Are Young Children Adaptive Decision Makers? A Study of Age Differences in Information Search Behavior

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How adaptive are young children as decision makers? Although similar questions have been raised frequently with regard to adult consumers, very little attention has been paid to the nature of consumer decision-making abilities in young children. The purpose of this article is to explore the emergence of adaptivity in young children's decision-making skills in the context of predecisional search behavior. This article specifically examines the extent to which young children are capable of adapting their search behavior to differing levels of search costs and benefits in the decision environment. We report results from two experiments, conducted with children aged four to seven years, in which we examined children's search activity in the context of a game called "house of prizes." The game involved making a choice between two "houses" that contained prizes hidden behind each "window." Children were allowed to search behind the windows to uncover the prizes prior to making their choices, with differing costs and benefits of doing so. Data regarding the extent of search conducted by children of different ages suggest that the ability to adapt emerges during the preschool years in a limited fashion and develops rapidly thereafter.

During the past decade, the role of children as consumers has expanded at an unprecedented rate. Increasingly, children are called upon to make decisions not only about their own purchases but also about purchases made by the family unit. More than ever before, children constitute a major consumer market, with $8.6 billion in direct purchasing power and $130 billion in indirect purchase influence. Last year alone, for example, children aged 4–12 years spent over $2 billion on snacks and sweets, $1.8 billion on toys and games, and $690 million on clothes (McNeal 1992). Not only are they spending more, but children are also purchasing items in a wider range of product categories and influencing a much wider array of family purchases, including big-ticket items such as automobiles and vacations. Children influence an estimated $35 billion in grocery items, $22 billion in fast-food purchases, and $11 billion in children's clothing (McNeal 1992).

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Despite these trends, understanding of how children make consumer choices remains extremely limited in scope. We lack even the most basic knowledge pertaining to children's decision-making skills, when and how these skills emerge in childhood, and when and how these skills are adapted across different decision environments. The only evidence to date in the marketing area suggests that decision-making skills emerge throughout childhood, with the complexity of strategies developing in tandem with age. The findings indicate, for example, that younger kids tend to use fewer dimensions to compare and evaluate brands (Bahn 1986; Capon and Kuhn 1980; Ward, Wackman, and Wartella 1977; Wartella et al. 1979), use simple choice mechanisms based on single attributes rather than employing compensatory choice strategies (Wartella et al. 1979), and tend to rely on dominant perceptual features (vs. functional features) of products in gathering information and making choices (Ward et al. 1977; Wartella et al. 1979).

Even less evidence, however, is available pertaining to children's abilities to adapt whatever decision-making strategies they possess to different consumer decision environments. Understanding adaptation has become one of the most important themes in recent decision-making research in adults (e.g., Bettman 1988; Payne,

Bettman, and Johnson 1993) and has also emerged as an important topic in recent cognitive development research in areas such as problem solving (e.g., Siegler 1991; Siegler and Jenkins 1989) and information processing (e.g., Miller et al. 1986; Woody-Ramsey and Miller 1988). Gradually, the focus has shifted from documenting the attainment of a particular strategy to understanding how and when individuals employ different strategies for different types of tasks. Examining children's adaptation across tasks, for example, has provided a greater understanding of how children think and reason.

Accordingly, the purpose of this article is to explore the emergence of adaptivity in the decision-making skills of young children. Specifically, this paper focuses on young children's predecisional search behavior and examines the extent to which young children adapt their search behavior to different levels of search costs and benefits in the decision environment. Predecisional search was selected as the context on the basis of its importance as an element of decision making as well as its relevance to children in everyday purchase situations. Children are often put in the position of deciding whether to expend more time and effort, as well as delaying immediate gratification, to get the "very best" treat or toy. Additional search might involve simply looking at another shelf in the candy display or may be more extensive, such as looking in other sections of the store or going to additional stores. The dilemma is played out in stores every day, for example, as children decide whether to settle for an available version of a Matchbox car or Barbie doll or to hold out for what might be available at a different store. Our objective here is to understand when children begin to adapt their search strategies to the situation at hand, with a focus on the existence of age differences in adaptivity.

CONCEPTUAL BACKGROUND

Adaptivity in Information Search

Perhaps the most explicit framework of how individuals adapt their search behavior to the decision environment is the cost-benefit approach first proposed by Stigler (1961). According to this view, consumers will gather information as long as the perceived benefits of doing so are equal to or outweigh the perceived costs of acquiring the information. Empirical evidence generally supports the notion that individuals do modify their behavior in response to different search costs using strategies such as restricting the amount of information they obtain or the number of stores they visit (for reviews, see Bettman [1986]; Punj and Staelin [1983]; Urbany [1986]). Research also indicates, however, that the direction in which individuals adapt is not always in line with a strict "marginal cost equals marginal benefit" analysis. Individuals, for example, might respond more to relative than to absolute costs and benefits of search (e.g., Thaler 1980), or they might underutilize relatively inexpensive pieces of information prior to rendering decisions (e.g., Connolly and Serre 1984; Lanzetta and Kanareff 1962; Olshavsky and Granbois 1979).

Similar evidence regarding children's abilities to balance costs and benefits in gathering information has yet to surface. The lack of evidence is surprising, especially given that children clearly face different levels of search costs and benefits in the decisions they make. Search costs, for example, can vary from a relatively low level (e.g., simply looking at the different flavors of Tootsie Roll Pops before selecting one) to a relatively high level (e.g., looking at different stores to see what versions of Barbie dolls are available before selecting one). Search benefits can also vary from a relatively low level (e.g., selecting the most-preferred flavor of Tootsie Roll Pops for a small treat) to a relatively high level (e.g., selecting the best Barbie doll for a birthday present).

Recently, some limited evidence has emerged suggesting that young children are able to modify their search behavior in view of the type of search benefits suggested above. Even preschoolers, four to five years of age, take more time searching through a set of alternatives when they are told that their final choice will be irreversible rather than reversible at a later date (Davidson and Hudson 1988, experiment 1). Children in the early elementary school grades, ranging in age from six to nine years, exhibit an even wider range of adaptive responses. These children increase the amount of information gathered in response to choice situations that are irreversible, recognize the need to spend more time gathering information for decisions that are important or irreversible, and voice the need to examine more brands before making a choice that is important versus relatively unimportant (Davidson and Hudson 1988).

It would appear, then, that young children are able to adapt their predecisional search behavior to at least some parameters in the decision environment. Previous efforts, however, have not considered search costs, allowing children to gather information with relatively minimal search costs (e.g., minimal time and little effort). In view of this, it is quite possible that children may encounter difficulties in adapting to search costs and benefits simultaneously, even though they are able to respond to differences in search benefits alone. In order to generate predictions about these possibilities, a better understanding of the cognitive mechanisms that underlie the process of adaptation, and the developmental aspects of these mechanisms, is in order.

Adapting to Cost-Benefit Trade-Offs

Despite the fact that we have a large body of evidence pointing to adaptivity in decision making among adults,

there is very little theorizing about what cognitive mechanisms might underlie the process of adaptivity. Although some general notions have been proposed (see, for example, Bettman 1988), a more extended analysis of the specific search task facing individuals in our context, involving adaptation to varying levels of search costs and benefits, seems appropriate for generating additional ideas regarding developmental trends.

At a minimum, it would seem that at least three different processes are involved in adapting one's search behavior to differing costs and benefits of search. First, one needs to attend to factors in the decision environment that relate to costs and benefits, and encode them as such. Second, one needs to process both cues (costs and benefits) simultaneously in making trade-offs between the two. And, finally, one needs to select or construct a search strategy in light of the cost-benefit trade-offs determined above.

Using this scenario as a starting point, we can begin to merge several areas of developmental evidence into the adaptive search question. With regard to the first step, we can expect children as young as preschoolers to attend to and encode both search costs and benefits as long as they are tangible and perceptually salient. Search costs arising from intangible or abstract notions such as effort, time, or opportunity cost would be unlikely to receive consideration until children enter elementary school. Evidence to this effect can be found in visual search studies, which clearly indicate that attention and encoding are driven by perceptual salience for young children, with other types of salience overriding the perceptual dimension only in children six to seven years of age or older (e.g., Rothman and Potts 1977; Vurpillot 1968).

Turning to the second step, we can expect preschoolers, and some children in the early elementary school grades, to have difficulty considering both cost and benefit cues simultaneously, at least under some conditions. Preschoolers, for example, might focus on a single cost cue or benefit cue in adapting their search behavior. Supportive of this idea is an abundance of developmental literature demonstrating that young children often have difficulty processing and combining two or more cues at a time (Siegler 1991). Studies of children's problem-solving abilities, for example, indicate that children younger than six or seven years of age often attend to single dimensions of problems and fail to consider multiple dimensions needed for problem solution (Siegler 1976). Although these tendencies can often be alleviated by reducing task demands (see, for example, Brainerd 1978; Gelman 1978), preschoolers are more likely to experience difficulties in processing multiple cues (such as costs and benefits) than their older counterparts.

The final step, selecting or constructing strategies based on a consideration of search costs and benefits, seems less straightforward in terms of hypothesizing a developmental trend. The research on adaptivity in children's search behavior reviewed earlier appears to indicate that even preschoolers have the ability to adapt in the face of changing conditions. Evidence regarding adaptivity from other areas of child psychology research, such as visual search and memory development, presents a more mixed view of young children's abilities. More often than not, researchers in these areas have found that children do not adapt strategies to the task at hand until they are at least eight years old, if not older (see, for example, Bjorklund 1990; Miller et al. 1986; Siegler 1991). Recently, however, a number of studies in these areas have demonstrated some adaptivity even on the part of preschoolers (see, e.g., Siegler and Jenkins 1989; Woody-Ramsey and Miller 1988). It appears that preschoolers can exhibit adaptivity if the task is a simple one, is presented in a familiar and engaging context, and requires relatively simple changes in strategies to adapt.

In sum, if one takes all three steps of the process into consideration, it seems that the ability to adapt to cost-benefit trade-offs in search behavior develops through early childhood. Preschoolers appear to have emerging, yet rather fragile, abilities in this regard. That is, they may be able to adapt if the cost and benefit cues are sufficiently engaging, involve very clear trade-offs, and require a relatively straightforward modification of search behavior for adaptation. Apart from this, adaptation to cost-benefit trade-offs would not seem likely until the early elementary school years. These years cover the most accelerated development in the three steps involved in adaptivity identified here.

HYPOTHESES

The overriding proposition of this research is that children's adaptivity to cost-benefit trade-offs increases with age. The evidence reviewed above supports the view that adaptivity in predecisional search behavior emerges, to some extent, in preschool children and develops thereafter. This development sequence might be captured in several ways by examining several aspects of children's predecisional search behavior, including the amount of information searched, the amount of time spent searching, and the efficiency of search patterns. For this investigation, we will focus on the amount of information search, given the fact that it is one of the most popular measures for testing cost-benefit notions (see Bettman 1986). In particular, two aspects of this measure will be of interest here: the total amount of information searched and the amount of information searched relative to an "optimal" amount. With respect to these two indicators of adaptivity, the following hypotheses regarding age differences are advanced:

H1: Adaptivity in children's search behavior, in terms of the amount of information searched, increases from the preschool to early elementary school years.

H2: Adaptivity in children's search behavior, in terms of approaching optimality, increases from the preschool to early elementary school years.

EXPERIMENT 1

Method

Overview. Children's search behavior was examined in the context of a game called "house of prizes" that involved making a choice between two "houses" that contained prizes hidden behind "curtains." Children were allowed to search behind the curtains to uncover the prizes prior to making their choices, which allowed us to document the extent of search activity in children of different ages. Three independent variables of interest were incorporated into a 2 (age: four to five years, six to seven years) × 2 (search costs: low, high) × 2 (search benefits: low, high) design, with age and search costs varied as between-subjects factors and search benefits varied as a within-subjects factor.

Subjects. Sixty-three children were recruited from three suburban day care centers in a large midwestern city. Thirty children were four to five years of age (13 males, 17 females) and 33 were six to seven years of age (18 males, 15 females). Parental permission was obtained for each child prior to the start of the study.

Experimental Task. Children's search patterns were examined in the context of a game called "house of prizes." The game, based on similar methodologies used with young children in child psychology (e.g., Davidson and Hudson 1988; Rothman and Potts 1977), involved making a choice between two "houses" that contained different prizes. In order to play the game, children were shown two cardboard boxes designed to look like houses. Each house had four windows cut out in front, with a prize mounted behind each window. At the start of the game, each window was covered with a blue felt "curtain" attached to the box with Velcro. Children were informed that prizes were behind the curtains in each house and were told that they could take home all the prizes in one of the houses of their choice. Before making their choice, children were allowed to gather information by asking the experimenter to take down as many curtains as they wanted.

Manipulations of search costs and benefits were incorporated into the basic game described above. In the low benefit condition, all four windows within each house contained the same prize. That is, there were only two different types of prizes, with four of one type displayed in one house and four of a second type displayed in a second house. In contrast, in the high benefit condition, every window in each house had a different prize. That is, there were eight different types of prizes, with four different ones displayed in each house. In the low cost condition, children could uncover as many curtains as they wished prior to making their choice, with the only cost of doing so being minimal effort and a brief wait to make their choice. In the high cost condition, children were given several pieces of candy prior to the start of the game and had to give up one piece of candy for each curtain they wanted to take down.

Several considerations guided the design of these games. First, the number of choice alternatives (houses) and dimensions (windows) was limited to minimize task demands on young children. Overwhelming young children with complex choice tasks can occlude whatever processing abilities they may possess and can accentuate age differences beyond the basic skills of interest (see Roedder, Sternthal, and Calder 1983). For similar reasons, the choice task was not structured in a brand-by-attribute format, which has been employed frequently in studies with adults. This format assumes that subjects are capable of a certain level of analytical processing, enabling them to think about objects in terms of separable attributes, that may not be well developed in children of the ages studied here (Smith 1989).

Second, the game was structured to be involving. Children were engaged in making real choices, with real consequences, to generate involvement with the search activity they would undertake. Other possibilities, such as hypothetical choice tasks, leave open the issue of whether children are given a sufficient incentive to make cost-benefit trade-offs of the nature expected. Manipulations of search benefits and costs were also designed to provide an incentive for children to carefully consider their search activities. For example, overly restrictive searches could result in obtaining undesirable prizes, and overly exhaustive searches could result in losing all of one's candy (in the high cost condition).

Procedure. Children were withdrawn one at a time from their classrooms and brought to a separate interviewing area. During this time, the interviewer introduced herself and engaged in a brief discussion as a warm-up. Once in the interviewing room, children were told they were going to play several games. Children played two games, unrelated to the experiment reported here, and were then given the chance to win some prizes as a reward for their efforts by playing the "house of prizes" game.

Children were led to the area of the interviewing room containing the game materials and were given the basic instructions for playing the game. At this time, children in the high cost condition were given a piece of poster board with eight pieces of candy (either M&Ms or Skit-

tles) stuck on it with double-sided tape. They received the following instructions:

> To start the game, I will give you some pieces of candy. You can keep all of these pieces of candy for yourself. Or, you can use some of the candy to find out what prizes are behind the curtains to help you decide which house to pick. You can look behind as many curtains as you want before you make your choice. But, every time you want to look behind a curtain, you will have to give me one of your pieces of candy. Once you give me a piece of candy, I can't give it back to you, OK? When you want to see behind a curtain, tell me which curtain you want and give me a piece of candy. I will take down the curtain.

Children in the low cost condition were not given any candy. They were simply told to take down as many curtains as they wanted before picking their favorite house. Subjects were assigned randomly to the high and low search cost conditions.

Children proceeded to play the "house of prizes" game, participating in both the low and high benefit conditions. The order in which these conditions were presented was randomized across subjects. Children assigned to the low benefit/high benefit sequence completed the experiment as follows. First, they were given a warm-up task for the low benefit version of the game. This entailed presenting children with two houses and explaining the nature of the prizes in each house in detail. Children were then allowed to practice the game on these two houses, searching the contents of the houses and making a final choice. While doing so, children were prompted to either pick a curtain or make a choice ("Do you want to take down a curtain to see what prize is there or do you want to pick your favorite house?"). At the completion of this game, all the curtains were removed (if the child had not requested all to be removed), and the contents of the houses were pointed out to visually reinforce the verbal descriptions. Following this, children were presented with the two houses for the actual low benefit game and played the game until making a choice. The number of curtains selected, the order in which they were selected, and the house chosen were noted by the interviewer. A similar procedure then followed for the high benefit game, with a complete warm-up task administered for this version of the game, followed by the actual high benefit game. For children assigned to the high benefit/low benefit sequence, the procedure was ordered accordingly: warm-up for high benefit game, actual high benefit game, warm-up for low benefit game, and actual low benefit game.

At the end of the last game, children were thanked for their participation, were informed that they would receive their prizes before going home that day, were asked not to discuss the study with their classmates, and were returned to their classroom.

Independent Variables. Three independent variables were incorporated into the experimental design: age, search costs, and search benefits. Age differences were examined by including children from two age groups in the study: four to five years and six to seven years. Selection of these age groups was based on the evidence reviewed earlier that suggests adaptivity may emerge as a skill during the period from preschool to the early elementary school years.

Search costs were manipulated by varying the costs of taking down additional curtains in the "house of prizes" game. Children in the low cost condition were allowed to take down as many curtains as they wanted, with the only cost being a minimal amount of effort and a minimal amount of waiting time until choices were made. Children in the high cost condition, however, were required to give up one piece of candy for every curtain they "opened." Because children participated in two choice games, both the low and high benefit games, two different types of candy were used in the study. M&Ms and Skittles were chosen because of their popularity with children,[1] the fact that they are of comparable size and shape (ruling out a problem with perceptual salience), and the fact that they come in different colors (thereby making each piece of candy more valued). To avoid confounding the type of candy with a particular benefit condition, M&Ms were always used for the first game children played (either low or high benefit), and Skittles were always used for the second game children played (either low or high benefit).

Finally, search benefits were manipulated by varying the redundancy of the prizes contained in the game houses. In the low benefit condition, all prizes in the first house were the same and all prizes in the second house were the same. Thus, opening a single curtain in each house would provide all the information needed to make a completely informed choice. In the high benefit condition, all of the prizes were completely different in both houses. Thus, each curtain opened provided unique input into the decision-making process.

The prizes chosen to fill the houses satisfied several criteria. First, it was important that the prizes appeal to children in both age groups to engage them in the choice task. This was particularly important in the high search cost condition, in that the prizes must be as attractive as the candy to elicit cost-benefit trade-offs in search. Second, it was important that some prizes be more appealing than others. Otherwise, children might be equally happy with any set of prizes, which would decrease the motivation behind the search process.

With these considerations in mind, aided by discussions with teachers and retail personnel, we chose the

[1]The assumption that M&Ms and Skittles would be highly favored across both age groups was checked at the conclusion of the study by asking children to rate both candies on a five-point smiley-face scale (1 = like a lot; 5 = dislike a lot). Children's evaluations confirmed that both candies are extremely popular ($\bar{X}$ = 1.33 for M&Ms and $\bar{X}$ = 1.63 for Skittles) and that these preferences are consistent across the age-groups studied (for M&Ms and Skittles, $t(28) < 1$, $p > .20$).

following prizes. For the low benefit condition, with four identical prizes per house, we selected one neutral item (balloons) and one highly-favored item (gum). For the high benefit condition, with four different prizes per house, we needed a more subtle manipulation. Based on the fact that certain prizes would appeal more to different genders, we selected prizes in such a way that each house would appeal more to one gender than the other. For instance, the house designed to appeal more to male subjects contained two male-oriented prizes (race car and truck stickers), one gender-neutral prize (Starburst candy), and one female-oriented prize (flower-shaped stick-on earrings). The house designed to appeal more to female subjects contained two female-oriented prizes (bracelet and kitchen stickers), one gender-neutral prize (raisins), and one male-oriented prize (ferocious-looking plastic dinosaurs). Note that the prizes in each house were not strictly male oriented or female oriented, which encouraged more search behavior on the part of children and presented them with real cost-benefit trade-offs in their search activity.

Dependent Variables. Predictions regarding adaptive search behavior in children were tested by examining the amount of information they gathered prior to making a choice. Two aspects of this indicator were employed as dependent measures. The number of curtains opened during the "house of prizes" game constituted the main dependent measure of interest across all conditions. The subjects' response on this measure could vary between 0 (no curtains opened) and 8 (all curtains opened).

A second dependent measure was constructed to examine the amount of information searched relative to an "optimal" amount. Although optimal search can be difficult to define, the low benefit condition in this study provides an opportunity to do so. Recall that in the low benefit condition just one curtain per house, or two curtains in total, needs to be opened to obtain all the necessary information to make an informed choice. Opening less than two curtains provides less information than is necessary, whereas opening more than two curtains provides no further information toward making a choice. Given this scenario, a measure of deviation from optimal search quantity was computed by taking the absolute value of the difference between the number of curtains opened and the optimal number of curtains to open. Note that this measure was not pursued in the high benefit condition because of the inherent ambiguity in defining optimal search in this case.

Results

Amount of Information Searched. The first hypothesis predicted age differences in adaptivity as evidenced by the total amount of information searched. In particular, it was expected that preschoolers might adapt to a very limited set of cost-benefit conditions or might even focus on just costs or benefits alone. Older children in the study were expected to exhibit adaptive search behavior across a wider range of situations, processing cost and benefit cues simultaneously in modifying their search behavior.

TABLE 1

MEANS AND STANDARD DEVIATIONS FOR NUMBER OF CURTAINS OPENED AND DEVIATION FROM OPTIMAL QUANTITY, EXPERIMENT 1

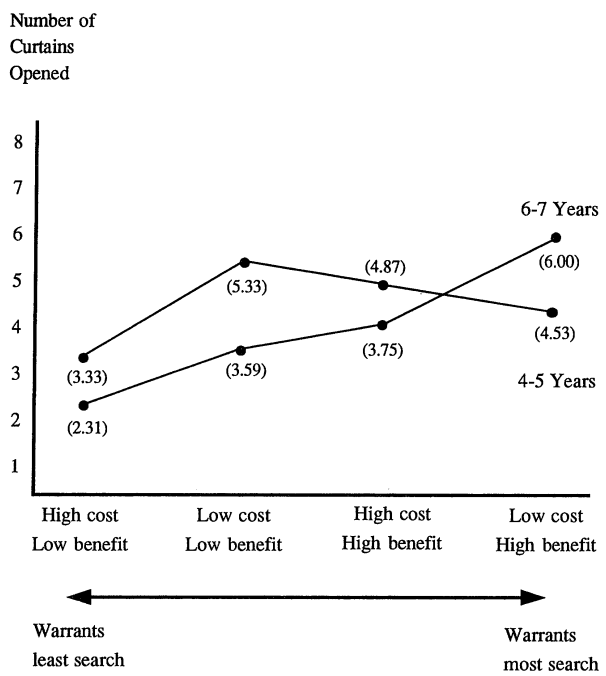
Search condition	Number of curtains opened		Deviation from optimal quantity	
	4–5 Years	6–7 Years	4–5 Years	6–7 Years
Low benefit:				
Low cost	5.33 (3.50) n = 15	3.59 (3.18) n = 17	4.13 (2.42) n = 15	2.65 (2.32) n = 17
High cost	3.33 (3.13) n = 15	2.31 (2.30) n = 16	2.40 (2.35) n = 15	1.19 (1.97) n = 16
High benefit:				
Low cost	4.53 (3.74) n = 15	6.00 (2.68) n = 17	...	...
High cost	4.87 (3.25) n = 15	3.75 (3.34) n = 16	...	...

NOTE.—SDs are in parentheses.

Evidence to this effect can be seen by examining the number of curtains children opened in the "house of prizes" game (see Table 1). Although differences between age groups are evident in several experimental conditions, the more important issue here is how children in each individual age group responded across different cost-benefit conditions. Adaptive search behavior would be indicated by a trend whereby children search more extensively in those conditions warranting more information search (e.g., low cost, high benefit) and less extensively in those conditions warranting less information search (e.g., high cost, low benefit). If one examines this trend for each age group, presented in Figure 1, it becomes apparent that the six- to seven-year-olds modified their search behavior more in line with appropriate cost-benefit trade-offs than did the four- to five-year-olds. The trend for older children is linear, with the least information being gathered for the condition with the least favorable cost-benefit profile (high cost, low benefit) and the most information being gathered for the condition with the most favorable cost-benefit profile (low cost, high benefit). This is not the case for younger children, for which the trend appears more curvilinear in nature. In particular, these preschool children gather the most information for one of

FIGURE 1

NUMBER OF CURTAINS OPENED, BY EXPERIMENTAL CONDITION, EXPERIMENT 1



the conditions warranting a very modest degree of search (low cost, low benefit) and gather less information for one of the conditions warranting the most extensive information search (low cost, high benefit).

To examine these age differences in more detail, children's responses were analyzed in a 2 (age) × 2 (search cost: low, high) × 2 (search benefit: low, high) repeated-measures ANOVA.[2] Age and search cost were between-subjects factors, whereas search benefits were varied within subject. Support for our prediction would be obtained to the extent that the three-way interaction (age × search cost × search benefit) reached significance. That is, our expectation was that the pattern of cost-benefit trade-offs in search would be different for children of different ages (thereby producing an age × search cost × search benefit interaction). The results of our analysis were consistent with this prediction in that the three-way interaction was significant ($F(1,59) = 4.01$, $p = .05$).[3] This interaction, shown in Figure 2, documents the fact that search patterns for each age group are quite different.

In order to understand more about the nature of these age differences, we performed contrasts between the low and high cost conditions for each benefit condition and for each age group. The purpose of these contrasts was to pinpoint those instances in which children exhibited adaptive behavior by reducing the amount of information they gathered as they moved from a low cost to a high cost situation.[4] The findings reveal different levels of adaptivity between age groups. The four- to five-year-olds, for example, exhibited adaptive behavior in the low benefit condition, evidenced by the fact that they gathered less information in the high cost than the low cost condition (3.33 vs. 5.33, $t(28) = 1.65$, $p = .055$). In the high benefit condition, however, these same children were unable to adjust their search behavior accordingly, as noted by the fact that they gathered the same amount of information regardless of cost (4.87 vs. 4.53, $t(28) = -.26$, $p > .10$).

The six- to seven-year-olds exhibited more adaptive behavior. Like the younger children, they gathered less information in the high cost than in the low cost condition when search benefits were low, although the difference was only marginally significant (2.31 vs. 3.59, $t(32) = 1.31$, $p = .10$). This finding is due, in part, to the fact that the optimal search quantity for the low benefit condition was small and did not vary by the cost of seeking information. Older children, unlike their younger counterparts, also gathered less information in the high cost than in the low cost condition when search benefits were high (3.75 vs. 6.00, $t(32) = 2.18$, $p = .037$).

Deviation from Optimal Search Quantity. The second hypothesis predicted age differences in the extent to which children would be adaptive in terms of approaching an optimal search quantity. Examining the means for each age group, shown in Table 1, it appears that the six- to seven-year-olds have a decided advantage over the four- to five-year-olds, as evidenced by much smaller deviations from the optimal quantity. To investigate this possibility further, we analyzed these data in a 2 (age) × 2 (search cost: low, high) ANOVA. Consistent with our expectations, the results confirm the existence of a significant age main effect ($F(1,59) = 5.56$, $p = .02$). Older children's searches were closer to the

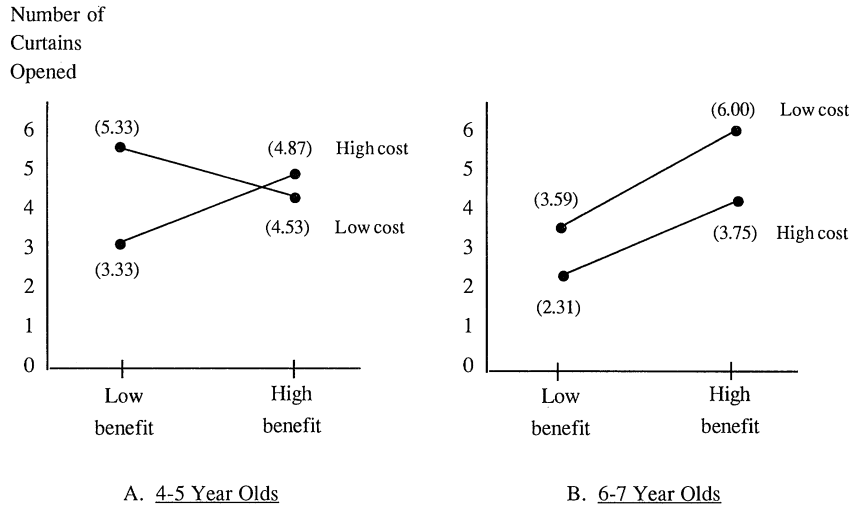
[2]Two additional variables, gender and order of benefit condition, were examined in preliminary analyses. Neither variable produced significant effects, either as main effects or in interactions with other independent variables. Subsequent analyses of gender and order within each experimental cell yielded no significant gender differences, but did uncover marginally significant order differences in two cells (for four- to five-year-olds in the high cost/high benefit cell, $p = .08$; for six- to seven-year-olds in the high cost/high benefit cell, $p = .10$). Given that these order differences were marginal in nature and did not emerge in the second study, order was dropped from further analyses, along with gender.

[3]The three-way interaction qualified a significant benefit main effect ($F(1,59) = 7.86$, $p < .01$), a marginally significant cost main effect ($F(1,59) = 3.37$, $p = .07$), and a marginally significant age × benefit interaction ($F(1,59) = 3.54$, $p = .065$). The remaining effects were not statistically significant.

[4]Given that adaptability implies a directional hypothesis (the amount of information searched should be lower for high cost vs. low cost situations), one-tailed tests were used to perform the contrasts, unless noted otherwise.

FIGURE 2

NUMBER OF CURTAINS OPENED, BY EXPERIMENTAL CONDITION, EXPERIMENT 1



Note.—Values are $\bar{X}$.

optimal quantity, even though they continued to search longer than necessary. It is interesting, however, that the age × cost interaction was not statistically significant ($F(1,59) < 1$, $p > .20$). Children in both age groups moved closer to the optimal search quantity as they incurred greater search costs, as indicated by a significant search cost main effect ($F(1,59) = 7.78$, $p < .01$).

Analysis of Search Patterns. The preceding analysis supports the main prediction of age differences in the extent to which children adapt their search behavior in terms of the quantity of information gathered. Still at issue, however, is how children adapt by modifying the way in which they search, as opposed as the number of items searched. Although prior research was not sufficient to generate hypotheses in this area, data were gathered during the course of the study to provide some insight into this issue.

As previously described, the order in which children opened curtains in the "house of prizes" game was recorded to provide some qualitative data on how children of different ages search. On the basis of these data, we developed three major categories of search patterns to summarize the responses: no search, incomplete search, and complete search.[5] The "no search" pattern describes situations in which no curtains were opened, whereas the "complete search" patterns describes situations in which all eight curtains, in both houses, were opened. The "incomplete search" category includes a number of interesting search patterns, such as alternating back and forth between houses in opening curtains (e.g., a type of interdimensional search) and opening some or all of the curtains in one house but not the other (e.g., a type of intradimensional search).

The percentages of children characterized by these patterns, within experimental condition, are shown in Table 2. Although the small number of children in any one category within an experimental condition precludes statistical tests, the data reveal some interesting trends in the way that children of different ages modify their search behavior when faced with cost-benefit tradeoffs. Consider first the four- to five-year-olds, who altered the quantity of information they gathered in the low benefit condition in response to increasing search costs but did not respond in a similar fashion in the high benefit condition. In the low benefit condition, these children modified their search pattern from one dominated by complete searching of both houses in the low cost condition to one dominated by incomplete searching in the high cost condition. Also of interest here is the fact that the increase in incomplete searches in the high cost condition was achieved by going to more of an interdimensional search strategy. In the high benefit condition, young children used a variety of search patterns in the low cost condition but switched more to an incomplete search strategy in the high cost condition. Although the percentage change is not impressive, consistent with earlier results, the fact that there appears to be some movement is quite evident.

If we turn to data for the six- to seven-year-olds, there appear to be more differentiated search patterns across

[5]Data pertaining to children's search patterns were originally coded into nine categories that identified the search sequence and subsequent choice in more detail. Because of the small number of subjects per cell, these nine categories were collapsed into three for further analysis.

TABLE 2

PERCENTAGES OF CHILDREN CATEGORIZED BY SEARCH PATTERN EXPERIMENTAL CONDITIONS, EXPERIMENT 1

	Low benefit		High benefit	
Age and search pattern	Low cost (%)	High cost (%)	Low cost (%)	High cost (%)
4–5 years:				
No search	13.3	20.0	20.0	13.3
Incomplete search	26.7	*60.0*	33.3	*46.7*
Complete search	*60.0*	20.0	*46.7*	40.0
6–7 years:				
No search	11.8	6.3	0	18.8
Incomplete search	*58.8*	*81.3*	41.2	*50.0*
Complete search	29.4	12.5	*58.8*	31.3

NOTE.—Percentages within an experimental condition may not add up to 100 percent because of rounding. Values in italics indicate the dominant search pattern for each experimental condition.

experimental conditions. In the low benefit condition, an incomplete search pattern predominates in the low cost condition and becomes even more dominant in the high cost condition. Although this pattern is consistent with searching in a more optimal manner, given the fact that only two curtains needed to be opened to obtain complete information, a surprisingly large percentage of children in the low cost condition take advantage of the situation to perform a complete search (29.4 percent). In the high benefit condition, a very distinct shift occurs from a complete search strategy that dominates under low cost conditions to an incomplete search strategy that becomes popular under high cost conditions. One finding of note here is that, in the high cost condition, similar percentages of both older children (50.0 percent) and younger children (46.7 percent) exhibit incomplete search patterns, even though the number of curtains opened is much lower for the older children. Perhaps this suggests that younger children may be attempting to switch strategies here but are less efficient at doing so than the older children.

Discussion

The results of the first experiment support the view that age differences exist in children's abilities to adapt to cost-benefit trade-offs in information search. Older children respond to changes in the decision environment, with varying levels of search costs and benefits, by modifying the amount of information they gather and by altering the search strategies they employ. Younger children, in contrast, respond in a more limited fashion. They do not appear to adapt their search behavior across a variety of cost-benefit conditions, yet they do evince some modification of their strategies under certain conditions. In this study, younger children demonstrated an ability to modify the amount of information gathered and the search strategy employed in the low benefit condition.

Perhaps what is most interesting here is not the presence of age differences in children's search behavior, as numerous areas of research in child psychology would attest, but the fact that the younger children in the study demonstrated some ability to adapt. Although more complex search tasks might produce less encouraging results, the idea that even preschoolers show some ability to match search strategies to factors in the decision environment seems quite important. In fact, when we examine their behavior once again, a question arises as to why young children would be able to adapt in the low benefit condition but would not be equally effective in the high benefit condition.

One hypothesis is that the presence of many different and appealing prizes in the high benefit condition simply overwhelms any consideration of the costs of search. That is, it may be that the variety of different prizes (benefits) in this condition is simply more salient than the small pieces of candy (costs) that must be forfeited. Given the fact that previous research attests to the importance of perceptual salience in driving children's judgments, this interpretation seems quite plausible. A second hypothesis, however, is that young children's abilities to adapt their search behavior are in an emerging and fragile state. If this is the case, the ability to operationalize different strategies may surface only in situations that present a clear-cut trade-off, such as the low benefit/high cost condition.

The purpose of the second experiment is to shed some light on which of these interpretations seems most reasonable. Although one can never disprove the first hypothesis, unless a large number of studies with different task demands provide convergent evidence, we sought to provide some evidence in this regard by making our manipulation of search costs more salient in the second study. In particular, the small candies were replaced with much larger candies of greater value. Of interest here is whether preschoolers would exhibit greater adaptive abilities than those evident in the first study. Also of interest was whether the more salient manipulation of search costs would engender more adaptive behavior in even older children, especially with regard to a more extreme movement toward optimal search patterns in the low benefit condition.

EXPERIMENT 2

Method

Subjects. Forty-five children participated in the second experiment. Twenty-three were four to five years of age (12 males, 11 females) and 22 were six to seven years of age (11 males, 11 females). Subjects were recruited from educational settings similar to those in the first study, including a day care center, a university-

affiliated nursery school, and an elementary school. Parental permission was obtained for each child prior to the start of the study.

Procedure. The procedure was identical to the one employed in the first study, with the following exceptions. First, we did not include a low cost condition here, given the fact that our interest centered on possibly modifying children's responses in the high cost condition. Therefore, all children in this study were assigned to the high cost condition and were given candy with which to purchase information.

Second, instead of using M&Ms and Skittles to manipulate the cost of information search, large foil-covered chocolate coins and Hershey's Kisses were used. Both types of candy are highly favored and are more substantial in weight and size than the candies used in the first study. The coins and Hershey's Kisses came in a variety of different colors (increasing the perceived value of each individual piece), were perceptually salient by virtue of the shiny foil and large size, and were equally valued across age groups.[6]

Independent and Dependent Variables. Two independent variables, age and search benefits, were incorporated into the design of this study. The age variable was represented by two age groups, as before. Search benefits were also varied as before, with a different prize behind each curtain in the high benefit condition and the same prizes in each house in the low benefit condition. The same prizes used in the first study were replicated here. Variations in response across these conditions were measured as in the first experiment, with number of curtains opened and deviations from optimal search quantity as the major dependent variables.

Results

Amount of Information Searched. Of primary interest here is whether the more salient manipulation of search costs incorporated in the second experiment might facilitate further adaptation by preschoolers, especially in the high benefit condition. To address this issue, data for the high cost condition in this second study (see Table 3) were combined with data for the low cost condition in the first study (see Table 2). In effect, the analysis is identical to the one employed in the first study, except that the high cost data for the first study is now being replaced by the high cost data for the second experiment.

TABLE 3

MEANS AND STANDARD DEVIATIONS FOR NUMBER OF CURTAINS OPENED AND DEVIATION FROM OPTIMAL QUANTITY, EXPERIMENT 2

	Number of curtains opened		Deviation from optimal quantity	
Search benefit	4–5 Years	6–7 Years	4–5 Years	6–7 Years
Low	3.70 (3.65) $n = 23$	1.68 (2.12) $n = 22$	3.35 (2.15) $n = 23$	1.41 (1.59) $n = 22$
High	4.48 (3.80) $n = 23$	2.86 (2.98) $n = 22$	. . .	. . .

NOTE.—SDs are in parentheses.

The resulting pattern of data, shown in Figure 3, looks similar to the corresponding graph from the first study. Once again, the four- to five-year-olds appear to have adapted their search behavior in the low benefit but not the high benefit condition. Contrasts between the low and high cost conditions for each benefit condition confirm the observation that these children reduced the amount of information they gathered in response to higher search costs in the low benefit condition, although the reduction was only marginally significant (3.70 vs. 5.33, $t(36) = 1.37$, $p = .09$).[7] As before, no differences were observed in the high benefit condition (4.48 vs. 4.53, $t(36) < 1$, $p > .20$). Similar contrasts for the six- to seven-year-olds mirror the findings from the first study, in that these children reduced the amount of information gathered in response to higher search costs in both the low benefit (1.68 vs. 3.59, $t(37) = 2.24$, $p = .03$) and high benefit conditions (2.86 vs. 6.00, $t(39) = 3.16$, $p < .01$).

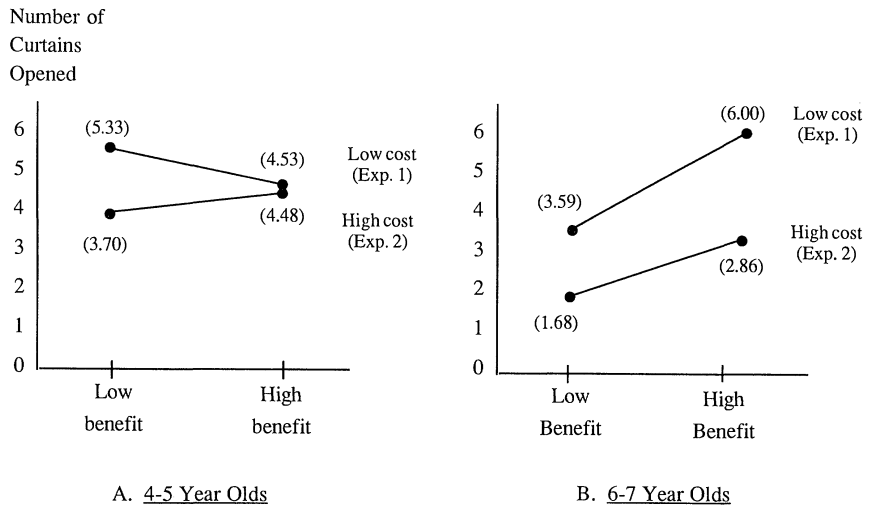
Deviation from Optimal Search Quantity. Also of interest in this study was whether a stronger manipulation of search costs might engender more movement toward optimal search quantities on the part of both age groups. Inspecting the data, shown in Table 3, one sees little difference between these patterns and those of the first study. Age differences are still apparent, as evidenced by a significant contrast between the two age groups (3.35 vs. 1.41, $t(43) = 3.43$, $p < .01$). More important, comparing the data for the high cost condition

[6]The assumption that larger candies would be more valued than the smaller ones used in the first study was checked with a sample of children aged four to five years ($n = 17$) and six to seven years ($n = 14$). In brief, children were given eight M&Ms (as in the first study) and were asked how many they would be willing to give up to get one of the foil-covered chocolate coins and one of the Hershey Kisses. On average, the four- to five-year-olds gave up 4.88 M&Ms to get a chocolate coin and 4.18 to get a Hershey Kiss; six- to seven-year-olds gave up an average of 5.78 M&Ms to get a chocolate coin and 5.07 M&Ms to get a Hershey Kiss. These results indicate that the larger-sized candies were indeed more valued and that they were valued equally for the two age groups tested ($p > .20$).

[7]Because two independent samples are being compared, two sample variances enter into calculations for each t-statistic. Each sample variance has $n - 1$ *df*, so across the two samples we have $(n_1 - 1) + (n_2 - 1) = n_1 + n_2 - 2$ *df*.

FIGURE 3

NUMBER OF CURTAINS OPENED, BY EXPERIMENTAL CONDITION, EXPERIMENTS 1 AND 2 COMBINED



Note.—Values are $\bar{X}$.

in this study to the high cost condition in the first study, one finds no significant differences for either the four- to five-year-olds (3.35 vs. 2.40, $t(36) = 1.28$, $p > .10$) or the six- to seven-year-olds (1.41 vs. 1.19, $t(36) < 1$, $p > .20$).

Discussion

The results of this study corroborate the findings from Experiment 1. Younger children continue to adapt their search behavior in a more limited set of conditions than do older children. Stronger manipulations of search costs did not alter this conclusion, which suggests that preschoolers probably have more fragile abilities to adapt to cost-benefit trade-offs than those exhibited by older children in the study.

GENERAL DISCUSSION

Our results provide an important first glimpse of how children of different ages adapt to cost-benefit trade-offs in predecisional search situations. Preschoolers exhibited an emerging, yet limited, ability to adapt their search behavior to cost-benefit trade-offs. In particular, they altered the amount of information gathered, and the strategies used to gather it, only in the most straightforward situations. These children reduced the amount of information gathered only when search benefits were low and search costs were high, probably the most extreme case requiring a clear shift in information search patterns. Older children adapted across more situations, demonstrating a greater degree of differentiation in search activity and strategies. They reduced the amount of information gathered in a manner indicative of more mature cost-benefit trade-offs, searching more in situations warranting more extensive search (high benefits, low costs) and least in situations warranting only cursory search (low benefits, high costs).

These findings have implications for understanding how and when adaptivity in consumer decision making emerges in young children. It is to this topic that we now turn.

Developmental Trends in Adaptive Information Search

Our results are consistent with the view that the ability to adapt information search strategies to the decision environment emerges in the preschool years. Although the abilities may be in a fragile state, preschoolers can adapt under certain conditions. These data support Davidson and Hudson's (1988) finding that preschool children acknowledge the need to modify their predecisional search patterns depending on parameters in the choice setting. Our findings are also consistent with evidence regarding the developmental progression for gathering information in tasks not involving choice among objects. In particular, several recent studies in the visual search literature have found that preschoolers are capable of modifying their search behavior in the process of performing memory tasks and object judgments (e.g., Wellman 1985; Woody-Ramsey and Miller 1988).

Equally evident, however, is the fact that children's abilities are not fully developed until the grade school years. Although preschoolers' abilities have been high-

lighted, it is obvious that their attempts to adjust information search strategies to the decision task are not fully-developed and emerge only under very facilitative conditions. From our data, it appears that preschoolers can adjust to the most extreme changes in the decision environment, but only older children exhibit differentiated behavior across a range of possible changes.

The characterization of young children's abilities just forwarded suggests the following developmental sequence in adaptative information search. At some point prior to the preschool years, children do not modify their search behavior in response to changes in the task environment. Their predecisional search patterns, for example, might be determined by some type of spatial organization (e.g., looking at all the objects in the left house and then all the objects in the right house) or by some type of alternation process (e.g., looking at one object in the left house, then one object in the right house, and so forth). During the preschool years, young children begin to exhibit some limited form of adaptivity in their information-gathering activities. A good deal of the time, however, these children do not produce a strategy that would lead to adaptive search behavior, or they use an appropriate strategy in an ineffective manner. Evidence supportive of the second interpretation was found in our first study, in which preschoolers in the high benefit condition were found to shift search strategies in a manner quite similar to that of the older children, without any resulting change in the average quantity of information they gathered. This same type of deficiency, termed a "utilization deficiency," has been found in young childrens' usage of selective attention strategies and mnemonic strategies (see Miller 1990). Finally, during the grade school years, children not only develop an increasingly large repertoire of search strategies but also become more adept at employing them in an appropriate fashion across tasks.

This developmental sequence is offered with one cautionary note. In generalizing our findings, we should note that different search tasks with higher task demands may not uncover the same abilities in preschoolers as those observed in our studies. As in almost every area of developmental research, the specific age at which a cognitive skill or ability is concluded to take place is dependent on task demands. We designed the particular search task used in our studies to limit task demands on children, motivate them to think carefully about the choices they were making, and encourage them to consider both the costs and benefits of additional search. The fact that preschoolers exhibited adaptive search patterns in some conditions shows that factors such as task difficulty, familiarity, and involvement were kept at bay and had little influence on the age differences observed here. At the same time, however, it would be ill-advised to assume that the same abilities will emerge in young children under less-facilitative conditions. In particular, search tasks with more alternatives, more attributes, less perceptually-salient search costs, and more irrelevant information (see Davidson 1991b) can be expected to hamper preschoolers' abilities and reduce their ability to adapt in an effective manner.

Developmental Trends in Adaptive Decision Making

Our findings raise an interesting question about the extent of young children's abilities to adapt in all phases of the decision-making process. Are the abilities evidenced by young children in the search phase likely to be mirrored by similar abilities in the choice phase? If young children are able to trade-off costs and benefits and adapt their information search strategies accordingly, are they also able to trade-off effort and accuracy in selecting choice strategies in the latter phases of the decision-making process?

Although developmental evidence is virtually nonexistent in the area of adaptive choice strategy selection, we do know that by the age of 12 years, children appear to adapt their choice strategies in ways very similar to those of adults (Klayman 1985). That is, with increasing task complexity, associated with increasing the number of choice alternatives or the amount of information per alternative, these children shift to noncompensatory strategies and reduce the proportion of available information searched. Although missing a thorough analysis of choice strategy adaptation, recent studies by Davidson (1991a, 1991b) suggest that adaptation may be occurring at some level in children as young as 10–11 years of age. In these studies, children across an age range of 7–14 years reduced the proportion of available information gathered as task complexity increased, but only children aged 10–14 years appeared to be doing so while concentrating on relevant information.

Our results, while indicating some emerging abilities in performing trade-offs in preschoolers, do not necessarily contradict these findings. The type of adaptation involved in shifting choice strategies is more involved than the relatively simple types of adaptation studied here. In our studies, a relatively simple modification in terms of reducing the amount of information gathered was all that was required. Adaptation of choice strategies obviously involves more complicated strategies being employed under less-facilitative conditions than the ones studied here. As discussed earlier, the presence of irrelevant information is virtually guaranteed, as are more complex information environments. A more exacting analysis awaits further research, but it seems probable that adaptation of choice strategies does not emerge until the mid-elementary school years.

Future Research

As the preceding discussion suggests, there are probably more questions than answers about adaptive de-

cision making in children at this juncture. Moving ahead on this topic is important if we are to acquire a better understanding of how children make decisions as consumers. First on the agenda should be a more exacting analysis of predecisional search strategies in children. Although some attempt was made in our studies to look at strategies in addition to search quantity, the experimental task was not specifically designed to pick up a repertoire of possible search strategies. What is needed is a diversity of tasks amenable to search patterns such as spatial search, interdimensional search, and intradimensional search (see, for example, Klayman 1985; Miller et al. 1986). In order to address issues of adaptivity in more detail, these tasks might also be varied in terms of task difficulty to detect strategy changes in response to complex decision environments.

Second, a further analysis of why younger children are not as adaptive as older children seems in order. We have suggested the existence of a utilization deficiency on the part of the youngest children in our study. Additional data, with perhaps a more detailed analysis of search strategies, seem necessary before accepting the utilization deficiency hypothesis. Beyond this, there are certainly additional questions that can be raised about why younger children use strategies ineffectively. On the basis of research in children's use of attentional and mnemonic strategies, possible explanations might center on difficulties in retrieving and executing appropriate search strategies (see Bjorklund and Harnishfeger 1990).

Finally, the topic of training young children in decision-making skills seems quite relevant. Can we teach younger children to make cost-benefit trade-offs in information search tasks? Can we teach younger children to make effort versus accuracy trade-offs in choice strategy selection? Although minor attention has been given to the topic in child development, an emerging body of literature in the adult decision-making literature appears to offer some hope. In particular, recent work by Nisbett and his colleagues (see Nisbett 1993) seems to indicate that general decision rules, much like cost-benefit trade-offs, can be taught and are generalizable across a number of different content domains. Certainly, the possibility that children might be taught to be better decision makers is an exciting one and, perhaps, holds the key to more effective consumer education for young consumers.

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