
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<td>5</td>
<td>4</td>
<td>4</td>
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<tr>
<td></td>
<td></td>
<td>K</td>
<td>1</td>
<td>8</td>
<td>18</td>
<td>4</td>
<td>3</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>Ring Toss</td>
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<td>4</td>
<td>5</td>
<td>12</td>
<td>9</td>
<td>4</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td></td>
<td>K</td>
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<td>10</td>
<td>19</td>
<td>2</td>
<td>1</td>
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</tr>
<tr>
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<td></td>
<td>K</td>
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<td>8</td>
<td>9</td>
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<td></td>
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<td>11</td>
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<td>6</td>
<td>3</td>
</tr>
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</table>

Note. + denotes rating the low-effort actor, and - the high-effort actor, higher in ability; 0 denotes no decision; data is from the equal condition.
presentation-type and plus responses were significant for both grades. Grade 2 children offered a greater frequency of plus responses in the pictorial condition for both the math, $R_p = .670 \ (N = 80, \ p < .0001)$, and ring toss, $R_p = .568 \ (N = 80, \ p < .0001)$, tasks. Similar relationships were found, but to a lesser degree, for kindergarten children, for both the math, $R_p = .250 \ (N = 80, \ p = .013)$, and ring toss, $R_p = .285 \ (N = 80, \ p = .005)$, tasks. No significant Phi coefficients were found at the $p = .05$ level when comparing math to ring toss results for grade 2 or kindergarten children under either the verbal or pictorial conditions. The coefficients ranged from $R_p = .040 \ (N = 80, \ p = .345)$ for grade 2 children and $R_p = .113 \ (N = 80, \ p = .156)$ for kindergarten children in the verbal condition to $R_p = .081 \ (N = 80, \ p = .236)$ for grade 2 children and $R_p = .034 \ (N = 80, \ p = .362)$ for kindergarten children in the pictorial condition.

Data for the McNemar-Chi-squared analysis comparing changes in children’s ratings from the verbal to pictorial conditions can be seen in Table 4. The analysis revealed that significantly more grade 2 children changed their ratings from non-plus to plus than the reverse when viewing both the math, Chi-squared $(1, \ N = 40) = 22.15, \ p < .0001$, and ring toss, Chi-squared $(1, \ N = 40) = 22.00, \ p < .0001$, tasks. A significant difference in the same direction was found for kindergarten children when viewing the math ($p = .031$) but not the ring toss ($p = .125$) task.

Data for the McNemar Chi-squared analysis comparing changes in children’s ratings from the math to ring toss tasks can be seen in Table 5. The analysis revealed no significant differences in the frequencies of grade 2 children changing their ratings under either the verbal ($p = .1$) or pictorial ($p = .549$) conditions. Similarly, no significant differences were found for
<table>
<thead>
<tr>
<th>Task</th>
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<th>Other/Other</th>
<th>++/Other</th>
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<td>25</td>
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<td>K</td>
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<td>31</td>
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<td>7</td>
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<td>22</td>
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<td>K</td>
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<td>34</td>
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<td>6</td>
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</table>

Note. ++ denotes rating the low-effort actor higher across both trials of a condition; symbols are in order of the verbal/pictorial conditions; data is from the equal condition.
Table 5
Consistency of Children's Ability Ratings from the Math to Ring Toss Tasks

<table>
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<th>++/Other</th>
<th>Other/++</th>
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</thead>
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<td>K</td>
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<td>39</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Pictorial</td>
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<td>7</td>
<td>7</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>K</td>
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<td>2</td>
</tr>
</tbody>
</table>

Note. ++ denotes rating the low-effort actor higher across both trials of a condition. Symbols are in order of the math/ring toss tasks; data is from the equal condition.
kindergarten children under either the verbal \( p = 1 \) or pictorial \( p = 1 \) conditions.

**Responses to Open Question**

Children's explanations regarding the disparity in effort and success between actor-pairs were elicited through an open question. Responses were categorized according to the following 2 general groups:

1) Inverse: an explanation suggesting the use of the concept of an inverse relationship between effort and ability (e.g. one didn't try as hard because she was better; or the high-effort actor was not as good), termed inverse;

2) Halo: an explanation suggesting the use of the concept of a positive relationship between effort and ability or outcome (e.g. the low-effort actor did better because she must have somehow tried harder; or the high-effort actor was better at it), at times contradicting presented stimuli (e.g. stating that the high-effort actor really didn't try very hard), termed halo.

The frequencies of children's inverse explanations offered under the equal condition (both actors succeeding) can be seen in Table 6 and are analyzed subsequently. The frequencies of children's halo responses can be seen in Table A in Appendix C. Only the equal condition was included because the unequal condition (only the low-effort actor succeeding) does not differentiate between those children utilizing judgements consistent with inverse compensation and those using simple outcome data to judge the low-effort actor higher in ability. The focus of the analysis was on the consistent use of inverse explanation under a given condition. Therefore, results were analyzed by comparing those instances in which children offered inverse explanations on both of the two trials of a condition with all other outcomes.
<table>
<thead>
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<th>Inverse</th>
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<td>26</td>
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<td>Ring Toss</td>
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<td>38</td>
<td>2</td>
<td>5</td>
<td>13</td>
<td>27</td>
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</table>

Note: Data is from the equal condition.
Phi coefficients ($\phi$) were derived for these data in order to determine the
degree of relationship between the frequency of inverse ratings and the
grade, presentation and task variables. In addition, McNemar Chi-squared
comparisons were utilized in order to determine whether significant
differences existed in the frequencies of change in children's inverse ratings
(non-inverse-to-inverse, or the reverse) within each grade as a function of
task and/or presentation-type variables. Due to the limited number of
inverse responses in some conditions, data were collapsed across sex in order
to make this analysis more meaningful.

Significant relationships were found between grade and frequency of
inverse responses under the pictorial but not the verbal conditions. Under the
pictorial condition, being in a higher grade was related to a higher frequency
of inverse responses for both the math, $\phi = .264$ ($N = 80$, $p = .009$), and ring
toss, $\phi = .275$ ($N = 80$, $p = .007$), tasks. No significant relationships were
found in the verbal condition for either the math, $\phi = .170$ ($N = 80$, $p = .064$),
or ring toss, $\phi = .044$ ($N = 80$, $p = .345$), tasks. Relationships between
presentation-type and inverse responses were significant for grade 2 but not
kindergarten children. Grade 2 children offered a greater frequency of
inverse responses in the pictorial condition for both the math, $\phi = .231$ ($N =
80$, $p = .019$), and ring toss, $\phi = .245$ ($N = 80$, $p = .014$), tasks. In contrast,
kindergarten children's responses did not vary significantly as a function of
presentation-type for either the math, $\phi = .132$ ($N = 80$, $p = .117$), or ring
toss, $\phi = 0$ ($N = 80$, $p = 1$), task. No significant Phi coefficients were found at
the $p = .05$ level when comparing math to ring toss results for grade 2 or
kindergarten children under either the verbal or pictorial conditions. The
coefficients ranged from $\phi = .119$ ($N = 80$, $p = .145$) for grade 2 children and
$\phi = -.095$ ($N = 80$, $p = .198$) for kindergarten children in the verbal condition.
to $R_p = .026$ ($N = 80, p = .405$) for grade 2 children and $R_p = .040$ ($N = 80, p = .363$) for kindergarten children in the pictorial condition.

Data for the McNemar Chi-squared analysis comparing changes in children's ratings from the verbal to pictorial conditions can be seen in Table 7. The analysis revealed that significantly more grade 2 children changed their ratings from non-inverse to inverse than the reverse when viewing both the math ($p = .008$) and ring toss ($p = .008$) tasks. No significant difference was found for kindergarten children when viewing either the math ($p = .500$) or the ring toss ($p = 1$) task.

Data for the McNemar Chi-squared analysis comparing changes in children's ratings from the math to ring toss tasks can be seen in Table 8. The analysis revealed no significant differences in the frequencies of grade 2 children changing their ratings under either the verbal ($p = .453$) or pictorial ($p = 1$) conditions. Similarly, no significant differences were found for kindergarten children under either the verbal ($p = .125$) or pictorial ($p = 1$) conditions.

Co-occurrence of explanations and ability estimates. Were those children who used explanations consistent with an inverse relationship between ability and effort, given equal outcome, more likely to rate the low-effort actor higher in ability than those offering other types of explanations? Since both are proposed to be a function of children's level of concept of ability, the degree of overlap between ability ratings and explanations provided an elaboration of the way in which children conceptualize and report on ability in achievement situations. In order to answer this question, ability and explanation data were cross-tabulated separately for grade 2 and kindergarten children, and are displayed in Table 9. Phi coefficients ($R_p$) were derived for these data in order to determine the degree of relationship...
Table 7
Consistency of Children's Inverse Ratings from the Verbal to Pictorial Conditions

<table>
<thead>
<tr>
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<th>Other/Other</th>
<th>YY/Other</th>
<th>Other/YY</th>
</tr>
</thead>
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</tr>
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<td>36</td>
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<td>RJng Toss</td>
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<td>10</td>
</tr>
<tr>
<td></td>
<td>K</td>
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<td>35</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

Note. YY denotes an inverse explanation across both trials of a condition; symbols are in order of the verbal/pictorial conditions; data is from the equal condition.
Table 8
Consistency of Children’s Inverse Ratings from the Math to Ring Toss Tasks

<table>
<thead>
<tr>
<th>Presentation</th>
<th>Grade</th>
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<th>Other/Other</th>
<th>YY/Other</th>
<th>Other/YY</th>
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</thead>
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<td>2</td>
</tr>
<tr>
<td></td>
<td>K</td>
<td>2</td>
<td>34</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
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<td>19</td>
<td>8</td>
<td>7</td>
</tr>
<tr>
<td></td>
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<td>3</td>
<td>34</td>
<td>2</td>
<td>1</td>
</tr>
</tbody>
</table>

Note. YY denotes an inverse explanation across both trials of a condition; symbols are in order of the math/ring toss tasks; data is from the equal condition.
Table 9
Cross-tabulation of Children's Explanations and Relative Ratings of Ability

<table>
<thead>
<tr>
<th>Task</th>
<th>Grade</th>
<th>Explanation</th>
<th>Ab. Diff.</th>
<th>Verbal</th>
<th>Pictorial</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>++ Other</td>
<td>++ Other</td>
<td></td>
</tr>
<tr>
<td>Math</td>
<td>2</td>
<td>YY</td>
<td>3 3</td>
<td>12 2</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Other</td>
<td>2 32</td>
<td>17 9</td>
<td></td>
</tr>
<tr>
<td>K</td>
<td>YY</td>
<td>0 2</td>
<td>3 1</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Other</td>
<td>1 37</td>
<td>4 32</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ring Toss</td>
<td>2</td>
<td>YY</td>
<td>1 2</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Other</td>
<td>3 34</td>
<td>13 14</td>
<td></td>
</tr>
<tr>
<td>K</td>
<td>YY</td>
<td>0 4</td>
<td>3 1</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Other</td>
<td>0 36</td>
<td>3 33</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note. YY denotes an inverse explanation across both trials of a condition; ++ denotes rating the low-effort actor higher across both trials of a condition; data is from the equal condition.
between the incidence of plus responses (children consistently rating the low-effort actor higher in ability) and inverse explanations within combinations of the grade, presentation and task variables. Due to low frequencies in some groups, data were collapsed across sex in order to make the analyses more meaningful.

When the stimuli were presented verbally, a significant relationship between the incidence of plus responses and inverse explanations was found for grade 2 children for the math, $R_p = .476 \ (N = 40, p = .001)$, but not the ring toss, $R_p = .221 \ (N = 40, p = .081)$, task. No significant relationships were found for kindergarten children for either the math, $R_p = -.037 \ (N = 40, p = .409)$, or ring toss, $R_p = 0 \ (N = 40, p = 1)$, tasks. These results must be interpreted cautiously since between 32 and 37 of the 40 responses in each group fell into the "neither plus nor inverse" category. In the pictorial condition, no significant relationship was found for grade 2 children's responses for either the math, $R_p = .217 \ (N = 40, p = .085)$, or ring toss, $R_p = .173 \ (N = 40, p = .138)$, task. Significant relationships were found for kindergarten children's responses for both the math, $R_p = .504 \ (N = 40, p = .0007)$, and ring toss, $R_p = .560 \ (N = 40, p = .0002)$, tasks. Again, relationships found for kindergarten children's responses in the pictorial condition must be qualified by the fact that 31 and 33 of the 40 offered fell in the "neither plus nor inverse" category.

**Choice Between Actor-Pairs**

Children were asked to make choices between actor-pairs according to which they would rather have performed as. It has been suggested (e.g. Nicholls, 1984) that young children tend to choose a high-over low-effort
actor. The effects of differing ability estimates on this tendency was examined by comparing the choice of children rating the low-effort actor higher in ability with those rating the high-effort actor higher in ability. Possible choices for a trial included: the low-effort actor (L), the high-effort actor (H), both (O), neither (O) or don't know (O). Each trial was presented twice, therefore nine combinations of the above three choices were possible within each condition (namely, LL, L0, 0L, 00, OH, HO, HH, LH and HL). Results for equivalent responses were combined, i.e. L0 with 0L, HO with 0H and LH with HL. Coded data regarding children's direction of ability judgements for each condition and age group may be seen in Table 10. Since the object of collecting these data was to detect children showing a clear preference for the low-effort actor's performance, the above results were grouped by comparing those instances in which children chose the low-effort actor across both trials of a given condition (LL) with all other outcomes. Due to the infrequency of LL responses in some groups, data were collapsed across sex in order to make analyses more meaningful. Phi coefficients ($\Phi$) were derived for these data in order to determine the degree of relationship between the frequency of LL choices and the grade, presentation and task variables. In addition, McNemar Chi-squared comparisons were utilized to determine whether significant differences in the frequency of change in children's choices (non-LL to LL, or the reverse) within each grade as a function of task and/or presentation-type variables.

Significant relationships were found between grade and frequency of choice under both presentation-types. Under the pictorial condition, being in a higher grade was related to a higher frequency of LL responses for the math, $\Phi = .378$ ($N = 80$, $p = .0004$), and ring toss, $\Phi = .506$ ($N = 80$, $p < .0001$), tasks. Under the verbal condition, being in a higher grade was related to a
<table>
<thead>
<tr>
<th>Task</th>
<th>Grade</th>
<th>Presentation</th>
<th>Verbal</th>
<th>Low-effort</th>
<th>Other</th>
<th>Pictorial</th>
</tr>
</thead>
<tbody>
<tr>
<td>Math</td>
<td>2</td>
<td>8</td>
<td>32</td>
<td>7</td>
<td>33</td>
<td>15</td>
</tr>
<tr>
<td>Ring Toss</td>
<td>K</td>
<td>11</td>
<td>29</td>
<td>2</td>
<td>38</td>
<td>13</td>
</tr>
</tbody>
</table>

Note: Data is for the equal condition.
higher frequency of LL responses for the ring toss, $\Phi = .305 \ (N = 80, p = .003)$, but not the math, $\Phi = .105 \ (N = 80, p = .174)$, task. With regard to relationships between presentation-type and plus responses, grade 2 children offered a greater frequency of LL responses in the pictorial condition for both the math, $\Phi = .432 \ (N = 80, p < .0001)$, and ring toss, $\Phi = .401 \ (N = 80, p = .0002)$, tasks. Kindergarten children offered a greater frequency of LL responses for the pictorial condition in the ring toss, $\Phi = .198 \ (N = 80, p = .038)$, but not the math, $\Phi = .029 \ (N = 80, p = .327)$, task. No significant Phi coefficients were found at the $p = .05$ level when comparing math to ring toss results for grade 2 children under either the verbal, $\Phi = -.088 \ (N = 80, p = .212)$, or pictorial, $\Phi = -.052 \ (N = 80, p = .319)$, conditions. For kindergarten children, viewing the math task was related to a higher frequency of LL responses in the verbal, $\Phi = .198 \ (N = 80, p = .038)$, but not pictorial, $\Phi = .092 \ (N = 80, p = .206)$, condition.

Data for the McNemar Chi-squared analysis comparing changes in children's choices from the verbal to pictorial conditions can be seen in Table 11. The analysis revealed that significantly more grade 2 children changed their ratings from non-LL to LL than the reverse when viewing both the math, Chi-squared $(1, N = 40) = 12.57, p < .0001$, and ring toss $(p = .0004)$ tasks. No significant difference was found for kindergarten children when viewing either the math $(p = .607)$ or ring toss $(p = .170)$ tasks.

Data for the McNemar Chi-squared analysis comparing changes in children's choices from the math to ring toss tasks can be seen in Table 12. The analysis revealed no significant differences in the frequencies of grade 2 children changing their ratings under either the verbal $(p = .508)$ or pictorial $(p = .727)$ conditions. Similarly, no significant differences were found for
<table>
<thead>
<tr>
<th>Task</th>
<th>Grade</th>
<th>LL/LL</th>
<th>Other/Other</th>
<th>LL/Other</th>
<th>Other/LL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Math</td>
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<td>5</td>
<td>12</td>
<td>3</td>
<td>20</td>
</tr>
<tr>
<td></td>
<td>K</td>
<td>1</td>
<td>24</td>
<td>6</td>
<td>9</td>
</tr>
<tr>
<td>Ring Toss</td>
<td>2</td>
<td>9</td>
<td>11</td>
<td>2</td>
<td>18</td>
</tr>
<tr>
<td></td>
<td>K</td>
<td>0</td>
<td>31</td>
<td>2</td>
<td>7</td>
</tr>
</tbody>
</table>

Note. LL denotes a choice of the low-effort actor across both trials of a condition; symbols are in order of the verbal/pictorial conditions; data is from the equal condition.
### Table 12
Consistency of Children's Actor-Choice from the Math to Ring Toss Tasks

<table>
<thead>
<tr>
<th>Presentation</th>
<th>Grade</th>
<th>LL/LL</th>
<th>Other/Other</th>
<th>LL/Other</th>
<th>Other/LL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Verbal</td>
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<td>5</td>
<td>26</td>
<td>3</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>K</td>
<td>0</td>
<td>31</td>
<td>7</td>
<td>2</td>
</tr>
<tr>
<td>Pictorial</td>
<td>2</td>
<td>22</td>
<td>10</td>
<td>3</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>K</td>
<td>2</td>
<td>26</td>
<td>7</td>
<td>5</td>
</tr>
</tbody>
</table>

Note. LL denotes a choice of the low-effort actor across both trials of a condition; symbols are in order of the math/ring toss tasks; data is from the equal condition.
kindergarten children under either the verbal ($p = .170$) or pictorial ($p = .549$) conditions.

**Co-occurrence of choice and ability estimates.** In order to assess how children's choices related to their ability estimates, the grouped choice data were cross-tabulated with plus responses (children consistently rating the low-effort actor higher in ability), and are displayed in Table 13. The data were analyzed in terms Phi coefficients ($\Phi_p$) in order to determine the degree of relationship between the incidence of plus responses and choice of the low-effort actor (LL) within combinations of the grade, presentation and task variables. Due to low frequencies in some groups, data were collapsed across sex in order to make the analyses more meaningful.

When the stimuli were presented verbally, a significant relationship between the incidence of plus responses and the choice of the low-effort actor was found for grade 2 children for the math, $\Phi_p = .756$ ($N = 40$, $p < .0001$), but not the ring toss, $\Phi_p = .168$ ($N = 40$, $p = .145$), task. Similarly, a significant relationships was found for kindergarten children for the math, $\Phi_p = .348$ ($N = 40$, $p = .014$), but not the ring toss, $\Phi_p = 0$ ($N = 40$, $p = 1$), task. These results must be interpreted cautiously since between 27 and 38 of the 40 responses in each group fell into the "neither plus nor LL" category. In the pictorial condition, no significant relationship was found for grade 2 children's responses for either the math, $\Phi_p = .169$ ($N = 40$, $p = .142$), or ring toss, $\Phi_p = .049$ ($N = 40$, $p = .378$), task. A significant relationships was found for kindergarten children's responses for the math, $\Phi_p = .342$ ($N = 40$, $p = .015$), but not the ring toss, $\Phi_p = .175$ ($N = 40$, $p = .134$), task. Again, relationships found for kindergarten children's responses in the pictorial condition must be qualified by the fact that 27 and 29 of the 40 offered fell in the "neither plus nor LL" category.
### Table #5
Cross-tabulation of Children's Actor-Choice and Relative Ratings of Ability

<table>
<thead>
<tr>
<th>Task</th>
<th>Grade</th>
<th>Choice</th>
<th>Ab. Diff.</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
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<td></td>
<td>**</td>
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<td>++</td>
<td>Other</td>
<td></td>
<td></td>
</tr>
<tr>
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<td>3</td>
<td>19</td>
<td>6</td>
<td>0</td>
<td>32</td>
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<td></td>
</tr>
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<td>27</td>
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<td></td>
</tr>
</tbody>
</table>

Note. LL denotes a choice of the low-effort actor across both trials of a condition; ++ denotes rating the low-effort actor higher across both trials of a condition; data is for the equal condition.
Emotion Estimates

Emotion estimates were gathered as an adjunct to ability data. It has been shown that, in general, children tend to rate a high-effort actor happier than a low-effort actor (Brown and Weiner, 1984). Similarly to the data regarding choice, the effects of differing ability estimates on this tendency was examined by comparing the emotion ratings of children rating the low-effort actor higher in ability with those rating the high-effort actor higher in ability. Means and standard deviations for children’s emotion estimates are displayed in Table 14, separately for kindergarten and grade 2 children, as a function of different conditions. Similarly to ability estimates, these data were subjected to a 2 (grade) x 2 (sex) x 2 (presentation type: verbal vs. pictorial) x 2 (task: math vs. ring toss) x 2 (success: equal, i.e. both actors succeeding, vs. unequal, i.e. only the actor showing less effort succeeding) x 2 (effort: high effort vs. low effort) ANOVA with the last four variables being within-subject ones. The significant results of this analysis are summarized in Table 15. Since the main purpose of this study was to examine the effects of varying information regarding effort on children’s ability judgements, only those significant interaction effects involving the effort variable are elaborated on. In the interest of brevity, main and interaction effects will not be discussed in detail if appearing within higher order interactions.

Statistical analysis revealed the significant higher order interaction among grade, presentation type, success and effort variables, $F(2, 152) = 7.35, p < .01$. Follow-up comparisons of mean scores were made using Tukey tests (df = 8, 120). As portrayed in Figure 4, this significant higher-order interaction can be represented by differences in the grade x effort interaction within each of the four cells created from the crossing of the presentation by
<table>
<thead>
<tr>
<th>Task</th>
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<th>Success</th>
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<th>Unequal</th>
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</thead>
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<td>Pictorial</td>
<td>Verbal</td>
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<td>HighE</td>
<td>LowE</td>
</tr>
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<td>LowE</td>
<td>HighE</td>
<td>LowE</td>
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<td>4.33</td>
<td>3.06</td>
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<td>(0.99)</td>
<td>(1.33)</td>
<td>(0.59)</td>
</tr>
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<td>4.26</td>
<td>4.06</td>
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<td></td>
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<td>(0.81)</td>
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<td>(1.43)</td>
<td>(1.24)</td>
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<td>(0.38)</td>
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<td>3.36</td>
<td>4.49</td>
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<td>(1.10)</td>
<td>(0.74)</td>
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<td>(1.13)</td>
<td>(0.68)</td>
<td>(1.17)</td>
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<td>3.11</td>
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<td>(1.04)</td>
<td>(1.46)</td>
<td>(1.33)</td>
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</table>

Note. Numbers in parentheses are standard deviations.
Table 15
Repeated Measures ANOVA for Emotion Estimates

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<th>F</th>
<th>p&lt;</th>
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</thead>
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<td>.01</td>
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<td>.05</td>
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<td>.01</td>
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<td>9.04</td>
<td>.01</td>
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<td>7.35</td>
<td>.01</td>
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</tbody>
</table>
Figure 4. Grade x Presentation x Success x Effort interaction for Emotion Estimates.
success conditions (verbal-equal, verbal-unequal, pictorial-equal, pictorial-unequal). When actor-pairs both succeeded at their task (equal success condition), presentation type affected the grade x effort interaction. Verbal presentation resulted in grade 2 children rating the high-effort actors (M = 4.71) significantly happier than low-effort actors (M = 3.83), p < .01. Kindergarten children’s estimates did not differ reliably between the high (M = 4.43) and low-effort actors (M = 3.89). Pictorial presentation, on the other hand, resulted in grade 2 children’s estimates reversing, rating the low-effort actor (M = 4.70) significantly happier than the high-effort actor (M = 3.62). Kindergarten children again show no significant difference between ratings of the high- (M = 4.21) and low-effort actors (M = 4.18). By contrast, emotion ratings under the unequal success condition (only the low-effort actor succeeding) did not vary significantly as a function of either presentation-type or grade. Significantly happier ratings were ascribed to the low-effort actors across all conditions. Verbal presentation resulted in grade 2 children rating the low-effort actor (M = 4.29) significantly happier than the high-effort actor (M = 3.21), p < .01. Kindergarten children also gave higher ratings to the low- (M = 4.14) as opposed to high-effort actor (M = 3.26), p < .01. Similar results were obtained in the pictorial presentation condition with grade 2 children rating the low-effort (M = 4.54) significantly above the high-effort actor (M = 2.76), p < .01. Also, kindergarten children rated the low-effort actor (M = 4.18) significantly happier than the high-effort actor (M = 3.28), p < .01. Results in the relatively unambiguous unequal success condition (only the low-effort actor succeeding) are straightforward with the low-effort rated as happier. When both characters in an actor-pair were seen succeeding, however, only second grade children’s ratings showed a negative
relationship between emotion and effort, and only during pictorial presentation.

The remaining significant effect resulting from the repeated measures ANOVA was the main effect of the task variable, \( F(1, 76) = 4.49, p < .05 \). indicating that children ascribed a happier rating when actors were performing the ring toss \( (M = 3.99) \) as opposed to math task \( (M = 3.92) \).

**Relationship between emotion and ability estimates.** In order to assess how children's ratings of emotion were related to their ability estimates, difference data for emotion estimates were grouped as a function of plus responses (children consistently rating the low-effort actor higher in ability). Difference data were defined by the value of the emotion rating for the high-effort actor minus that for the low-effort actor within each condition. Since very few plus responses were given in general under the verbal condition, children were grouped across sex in order to make the comparisons more meaningful. Grouped difference data were subjected to independent t-tests. In addition, Pearson product moment correlations were computed between children's emotion and ability estimates within combinations of the grade, sex, presentation-type and task variables.

Difference data can be seen in Table 16. In the pictorial condition, when viewing the ring toss task, grade 2 children rating the low-effort actor higher in ability also rated the low-effort actor significantly happier \( (M = -1.33) \) than the high-effort actor \( (M = -0.50) \), \( t(38) = -2.19, p = .035 \). A similar, non-significant trend was found when actors were engaged in the math task, namely, children rating the low-effort actor higher in ability also rated the low-effort actor happier \( (M = -1.39) \) than the high-effort actor \( (M = -0.50) \), \( t(38) = -1.98, p = .055 \). In the verbal condition when viewing the math task, a trend was found in which children rating the low-effort actor
Table 16
Mean Differences in Emotion Estimates as Grouped by Relative Ratings of Ability

<table>
<thead>
<tr>
<th>Presentation</th>
<th>Task</th>
<th>Grade</th>
<th>Ability Difference</th>
<th>++</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Mean</td>
<td>S.D.</td>
</tr>
<tr>
<td>Verbal</td>
<td>Math</td>
<td>2</td>
<td></td>
<td>-0.10</td>
<td>0.89</td>
</tr>
<tr>
<td></td>
<td></td>
<td>K</td>
<td></td>
<td>-2.50</td>
<td>X</td>
</tr>
<tr>
<td>Ring Toss</td>
<td>2</td>
<td></td>
<td></td>
<td>-1.00</td>
<td>1.39</td>
</tr>
<tr>
<td></td>
<td></td>
<td>K</td>
<td></td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Pictorial</td>
<td>Math</td>
<td>2</td>
<td></td>
<td>-1.39</td>
<td>1.30</td>
</tr>
<tr>
<td></td>
<td></td>
<td>K</td>
<td></td>
<td>-0.86</td>
<td>1.91</td>
</tr>
<tr>
<td></td>
<td>Ring Toss</td>
<td>2</td>
<td></td>
<td>-1.33</td>
<td>1.12</td>
</tr>
<tr>
<td></td>
<td></td>
<td>K</td>
<td></td>
<td>-1.67</td>
<td>1.33</td>
</tr>
</tbody>
</table>

Note. ++ = low-effort actor rated higher in ability; a negative mean emotion rating indicates having rated the low-effort actor as more happy; data is for the equal condition.
higher in ability also rated the low-effort actor happier ($M = -1.00$) than the high-effort actor ($M = 0.36$), $t(38) = -1.98$, $p = .055$.

The data for kindergarten children showed similar results. In the pictorial condition when viewing the ring toss task, kindergarten children rating the low-effort actor higher in ability also rated the low-effort actor significantly happier ($M = -1.67$) than the high-effort actor ($M = 0.24$), $t(38) = -2.91$, $p = .006$. A similar, non-significant trend was found when actors were engaged in a math task in which children rating the low-effort actor higher in ability also rated the low-effort actor happier ($M = -0.85$) than the high-effort actor ($M = 0.348$), $t(38) = -1.79$, $p = .081$. In the verbal condition when viewing the math task, a significant difference was found in which children rating the low-effort actor higher in ability also rated the low-effort actor happier ($M = -2.500$) with his or her performance than the high-effort actor ($M = 0.397$), $t(38) = -2.186$, $p = .035$. This last result must be considered with caution since the plus group contained only one entry.

Correlation data between emotion and ability estimates can be seen in Table 17. Grade 2 females responses revealed a significant positive relationship ($p < .01$) between ability and emotion estimates in the verbal condition for both math ($r = .788$) and ring toss tasks ($r = .737$), as well as in the pictorial condition for both math ($r = .742$) and ring toss tasks ($r = .513$). Grade 2 males responses revealed a significant positive relationship ($p < .01$) in the verbal condition for the math task ($r = .564$) and in the pictorial condition for both math ($r = .674$) and ring toss tasks ($r = .627$). The correlation was not significant where the ring toss task had been presented verbally. Kindergarten females responses revealed a significant correlation ($p < .05$) only where the math task had been presented verbally ($r = .520$). Kindergarten males responses revealed significant correlations ($p < .01$)
<table>
<thead>
<tr>
<th>Grade</th>
<th>Sex</th>
<th>Task</th>
<th>Presentation</th>
<th>Verbal</th>
<th>Pictorial</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Grade</td>
<td>Math</td>
<td>R</td>
</tr>
<tr>
<td>2</td>
<td>F</td>
<td></td>
<td></td>
<td>.778**</td>
<td>.606</td>
</tr>
<tr>
<td></td>
<td>M</td>
<td></td>
<td></td>
<td>.564**</td>
<td>.318</td>
</tr>
<tr>
<td>K</td>
<td>F</td>
<td></td>
<td></td>
<td>.520*</td>
<td>.270</td>
</tr>
<tr>
<td></td>
<td>M</td>
<td></td>
<td></td>
<td>.406**</td>
<td>.160</td>
</tr>
</tbody>
</table>

** denotes a significant correlation at p < .01
* denotes a significant correlation at p < .05
Note: Data is for the equal condition.
where the ring toss task had been presented verbally \((r = .623)\) and where the math task had been presented pictorially \((r = .499)\).
CHAPTER IV
DISCUSSION

The major purpose of the present study was to investigate age-related differences in young children's understanding of the concept of ability. Findings were considered from the perspective that a mature concept of ability would be expressed through judgements consistent with an inverse relationship between ability and amount of effort expended for a given outcome. In order to determine this, children were asked to make ability judgements about pairs of actors, one described as exerting high-effort and the other low, under combinations of conditions of presentation-type, task and success. In order to further assess children's perceptions of the reasons underlying the portrayed performance, they were asked to offer explanations for the pair of actors' relative effort with respect to their success. As will be subsequently discussed, results were not totally unequivocal with respect to second grade children's estimates. Kindergarten children's results, on the other hand, displayed much less evidence of inverse compensation.

Ability estimates were analyzed in two ways, namely, through an ANOVA on the value of the estimates and through a comparison of the frequency of direction of difference between ratings of high- and low-effort actors. These analyses offered apparently inconsistent findings. Results of the ANOVA revealed that when both actors of a pair were seen to have succeeded on a task (equal condition), grade 2 children showed no difference in ability ratings (approximately "very good") for the high and low-effort actors, although there was a trend in the direction of rating the low-effort actor higher. In contrast, kindergarten children rated the high-effort actor (approximately "very good") significantly higher in ability than the low-effort
actor (approximately "good"). These findings suggest that kindergarten children may have been judging ability as related positively to effort (halo schema) while grade 2 children's ability judgements did not differ reliably with respect to effort.

Ability difference data revealed somewhat different results. Where previously when both actors were seen succeeding (equal condition) grade 2 children's estimates were not related to effort, now they were. When the stimuli were presented pictorially, close to 70% (55 out of 80) of grade 2 children's ratings were higher for the low- as opposed to high-effort actor across both trials (plus response) of the math and ring toss tasks. Ratings of grade 2 children in the verbal condition, and kindergarten children under both presentation-types were lower, ranging from roughly 1% to 16%. A significant number of grade 2 children changed the direction of their ratings to inverse in the pictorial condition. As a result, rating the low-effort actor higher in ability was found to be substantially related to being in a higher grade in the pictorial condition, and, for grade 2 children, to pictorial presentation.

The apparent contradiction between results of the ANOVA and difference estimates may be explained similarly to the way in which Surber (1980) evaluated Kun's results of 1977, and with respect to the measurement scale used. Surber suggested that the lack of a main effect of effort on children's ability judgements was not due to neglect of the effort information, but that effort was being used in two ways. Some children were judging ability as positively related to effort, and some as negatively related. With the differing schemas of judgement confounded within each age group, the effort variable appeared less related to ability judgements. Using the same reasoning within the present study, it is possible that averaging ability
estimates within age-groups also included averaging across differing schemas. These opposite rating styles, corresponding to the differing schemas, would then have served to increase variability and obscure differences. This appears to have occurred even though grade 2 children increased their rating of the low-effort actor from between "not good or bad" and "very good" to between "very good" and "very, very good" from the verbal to pictorial conditions. At the same time, they decreased their rating of the high-effort actor from between "very good" and "very, very good" to "not good or bad."

A second, related factor possibly affecting children's ratings was the range of the scale used to measure ability, i.e., five points from "not very good at all" to "very, very good". Grade 2 children's ratings of ability were generally high in the equal condition with the average judgement for both actors above the midpoint of the scale, i.e., the high-effort actor rated roughly "not good or bad" and the low-effort actor between "very good" and "very, very good" at the task. High effort combined with success may have been, quite logically, interpreted as implying some level of ability. Since the scale offered only two choices of ability better than the midpoint, the variability of responses was again limited. A scale including a greater range within the spectrum of good may have offered children enough choice so as finer comparisons could have been made.

In summary, results suggest that inferring ability negatively in relation to effort in an achievement situation may be available to most (roughly 70%) second grade children. Possible factors enhancing their expression of this relationship included the reduced memory demands of the pictorial condition, instructions to ignore the actors' gains in ability due to viewed practice while performing and the framing of the event as competitive. Interestingly, grade 2 children's responses under the verbal condition, and kindergarten
children's responses under all conditions, showed a high level of indecision with regard to direction of difference of ability. The majority of responses under these conditions were inconsistent from one trial to the next. This suggests that young children may not be as fixed upon inferring ability as positively related to effort, when not consistently using inverse compensation, as had previously been assumed.

Children's answers to the open question revealed a similar pattern, yet overall lower frequency, of results to the ability difference data. The greatest number of explanations (27 out of 80) offered which were consistent with an inverse relationship between effort and ability (inverse explanations) were offered by second grade children during pictorial presentation. The frequency of inverse explanations of grade 2 children in the verbal condition, and kindergarten children under both presentation-types were lower, ranging from roughly 6% to 11%. A significant number of grade 2 children changed their explanations to be consistent with inverse compensation from the verbal to the pictorial condition. As a result, greater frequencies of inverse explanations were found to be related to being in a higher grade in the pictorial condition, and, for grade 2 children, related to pictorial presentation.

These results may be best understood in relation to the cross-tabulation of ability differences with explanations (such that plus responses coinciding with negative explanations be considered a positive relationship) under the equal condition. Since children were able to offer a wide variety of types of explanations, it was expected those offering inverse explanations would also have tended to give plus responses. The only group in which less than 80% of the responses were neither inverse explanations nor plus responses was the pictorial condition for grade 2 children. In this case, a significant, yet relatively weak, positive relationship was found. The great
majority (25 of 27) of inverse explanations coincided with plus responses (rating the low-effort actor higher in ability), while over half (30 of 53) of the non-inverse explanations were also plus responses.

Being able to spontaneously offer an inverse explanation appears to predict the rating of the low-effort actor higher in ability for grade 2 children in the pictorial condition. The reverse, however, is not true. These results suggest either that being able to offer an inverse explanation developmentally post-dates the actual rating of ability inversely to effort, that children were able to use explanations other than ability differences to account for rating the low-effort actor higher in ability or that a combination of these occurred. A case may be made for the position that explanations were available to children which were consistent, yet did not directly make reference to inverse compensation. For example, a common non-inverse explanation offered by grade 2 children under the pictorial and equal conditions was, "She had much more practice before at home." While not categorized as inverse, this type of explanation may display both the ego- and task-involvement understanding of ability described by Jagacinski and Nicholls (1984). The task-involvement would be reflected in the understanding that practice over time resulted in greater performance. Understanding of ability in terms of ego-involvement would be reflected in the rating of the low-effort actor higher in ability (inverse compensation) on the task. In summary, those children whose ability difference and explanation data both involved higher ability for the low-effort actor clearly appeared to utilize the schema of inverse compensation. Those children rating the low-effort higher in ability but not offering inverse explanations, however, may have been a homogeneous group containing some children able to offer explanations consistent with inverse compensation.
The present findings are somewhat at variance with results reported by Nicholls (1978) and Kun (1977) who described six and eight year-old children as using less mature judgements than described above. These differences can be explained through consideration of the differences in methods employed.

Nicholls found that 68.8% of six year-olds' explanations fell in Level 1 of his hierarchic model (effort and ability not distinguished, the person trying harder is better regardless of success) and the remaining 31.2% fell in Level 2 (effort is seen as the sole cause of outcome). By eight years of age, children's responses were categorized as follows: Level 1 - 12.5%, Level 2 - 87.3%, Level 3 - 18.8% (ability begins to be seen as a separate cause of outcome) and Level 4 - 6.3% (mature concept of ability). Children did not offer mature judgements 50% of the time until age 12. In contrast, in the present study, during pictorial presentation, 68.8% of grade 2 children's (eight years of age), and 16.3% of kindergarten children's (six years of age), responses rated the low-effort actor higher in ability. Nicholls' (1978) methods were similar to those of the pictorial condition of the present study. The differences, however, included that Nicholls: a) did not explicitly state the level of effort of actors to children, allowing assumed effort to vary, b) included low-effort actors being viewed engaging in off-task behaviour, possibly affecting children's inferences about his or her motives, c) did not include instructions to base ratings prior to the practice viewed in the test stimuli, and d) used videotape as opposed to pictured stimuli.

The above results seem to support Nicholls' hypothesis of a developmental progression toward greater use of inverse compensation in the early grade-school years, but at different rates. The majority of grade 2
children were shown to be able to rate ability as inversely related to effort data, a result not proposed to occur in Nicholls' model until 12 years of age.

A comparison between Kun's (1977) results and those of the present study highlights the effects of methods employed under the pictorial condition of the present study in increasing the evidence of inverse compensation in young children. Kun's study utilized methods similar to those followed during verbal presentation in the present study. In both cases, children were asked to make ability judgements based on verbally presented effort and outcome data. Kun subjects included children from grades 1, 3, and 5. Results of Kun's study revealed little difference in ability judgements based on effort data. It was suggested that the use of inverse compensation does not gradually develop through the early grade school years, but appears only at approximately 12 years of age. The youngest children (5 to 6 years of age) were described as judging ability as positively related to effort. Kun's results are consistent with those from the present study during verbal presentation. Pictorial presentation, however, resulted in judgements by second grade children more consistent with mature ability inferences. The difference between results in the pictorial as opposed to the verbal condition or Kun's methods suggest a facilitating effect on ability judgements of the added elements of the pictorial condition. It seems plausible that the most influential of these involved the reduced memory demands due to pictorial representation of effort and success data. A second difference involved the added instructions to base ratings prior to the practice viewed in the test stimuli.

Additional data collected during the present study attempted assess the effects of inferred ability on young children's preference of actor performance and inferred emotion. Several researchers (e.g. Brown and
Weiner, 1984) have suggested that, in general, younger children tended to value high effort when judging others. Children's choice of actor data revealed a similar pattern of results to the ability difference data. The greatest percentage of preference of the low-effort actor (65.0%) consistent across both trials of a condition was offered by second grade children in the pictorial condition. Choices of the low-effort actor by grade 2 children in the verbal condition, and kindergarten children under both presentation-types were lower, ranging from roughly 11% to 28%. A significant number of grade 2 children changed their choices to the low-effort actor from the verbal to the pictorial condition. As a result, greater frequencies of choices of the low-effort actor were found to be related to being in a higher grade in the pictorial condition, and, for grade 2 children, related to the pictorial presentation. The cross-tabulation of choice and ability data also showed a significant tendency for grade 2 children to prefer the performance of the low-effort actor. Roughly twice as many grade 2 children's responses (37 versus 17) in the equal condition which consistently rated the low-effort actor higher in ability corresponded to preferring that actor's performance. In addition, roughly twice as many grade 2 children's responses (37 versus 15) which consistently preferred the low-effort actor's performance corresponded to rating the low-effort actor higher in ability. Grade 2 children in the verbal condition and kindergarten children across both conditions generally rated the high-effort actor higher in ability, and the majority of these (82.8% to 90.0%) did not choose the low-effort actor consistently.

It appears that judgements of ability do affect preference of actor's performance such that high ability is preferred. Actor choice appeared affected, therefore, by the level of ability inference used. This, in turn, was affected for grade 2 children by the presence (pictorial) or absence (verbal)
of conditions which facilitated inferences of ability as inversely related to effort.

Results of emotion ratings were consistent with the position that satisfaction with performance varies with respect to inferred ability. In the equal-condition (both actors succeeding), kindergarten children rated both actors as approximately "happy" across presentation type. Grade 2 children did not display a similar consistency. During verbal presentation, grade 2 children rated the high-effort actor (approximately "very happy") significantly more satisfied with his or her performance than the low-effort actor (approximately "happy"). During pictorial presentation, however, they reversed their ratings, judging the low-effort actor (approximately "very happy") more pleased than the high-effort actor (approximately "happy"). The relationship between ability and emotion estimates is highlighted in the correlation between the two ratings. Under combinations of task and presentation-type, grade 2 children showed a substantial positive relationship between emotion and ability ratings. Seven out of 8 coefficients were significant with an average of $r = .623$ (ranging from $r = .347$ to $r = .778$) and explaining an average 40.6% of the variance. Kindergarten children showed a weaker relationship in the same direction with 3 out 8 coefficients being significant, averaging $r = .408$ (ranging from $r = .083$ to $r = .623$) and explaining an average of 18.5% of the variance. Grade 2 children's responses showed a strong positive relationship with ability estimates while kindergarten children's responses showed a weaker relationship in the same direction. The higher in ability, the happier actors' were inferred to be, especially by grade 2 children.

These data seem to be at variance with the hypothesis proposed by Weiner (1982) that young children base satisfaction in an achievement
situation on effort. However, unless children had been exposed to the pictorial condition, their responses would have appeared to support Weiner's contention. In the verbal condition, children tended to rate the high-effort actor higher in ability and happiness. In the pictorial condition, kindergarten children tended to still rate the high-effort actor higher in ability and emotion while grade 2 children now rated the low-effort actor higher in ability and emotion.

The capacity of second grade children to utilize an inverse compensation schema in inferring ability from effort appears to be highly dependent on the medium in which achievement information is transmitted. The majority of children in grade 2 were able to utilize inverse compensation when memory demands were limited, the interaction was clearly defined as competitive and the performance of the test items was not considered as practice toward increased competence. In addition, grade 2 and, to a lesser extent, kindergarten children tended to choose and rate as more satisfied the actor they rated higher in ability. In general, these findings remained consistent across sex within a given grade and from an academic (math) to physical (ring toss) task.

Children as young as in the second grade may be approaching achievement situations in an attempt to maximize perceived self-competence as opposed to effort. It would appear, however, that, as described by Dweck and Elliot (1983) and Jagacinski and Nicholls (1984) for older children and adults, that manipulation of environmental elements such as attention to social comparison and framing performance in a competitive atmosphere would allow younger children to either experience effort as a means of increasing ability (task-involved) or as a measure of ability at the moment (ego-involved). Both of these approaches to achievement situations have
value, task-involvement as a means of focusing on increasing effort and ego-
involvement as a means to judge where efforts may provide maximal results.
Future research may best focus on attempts to help young children become
flexible in their use of different conceptualizations of ability. Furthermore, it
would be of interest to investigate whether young children's use of ability
schemas varies as a function of personal competence across areas of early
grade-school activities. Does the child who considers him or herself good at
math tend to conceptualize ability in this area as static or affected by effort?
Finally, once a relationship between concept of ability and actual competence
across several areas have been established, how these relate to, and effect, a
young child's budding overall self-concept would also be of interest.
APPENDIX A
Review of the Literature

In recent years, several authors have studied the development and differentiation of children's concept of ability (e.g. Karabenick and Heller, 1976; Kun, 1977; Nicholls, 1978; Surber 1980, 1984). This research has been conducted within the more general framework of investigation into the development of achievement behaviour. The impetus for this work has stemmed from early findings by Weiner and his colleagues (e.g. 1971, 1972) which highlighted the importance of attributions and related causal schemas (configuration of causal elements, Kelley, 1972) utilized in achievement situations (Nicholls, 1984). Nicholls (1984) describes that, in particular, the demonstration of ability to oneself or others and the avoidance of demonstration of low ability is the main focus of achievement behaviour. In addition, perceptions of ability have been seen to mediate a variety of attitudes and behaviours including persistence vs. learned helplessness in the face of obstacles, (Riner and Dweck, 1978), the experience of test anxiety (Sarason et al., 1960), feelings of shame in the face of failure (Covington and Omelich, 1979), and a sense of personal mastery or efficacy (Maddux and Stanley, 1986) after success. Such studies have generally been conducted using adults or older children as subjects. When considering young children, the specific effect of perceived ability depends on the developed level of understanding of the role of ability as a causal agent on achievement tasks. For example, a belief that increased effort in the classroom leads to increased ability would result in great satisfaction and expected praise from the teacher over high effort to achieve a goal. On the other hand, a belief that high effort on a task where others are seen to succeed with ease betrays a lack of ability.
on a task where others are seen to succeed with ease betrays a lack of ability
would lead to shame and an aversion to an activity in which much effort is
displayed. High praise from a teacher for high effort may be interpreted as a
signal of limited expectation. It is important, therefore, to understand the
range of causal attributions available at different age levels particularly with
young children who may be forming achievement habits they will retain
throughout their school years and beyond. The present section will briefly
summarize the contributions of attribution theory to the study of
achievement motivation, research focussed on the development of children's
concept of ability and how the level of understanding of ability affects
achievement behaviour.

**Attribution and Affect in Achievement Motivation**

In a review of the area, Dweck and Elliot (1983) described the
foundations of research on achievement motivation to have essentially
followed the Expectancy x Value model proposed by McClelland (1961) and
Atkinson (1964). The central constructs of the theory are motives, motives to
achieve success and to avoid failure. Motivation is considered to be a function
of the strength of the motives combined with the incentive value for success
and failure. It is assumed that both motives are aroused in every
achievement situation, leading to an approach-avoidance conflict. For those
whose motive to succeed outweighs their fear of failure, there is a greater
tendency to approach achievement situations. The reverse is true for those
with a stronger motive to avoid failure. An important aspect of the model
focussed on the anticipated affective reactions to achievement situations
(Heckhausen et al., 1985). Motives were considered to reflect the capacity for experiencing pride in goal attainment and shame in failure. The anticipation of these affects was considered to be the motivating agent. Furthermore, affects were seen as completely dependent upon subjective probabilities of success and failure. As described by Atkinson (1957), incentives for success (Is) and failure (If) were defined in an inverse linear relationship between subjective probabilities of success (Ps) and failure (Pf), i.e.: Is = 1 - Ps; and If = 1 - Pf. The possibility of success at a harder task results in greater anticipated joy and pride while more shame and embarrassment are anticipated from failure at an easy task. Finally, affective components are combined multiplicatively with the motives to succeed (Ms) and to avoid failure (Maf) to determine overall attractiveness, or valence, toward future success (Vs) and failure (Vf) as follows: Vs = Ms x Is; and Vf = Maf x If.

The contribution of attribution theorists (e.g. Weiner et al., 1971; Weiner, 1972) was to release affect from being totally determined by subjective probabilities (Heckhausen et al., 1985). The type and extent of experienced affect, such as pride, and shame was seen to depend to a greater extent on causal attributions regarding responsibility over a performance outcome. Dweck and Elliot (1983) describe the attributional approach as hinging on the assumption that beliefs and cognitions about success and failure mediate achievement behaviour. While achievement is still cast in an Expectancy x Value model, the expectancy component is elevated to a position of overriding importance. The interpretation of outcomes and the causes to which they are attributed are seen to determine future confidence and, subsequently, subjective probabilities of success.
Weiner et al. (1971) were the first to recognize and describe the significance of causal attributions of achievement motivation. These authors based their proposed causal factors on Heider’s (1958) division of causal elements along two dimensions: locus of control (internal vs. external) and stability (stable vs. unstable). The classification resulted in four causal elements: ability (internal-stable), effort (internal-unstable), task difficulty (external-stable) and luck (external-unstable).

While attribution theorists share the view that attributional tendencies are the source of achievement motivation and affect, which particular attributions lead to which affects is still under discussion. Many researchers (e.g. Cooper and Burger, 1970; Frieze, 1973; Meyer and Butzkmann, 1975, and Rheinburg, 1975, 1977; cited in Heckhausen, 1985; Weiner et al., 1978; Covington, 1984; and Nicholls, 1984) have attempted to assess the relative importance of Weiner’s four causal elements in success and failure conditions. The studies included subjects making causal attributions about themselves or others as a fellow student or as a hypothetical teacher. Authors have generally concluded that effort and ability were, by far, the most frequent causal elements invoked by subjects. These attributions were also seen to maximize affective consequences and were considered, therefore, the most important. From this point, however, several groups of researchers have proposed differing opinions concerning the relative weight of attributions to ability and effort in producing emotional reactions (Brown and Weiner, 1984).

Weiner (1972, 1974) has argued that attribution to effort generates more affect than that does ability. Weiner and Kukla (1970) demonstrated that reward by others was contingent upon effort given success. The authors asked subjects to give feedback to students based on information regarding
whether the students were gifted, whether they had exerted effort, and the performance results. Overcoming personal handicap through effort was given the highest reward while low effort by high ability students was penalized the worst. Weiner and Kukla's results were described as limited on three counts by Heckhausen et al. (1985). Firstly, the dependent variable in the previous study involved sanctions as opposed to affects. Sanctions are regulated by others while affects are self-regulated. Secondly, subjects were presented with fictitious situations, making the generation of achievement-related affects less likely. Lastly, evaluations were done of others, leaving open the possibility of differing evaluation criteria for others than for oneself. Instead, Heckhausen et al., based on previous research (Heckhausen, 1972, 1978, cited in Heckhausen, 1985), proposed that the affective consequences of success and failure are most pronounced when a revision of one's self-concept of ability is provoked. In a similar vein, Nicholls (1976) suggested that the impact of causal attributions on affect was a function of their implication for competence and self-esteem in the long run. The author stated further that ability is the critical element for achievement over a long range of time and, therefore, is most important in regulating affect. As a test of his position, Nicholls (1976) asked college students whether they would rather exert high effort and be of low ability or exert low effort and be of high ability on an achievement task. They chose the latter. Nicholls concluded "Effort is virtuous, but it's better to have ability" (1976, p. 306).

Given the proposed key role of attributions to ability in regulating the affective and subsequent approach tendencies in achievement settings, the development of the concept of ability became a focus of investigation for several researchers. How ability became differentiated from other causes in
the achievement schemas and how information regarding performance reflected on ability at different ages were studied. In his review of the development of achievement motivation, Heckhausen (1982) described the successive emergence of four basic cognitive prerequisites: a) centering on self-produced outcomes, b) attributing causes to one's action outcomes, c) distinguishing degrees of task difficulty and personal competence, and d) the differentiation of ability from effort. From a sampling of research across the first three levels in this sequence, Heckhausen stated that it is generally agreed that they are present by four years of age. The distinguishing of ability from effort, however, does not enjoy similar consensus, with estimates ranging from between five and eleven years of age. Research involving the final stage of the model will be considered in more detail.

The development of a concept of ability has generally been studied in terms of its differentiation from effort through the development of causal schemas pertaining to these two elements. Through the assumed relationship between causal elements in a schema, predictions may be made on the basis of partial information to infer the remaining causal elements. Causal schemas allow the formation of hypothetical deductive statements about the causes involved and their interaction in a particular situation (Kun and Weiner, 1973). On this basis, much research in the area of the development of children's concept of ability has used methods involving the inference of missing causal elements from the presentation of the remainder of a schema (e.g. asking children to infer ability from effort and outcome data). Responses were then categorized as per one of several related structural developmental models of attributional differences.
Most researchers have proceeded from the point of view of ability consistent with that of Heider (1958). Specifically, a mature concept of ability would be demonstrated by a prediction of outcome which resulted from a proportional combination of ability and effort (facilitative causes) data. As well, given a consistent outcome, the facilitative causes of ability and effort would follow a schema of compensatory (inverse) covariation (Heckhausen, 1982). For example, a mature concept of ability would be inferred if a child viewing equally successful performance by two persons, judged the one having to try less hard possessed greater ability and vice versa. Several studies have focussed on this question (e.g. Kun, 1977; Nicholls, 1978).

Descriptions of developmental sequences followed in the differentiation of the concept of ability have been offered by Kun (1977) and Nicholls (1978). Kun’s hypothesized progression of inferences involving ability includes: a) a simple covariation schema, b) a magnitude covariation schema, and c) a compensation schema. In simple covariation, the magnitude of the outcome is proportional to one of the causal factors and the other is seen as either fixed or appears unnecessary. Kun and Weiner (1973) have described the simple covariation as a type of multiple sufficient causes schema (Kelley, 1972) in which there is a disjunctive relationship between ability and effort. In a magnitude covariation schema the magnitude of the effect is proportional to one of the causal factors, which leads to the inference that an increase in the magnitude of an outcome is a result of the increase in a facilitative or decrease in an inhibitory cause. Therefore, greater success is a result of greater effort or ability or both. The presence of either may cause the effect. The third differentiation, a compensation schema, leads to the inference that if an outcome remained constant, a change in magnitude of
one cause was necessarily accompanied by a compensating change in the value of a second cause (the criterion for a mature concept of ability according to Heider's proposal). Inverse compensation would then occur for ability and effort given equal outcome. The final rule falls under Kelley's (1972) proposed schema of multiple necessary causes as it describes a conjunctive relationship between two causal factors, ability and effort.

Kun (1977, Study 1) attempted to determine the level of proposed schemas employed by first, third, and fifth grade children's in judging ability relative to effort and performance in a post-diction paradigm. Subjects were presented with nine graded situations, involving factorial combinations of three levels each of performance and effort, of hypothetical individuals solving puzzles. Subjects were asked to judge how "good at puzzles" each story character was. The results of this experiment showed no significant main effect of effort, and no age group by effort interaction on ability judgements. Kun described children's ability inferences as mainly positively related (as opposed to inversely) to exhibited effort. The person trying harder was more able and succeeded more. Kun termed this a "halo schema."

Nicholls (1978) charted the development of causal schemas involving effort and ability in children between the ages of 5 and 13 through questioning them about the ability of 2 filmed children working on math problems. In one instance, the children performed equally well with differing effort. The second portrayed the hard-worker obtaining a lower score, thus visibly contradicting a simple halo schema. From this work, Nicholls proposed 4 levels of differentiation of effort and ability. In Level 1, effort or outcome is ability, that is, effort, ability and performance outcomes are not differentiated. There is a centering on effort (those who try harder are
smarter even if scoring lower), or less frequently on outcome (those scoring higher worked harder and are smarter). This was seen in young children (5 years), descending in frequency with age. Level 1 corresponds roughly to Kun's simple covariation. In Level 2, effort is considered the cause of outcome. Equal effort is expected to result in equal performance. When equal outcome is paired with apparent differing effort, it is explained by effort compensations (e.g., the one who did better tried much harder the short while he was working): Here, effort will make you smarter and there is no danger that trying harder will indicate lower ability. This level is prominent in the 7 to 9 year group. Level 2 is consistent with Kun's description of a halo schema. In Level 3, effort and ability are partially differentiated. Effort is no longer the sole cause of outcome. Differing effort with equal outcome begins to be explained by differing levels of ability, but is not always followed through. This transition level peaks approximately at age 10. At the final level, Level 4, ability is seen as capacity. Ability and effort are clearly differentiated. Ability is seen as placing upper limits on the effect of effort on performance. When outcome is identical, lower effort implies greater ability and vice versa. This final level does not come into prominence until age 12. Level 4 is similar to Kun's magnitude covariation or inverse compensation.

Further evidence to support the above developmental sequences may be found in a study by Karabenick and Heller (1976). The authors had subjects in first, third, and fifth grades and college students make judgements of ability in two procedures: (a) serial presentation, and (b) paired comparison. In the serial presentation condition, subjects were first given information that a story character succeeded at a task and were asked to estimate the character's ability. Information about the character's effort was
then added (had to try very hard or didn’t have to try at all) and the subject was again asked to estimate the character’s ability. In the paired comparison procedure, subjects were given information about the effort of two story characters (one was described as having exerted high effort and the other low effort) who both successfully completed a puzzle. In the serial presentation condition, all age groups displayed a significant decrease in their ability judgements when high effort information was added. Heckhausen (1982) suggests that the serial integration task may have assisted children in making mature ability judgements by separating the task into two components. In first assessing the ability of actors with only performance data, children used only a single causal element, outcome, as they would at the level of magnitude covariation in Kun’s model, and Level 2 in Nicholls’. The addition of effort data apart for reevaluation may have approximated the mental procedure necessary for mature ability judgements, namely the consideration of one causal element first, and then its possible interaction with another.

Karabenick and Heller’s data during paired comparison, however, suggest that inverse compensation may be available as a schema already in first grade children. All age groups made a significantly greater proportion of total inverse compensation choices than chance (72, 72, 69 and 94% of the low effort characters were chosen by the first grade through college-age subjects, respectively). Furthermore, 60.4% of the children made the inverse compensation choice across two identical trials of the experiment. These findings, suggesting no change in inverse compensation during the elementary school years, will be discussed further with further evidence from investigations conducted by Surber (1980).
To evaluate the age at which inverse compensation for ability occurred, Surber (1980) had children in kindergarten, third and fifth grades, and college students judge the strength of hypothetical weightlifters given the size of weight lifted (very very light, kind of light, kind of heavy, or very very heavy) and the effort expended (didn't try at all, tried a little bit, tried pretty hard, and tried very hard). Initial analyses were quite similar to Kun's results in that there was no main effect of effort and no age by effort interaction when the adult subjects were excluded from the analyses. Upon further examination of the data of the individual children, however, Surber suggested that they did not appear to be ignoring the effort cue. The author separated the children into groups based on the slope of their judgements of ability as a function of effort. The results showed that for each of the elementary school age groups, some of the children showed inverse compensation while others did not. Furthermore, there was no clear relationship found between the proportion of children showing inverse compensation and age group. Surber suggests that the lack of a main effect of effort on the children's ability judgements was not due to neglect of the effort information. Almost all the children made use of the effort information, but they used it in two different ways.

Surber (1984) compared the above data with those offered by Kun (1977) and Karabenick and Heller (1976). Surber found that the studies differed in two related ways. First, Karabenick and Heller's task required the least memory demands, then came Surber's task and lastly Kun's. Secondly, the less the memory demands, the greater the incidence of inverse compensation revealed by young subjects. Surber (1984) argues that reduced memory demands may allow younger children the extra processing capacity...
necessary for the less familiar task of inversely varying ability and effort. Surber’s findings suggest that inverse compensation may be available to children as early as in the first grade. If so, then it becomes important to investigate when children tend to use an inverse compensation schema as opposed to a less differentiated view of ability, and what the consequences are to achievement behaviour and motivation. Preliminary information on this subject may be found in research asking similar questions and using adults and older children as subjects.

**Level of Ability Differentiation and Achievement Behaviour**

Achievement theories have only recently begun to be formulated so as to take into account the fact that persons can employ a more or less differentiated concept of ability depending on the characteristics of the achievement situation and the attitude used in approaching the task (Nicholls and Miller, 1984). Two groups of researchers, Dweck and Elliot (1983) and Jagacinski and Nicholls (1984), have proposed similar general frameworks of achievement motivation relative to the level of ability differentiation utilized.

Dweck and Elliot (1983) have stated that different achievement goals lead children to structure achievement situations in very different ways. The authors propose that there are two types of achievement goals available to older children and adults, namely learning goals and performance goals. Learning goals focus on an attempt to increase competence and understanding, while performance goals center on being judged as having high ability.
Dweck and Elliot also state that children approach achievement situations with a "theory of intelligence" which appears to predict their choice of achievement goals. The two general theories of intelligence that children tend to utilize are an incremental and an entity theory. Each theory assumes a very different concept of intellectual competence. In the incremental theory, intelligence is considered as an ever-growing repertoire of skills and knowledge. High effort at a task is, therefore, considered a worthwhile investment toward increasing competence. This view is similar to Nicholls' (1978) previously mentioned Second Level of ability differentiation. In contrast, the entity theory assumes that intelligence as a fixed, general, judgeable-entity. Within the entity view, high effort on a task may betray a lack of ability. The entity theory parallels Level 4 (mature ability inferences) in Nicholls' developmental sequence.

In their study of college students, Jagacinski and Nicholls (1984) identified two different views of ability that were utilized by subjects, and proposed that these views regulated cognitive and affective reactions to achievement outcomes. The authors also described two types of achievement situations which elicit the respective levels of ability differentiation, task-involving and ego-involving. Ego-involving situations are those in which the performance of others is made salient or when a person is induced to evaluate his or her or another's ability. College students used Nicholls' (1978) most differentiated view (Level 4) of ability during these times. Social comparisons become a factor in ego-involving situations and an objective, norm-referenced evaluation of ability is utilized. As a result, high effort with equal outcome implies low ability. Competitive situations naturally bring comparisons with others using a higher level of differentiation of ability. A
person attempting to be accepted on a hockey team may realize that no matter how hard he tries, if others can skate around the rink with less effort than he must expend, they will be chosen. Ego-involvement is similar to Dweck and Elliot's (1983) performance goals. Jagacinski and Nicholls further propose that if one's goal is simply to improve mastery, then a less differentiated concept of ability is required. Under these conditions, social comparisons are not necessary. Effort is considered as means of increasing mastery and, therefore, success following high effort results in an increased sense of competence. The most differentiated view of ability involves more information than is necessary to gauge absolute gains in mastery. A child attempting to learn how to skate feels great satisfaction from trying earnestly an entire day and finally making it around the rink once, no matter how well others on the rink are doing. Task-involvement is similar to Dweck and Elliot's (1983) learning goals.

In their review of the area, Dweck and Elliot (1983) cite research (e.g., Harari and Covington, 1981; Heckhausen, 1981; Marshall, et al., 1980; Surber, 1980) suggesting that by late grade school, virtually all children understand aspects of both views, incremental and entity, of intelligence. Nevertheless, independent of actual ability, the authors stated that different children tended to favor different theories and the corresponding different achievement goals when choices were made. As a result, those utilizing an entity theory preferred tasks in which the chances of making mistakes were minimized. Those following an incremental view preferred tasks offering increased learning opportunities. Nicholls (1981) stated that children oriented toward different achievement goals, tend to structure the "same" situation very differently. In
an experiment in which achievement goals and perceived ability were manipulated, Elliot and Dweck (1981) found no debilitation over a series of failure trials for children with learning goals (regardless of whether they believed themselves to have high or low ability). Children with performance goals who believed they had low ability, however, showed marked deterioration of performance under the same conditions. In addition, uncertainty is experienced quite differently as a function of achievement goal. Children seeking to to increase mastery through effort tend to view uncertainty with a sense of challenge and anticipation. When a display of competence is desired, however, challenging and uncertain situations are avoided as possible opportunities to err.

Two implications related to achievement situations in the classroom follow from the research of Dweck and Elliot (1983) and Jagacinski and Nicholls (1985). First, children should be encouraged to utilize an incremental view of intelligence as much as possible. Attributional retraining literature has consistently shown that, with older children, it is possible to change attributions of failure from lack of ability (a stable, internal, uncontrollable factor) to lack of effort (an unstable, internal, controllable factor) to produce increased persistence and performance (Försterling, 1985). Secondly, situational factors in the classroom should promote task- as opposed to ego- involvement, such as framing work in a competitive context as infrequently as possible.

Since it has generally been assumed in the literature that a mature concept of ability is not available to children before 10 years of age (e.g. Kun, 1977, Nicholls, 1978), research into the effects of situational and attributional factors on the level of differentiation of ability utilized has generally focussed
on older children and adults. Evidence has begun to emerge, however, (e.g. Surber, 1980, 1984) suggesting that children as young as six and seven years of age are capable of viewing ability in a manner consistent with that of adults. If so, it would seem that research should begin to focus on the effects of attributional and situational factors during the early school years. At this age, children are just beginning to develop their understanding of school and achievement as it relates to a classroom of peers. This research would have implications in terms of the attributional messages early primary school teachers give to children involving effort and ability as well as the extent of use of competition in structuring of achievement situations.
APPENDIX B

Examples of Stimulus Materials and Rating Scales

The following contains examples of the ring-toss and arithmetic tasks which actors were seen performing as well as the scales with which children were asked to rate the actors on ability, effort and emotion.
Examples of Ring Toss Stimuli
Grade 2 Arithmetic Task
Kindergarten Arithmetic Task
How good are they at it?

Is not very good at all at it

Is not very good at it

Is good at it

Is very good at it

Is very, very, good at it

Rating Scale for Ability
How hard did they have to try?

Didn't have to try very much at all

Didn't have to try very much

Had to try

Had to try very much

Had to try very, very much

Rating Scale for Effort
How do they feel?

Feels very sad
Feels sad
Doesn't feel happy or sad
Feels happy
Feels very happy

Rating Scale for Emotion
APPENDIX C

Grade x Sex x Task x Success Interaction for Ability Estimates

The ANOVA for ability estimates also revealed a significant grade x sex x task x success interaction, $F(2, 152) = 3.88, p < .05$. This interaction had little bearing on the central issue of the present study since it does not deal with ability estimates based on differential effort. These data describe general trends in the estimates of children regardless of effort. Follow-up comparisons of mean scores were made using Tukey tests (df = 8, 120). As portrayed in Figure 5, this significant higher-order interaction can be represented by differences in the sex x task interaction within each of the four cells created from the crossing of the success by grade variables (equal-grade 2, equal-kindergarten, unequal-grade 2, unequal-kindergarten). When actor-pairs both succeeded at their task (equal success condition), grade 2 males' estimates were significantly higher for the math ($M = 3.93$) and ring toss ($M = 4.05$) tasks than grade 2 females' for the math ($M = 3.68$) and ring toss ($M = 3.73$) tasks respectively. Under similar conditions, kindergarten males offered significantly higher ability estimates for the math task ($M = 3.73$) than did kindergarten females ($M = 3.45$). No difference was found between kindergarten males' ($M = 3.71$) and females' ($M = 3.81$) estimates for the ring toss task. In the unequal condition (only the low-effort actor succeeding), grade 2 males offered significantly higher ability estimates for the ring toss task ($M = 3.51$) than did grade 2 females ($M = 3.25$). No difference was found between estimates of grade 2 males ($M = 3.27$) and females ($M = 3.33$) for the math task. Under similar conditions, no differences were found between estimates of either kindergarten males ($M = 3.67$) and females ($M = 3.73$) for the math task.
Figure 5. Grade x Sex x Task x Success interaction for Ability Estimates
3.27) and females (M = 3.18) for the math task or kindergarten males (M = 3.30) and females (M = 3.29) for the ring toss task.

In summary, grade 2 males' overall estimates were significantly higher than those of grade 2 females' in all but the unequal condition for the math task. Estimates of kindergarten males were significantly higher than those of kindergarten females only in the equal condition when viewing the math task.
APPENDIX D
Halo Explanations

The frequencies of children’s halo responses in the equal condition
(only the low-effort actor succeeding) can be seen in Table A. Phi coefficients
($\phi_p$) were derived for these data in order to determine the degree of
relationship between the frequency of halo ratings and the grade,
presentation and task variables. Due to the limited number of halo responses
in some conditions, data were collapsed across sex in order to make this
analysis more meaningful.

In the pictorial condition, being in a lower grade was related to a
higher frequency of halo responses for both the math, $\phi_p = .310$ ($N = 80$, $p = .003$), and ring toss, $\phi_p = .285$ ($N = 80$, $p = .005$), tasks. A significant
relationship in the same direction was found in the verbal condition for the
math, $\phi_p = .302$ ($N = 80$, $p = .0035$), but not the ring toss, $\phi_p = .083$ ($N = 80$, $p = .227$), task. Grade 2 children tended to offer significantly more halo responses
in the verbal as opposed to the pictorial conditions when viewing the ring
toss task, $\phi_p = .197$ ($N = 80$, $p = .038$), but not the math, $\phi_p = .113$ ($N = 80$, $p = .156$), task. No significant relationship between presentation-type and halo
responses was found for kindergarten children in either the math, $\phi_p = .032$
($N = 80$, $p = .386$), or ring toss, $\phi_p = -.036$ ($N = 80$, $p = .375$), task. No
significant Phi coefficients were found at the $p = .05$ level when comparing
math to ring toss results for grade 2 or kindergarten children under either
the verbal or pictorial conditions. The coefficients ranged from $\phi_p = -.115$ ($N = 80$, $p = .152$) for grade 2 children and $\phi_p = .102$ ($N = 80$, $p = .181$) for
kindergarten children in the verbal condition to $\phi_p = 0$ ($N = 80$, $p = 1$) for

85
<table>
<thead>
<tr>
<th>Task</th>
<th>Grade</th>
<th>Presentation</th>
<th>Verbal</th>
<th>PIctorial</th>
<th>Halo</th>
<th>Other</th>
<th>Halo</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>Math</td>
<td>2</td>
<td>1</td>
<td>59</td>
<td>0</td>
<td>40</td>
<td>32</td>
<td>7</td>
<td>33</td>
</tr>
<tr>
<td>Ring Toss</td>
<td>2</td>
<td>3</td>
<td>37</td>
<td>0</td>
<td>40</td>
<td>3</td>
<td>35</td>
<td>34</td>
</tr>
</tbody>
</table>

Note: Data is from the equal condition.
grade 2 children and $R_p = .034$ ($N = 80, p = .382$) for kindergarten children in
the pictorial condition:
References


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VITA AUCTORIS

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