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Age Differences in the Effects of Conscious and Unconscious Thought in Decision Making

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Abstract

The roles of unconscious and conscious thought in decision making were investigated to examine both (a) boundary conditions associated with the efficacy of each type of thought and (b) age differences in intuitive versus deliberative thought. Participants were presented with two decision tasks, one requiring active deliberation and the other intuitive processing. Younger and older adults then engaged in conscious or unconscious thought processing before making a decision. A manipulation check revealed that younger adults were more accurate in their representations of the decision material than older adults, which accounted for much of the age-related variation in performance when the full sample was considered. When only considering accurate participants, decision making was best when there was congruence between the nature of the information and the thought condition. Thus, unconscious thought was more appropriate when the decision relied on intuitive rather than deliberative processing, whereas the converse was true with conscious thought. Although older adults displayed somewhat less efficient deliberative processing, their ability to process information at the intuitive level was relatively preserved. Additionally, both young and older adults displayed choice-supportive memory.

Keywords

decision making; aging; dual-process thinking; affective processing

Adults of all ages face simple and difficult decisions that affect short-term and long-term outcomes on a daily basis. Given the importance of effective decision making in supporting independent functioning in everyday life, it is important to consider the extent to which aging may affect this process. From a resource-based perspective, one might expect that age-related declines in basic cognitive skills (e.g., speed, working memory, executive functions) would negatively impact decision making in later life. An examination of the literature, however, reveals an inconsistent pattern of age effects across a variety of studies using different types of tasks (for reviews, see Mather, 2006; Peters, Hess, Västfjäll, & Auman, 2007). Of obvious interest is the identification of task-related demands that might interact with characteristics of different-aged individuals (e.g., processing efficiency), and thereby moderate age-related functions in performance. Based on existing theory and research on aging, there are at least

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two dimensions that might be used to explain the nature of age differences observed in studies of decision making.

The first dimension relates to the degree to which the task taps into existing knowledge. If knowledge can be used to support performance, older adults may be just as effective in making decisions as younger adults, or even better if relevant knowledge is based in age-related experience. Consistent with this perspective, studies have found that experience may make older adults less susceptible to irrational biases often observed in younger adults (e.g., Tentori, Osherson, Hasher & May, 2001). Age-related experience in the relevant decision domain also bolsters older adults' performance by focusing their attention on important diagnostic cues, resulting in efficient, expert-like behavior when making decisions in a variety of contexts (e.g., Hess, Osowski, & Leclerc, 2005; Meyer, Talbot, & Ranalli, 2007).

The second dimension—and the focus of our study—relates to the degree to which the task relies on intuitive versus more deliberative modes of thought.[1] Affective processes are assumed to be relatively spontaneous and effortless, whereas deliberative processes are slower, analytical, and effortful (Peters et al., 2007). Dual-process perspectives on decision making have suggested that both modes are involved in most decision making tasks (e.g., Epstein, 1994;Loewenstein, Weber, Hsee, & Welch, 2001;Reyna, 2004). Based upon normative aging trends in processes underlying these types of thought, Peters et al. (2007) proposed that the deliberative mode should be negatively affected by aging whereas the intuitive mode should be relatively stable. For example, there is clear evidence that working memory and executive functions associated with conscious deliberation decline with age (see Braver & West, 2008). In contrast, implicit and automatic memory processes and the automatic encoding of evaluative content tend to be relatively stable through later life (see Peters et al., 2007;Zacks, Hasher, & Li, 2000). An examination of the literature on aging and decision making provides examples that appear consistent with this perspective. For example, Mata, Schooler, and Rieskamp (2007) found that declining cognitive skills resulted in older adults using less demanding strategies overall, although they also adapted their information search strategies to take into account the nature of the decision context in a manner similar to that of younger adults. Other studies have found, however, that older adults make effective decisions—and may even outperform younger adults—when performance is based on the processing of evaluative content (e.g., Hess, Pullen, & McGee, 1996;MacPherson, Phillips, & Della Sala, 2002).

In the present study, we directly contrast the decision-making performance of younger and older adults in tasks that vary in their demands on deliberative and intuitive processes. In particular, we are interested in the degree to which presumed age differences in the efficiency of intuitive and deliberative processes interact with task characteristics in determining the effectiveness of decision making. We examined this relationship within the context of a recently developed, and somewhat controversial, perspective on decision making. Specifically, Dijksterhuis and Nordgren (2006) have proposed that, when confronted with complex decisions, people will make better decisions if they are prevented from engaging in active deliberation than if they do engage in such processing. They argue that conscious thought is constrained by the complexity of a decision, with decision quality decreasing as complexity increases. In contrast, decisions made without conscious deliberation are assumed to be unaffected by the complexity of the task, therefore making unconscious thought particularly valuable when faced with a difficult or complex decision. In support of this position, Dijksterhuis (2004) found that people make optimal decisions when the problem is weighed

[1]Others have used the terms experiential vs. rational (Epstein, 1994), System 1 vs. System 2 (Kahneman, 2003), affective vs. deliberative (Peters et al., 2007), and associative vs. rule-based (Sloman, 1996) to characterize the same basic distinction. We chose the terms intuitive and deliberative because we believed they were straightforward descriptions of the processes and to avoid potential confusion with other terms.

at the unconscious level, particularly when the amount of information to be considered is relatively large. In a series of experiments in which university students evaluated housing options and potential roommates, he found that participants who were instructed to actively reflect on the previously presented choice options were less likely to make optimal decisions than were participants who were prevented from doing so.

In addition to downplaying the importance of conscious deliberation, this perspective leads to the intriguing prediction that decision making might be quite effective in later life. That is, if age has a negative impact on deliberation, and deliberation actually interferes with arriving at optimal decisions, then age differences in performance may be attenuated in situations where unconscious thought is emphasized and active deliberation prevented.

Although the Dijksterhuis (2004) findings are provocative, discounting the importance of deliberation in the decision-making process is somewhat controversial (e.g., Simonson, 2005). Without disavowing the importance of intuitive processes, there seem to be conditions under which deliberative skills are essential. Thus, investigations of the boundary conditions of the hypothesized benefits of unconscious thought are necessary, and some initial research has identified possible limitations (e.g., Lassiter, Lindberg, González-Vallejo, Bellezza, & Phillips, 2009; Newell, Wong, Cheung, & Rakow, 2009; Payne, Samper, Bettman, & Luce, 2008). In the present study, we investigated one such condition in which optimal decision making required discriminating between relevant and irrelevant choice attributes. Previous support for the benefits of unconscious thought (e.g., Dijksterhuis, 2004) is based in part on the use of materials in which the optimal decision could be determined solely by comparing the number of positive features associated with each alternative without regard for relevance. In such cases, it makes sense that deliberation may not be beneficial given that evaluative content can be processed in a relatively automatic manner. A stronger test of the theory, and arguably a more realistic decision-making situation, would occur if an optimal decision required consideration of just a subset of the presented information. That is, in order to arrive at an optimal decision, individuals would be required to attend to central or relevant information and ignore peripheral content. In this situation, deliberative skills would appear to be essential, given that selectively attending to relevant information would require attentional resources and inhibitory control. Thus, preventing individuals from engaging in active deliberation would be expected to be detrimental to performance. In contrast, if the advantages of unconscious thought generalize across situations, then the nature of the attributes associated with the choice alternatives in the decision context should not matter. In fact, if Dijksterhuis and Nordgren (2006) are correct in that the benefits of unconscious thought increase with the complexity of the decision, the results should be directly opposite to those just predicted, with unconscious thought being more beneficial than conscious thought when attribute relevance in addition to valence needs to be considered.

In the current study, younger and older adults were asked to make two decisions. For each one, they studied four alternatives and then rated the optimality of each one in relation to a decision context. Following Dijksterhuis (2004), some participants in each age group were tested under conscious thought conditions, in which they were asked to actively evaluate the alternatives. The remaining participants were tested under unconscious thought conditions, in which they were prevented from engaging in active deliberation through the use of a distraction task. We also varied the nature of the attributes in the two decision contexts for each participant. The intuitive information condition was similar to that used by Dijksterhuis (2004), with the optimal choice being based on the total number of positive attributes. In contrast, the optimal decision in the deliberative information condition was based on a comparison of a subset of core attributes that were directly relevant to the decision context, with the number of positive attributes in this subset being uncorrelated with the total number of positive attributes across alternatives. Of interest was the extent to which participants' ratings were based on an evaluation of the relevant attributes in each condition.

We made the general prediction that decision-making performance would be best when the information on which the decision was based was consistent with the nature of processing. Thus, in line with Dijksterhuis (2004), decision making in the intuitive information condition —where optimality is based on the total number of positive attributes—should be best in the unconscious condition, where intuitive processing is emphasized. In contrast to Djiksterhuis and Nordgren's (2006) theory, we predicted that individuals would perform better in the deliberative information condition—where optimality was based on both the valence and relevance of attributes—when conscious thought (i.e., active deliberation) is emphasized. This prediction assumes the availability of relatively efficient deliberative skills, and thus was specifically expected to characterize the performance of younger adults. In contrast, older adults are assumed to possess relatively inefficient deliberative skills. For example, age-related difficulties in executive functions may make it more difficult for older adults to ignore irrelevant information (e.g., Hartman & Hasher, 1991), including evaluative content (e.g., Hess, Germain, Rosenberg, Leclerc, & Hodges, 2005), making it more difficult for them to suppress information about irrelevant attributes when making decisions. Therefore, involvement in active deliberation may not be as beneficial when dealing with difficult decisions. Thus, we hypothesized that optimal performance in older adults would be based more in the nature of the information on which the decision was based than in the match between thought and information conditions. That is, older adults should make better decisions in conditions where optimal judgments can be based on automatic processing of evaluative content (i.e., intuitive information condition) than in those where more active discrimination between attributes is required (i.e., deliberative information condition), regardless of thought condition. This assumes that when asked to engage in deliberation, they will be either less efficient or less active compared to younger adults.

We also examined choice-supportive memory (i.e., the degree to which an individual has positively biased memory for chosen over nonchosen alternatives). Mather and Johnson (2000) observed greater choice supportiveness in older than in younger adults. Dijksterhuis (2004) observed that choice memory became more polarized under unconscious thought conditions. In other words, participants in the unconscious thought condition attributed more positive attributes to their choice and more negative attributes to the non-chosen options. This suggests choice-supportive memory should be less evident under conditions associated with deliberative processing, which might explain the Mather and Johnson findings given that older adults are less efficient at such processing. Thus, we expected choice-supportive memory to be more evident following unconscious thought than after conscious thought, and to be stronger when decisions can be based solely on evaluative content. In addition, older adults may be less likely than younger adults to exhibit an impact of thought condition on choice supportive memory since they are less likely to engage in deliberative processing in general.

Method

Design

This experiment used a 2 ×2 ×2 (Age Group [young vs. old] ×Thought Condition [conscious vs. unconscious] ×Information Condition [deliberative vs. intuitive]) design, with age and thought condition treated as between-participants variables and information condition as a within-participants variable. Within each age group, participants were randomly assigned to the conscious or unconscious thought condition. In each thought condition, participants were presented with two decision tasks, one based on deliberative information and the based on intuitive information, with order of presentation counterbalanced within each Age ×Thought Condition group.

Participants

A total of 137 participants were recruited for this experiment. Sixty-two young adult participants (33 men, ages 17–28) were recruited from introductory psychology classes and 75 older adults (37 men, ages 60–86) were recruited from a database of community-dwelling adults. The latter group includes an additional 12 participants added to the original sample of 63 due to the later-documented issues associated with representational accuracy of the decision context. Young participants satisfied a course option through their participation, whereas the older adults received a $20 honorarium.

As can be seen in Table 1, the older adults had significantly higher levels of education than young adults, reflecting the undergraduate status of those in the latter group. The observed age differences on the other background measures are typical of those found in the research literature on aging. Additional Age Group ×Thought Condition analyses of variance (ANOVA) were conducted on each of the measures in Table 1 to test for potential confounds associated with our assignment to experimental conditions. The only effect observed was due to older adults in the unconscious thought condition being significantly older than those in the conscious thought condition (*M*s = 73.06 vs. 69.00). These differences did not influence the results of any of our analyses, however, and thus are not considered further.

Materials

Test materials were developed for two different common decision contexts that were thought to be relevant to both young and older adults: choosing an apartment and a bank. Within each context, the decision task was further specified through the identification of attributes on which participants should focus when making their decision. For example, in the apartment task, the following instructions were given:

> You and your spouse are searching for an apartment for yourselves and an occasional out-of-town guest. You are a physically active couple who prefer to live in a safe, well maintained community that is close in proximity to shopping. You would also prefer to have plenty of storage space.

Each decision task consisted of four choice alternatives, each of which was described by 12 attributes along the same 12 dimensions. In other words, all attributes were considered alignable. Six dimensions were considered "core" dimensions in that they were related specifically to important factors (e.g., storage space) identified in the instructions. The other six dimensions were considered "noncore" in that they were not necessarily relevant to the primary decision task.

Two different sets of materials for each decision task were developed, each consisting of one alternative that had 8 positive and 4 negative attributes, two alternatives with 6 positive and 6 negative attributes, and one alternative that had 4 positive and 8 negative attributes. This distribution of evaluative content across the four alternatives was identical to that used by Dijksterhuis (2004). The two sets of materials varied in terms of their distribution of positive core features. In the *intuitive information* condition, all four alternatives contained 4 positive and 2 negative core attributes, with the remaining attributes consisting of noncore attributes (see Table 2a). Given that the number of positive core attributes is identical across all four alternatives—and thus could not be used to discriminate between alternatives—we reasoned that decisions would then be based on the number of additional positive noncore attributes. Thus, the optimal choice would be determined by the overall evaluative content of each alternative without focusing on a subset of attributes.

In the *deliberative information* condition, the alternatives did vary in terms of the number of positive and negative core-dimension attributes. Thus, in contrast to the intuitive information condition, identification of the optimal choice could be made on the basis of core attributes, requiring participants to focus on this subset of attributes. The optimal alternative had 6 positive core features, two other alternatives had 4 positive core features, and the final alternative had 2 positive core features. The remaining noncore attributes were organized so that the overall evaluative content of the four choices (i.e., the total number of positive attributes) was identical to that used in the intuitive condition, but was uncorrelated with the number of critical core attributes. Thus, for example, the optimal and least optimal choices based on number of positive core attributes (alternatives 2 and 3, respectively) had the same total number of positive attributes (see Table 2a). In order to arrive at the optimal decision, participants had to differentially weight the core versus noncore attributes. By specifying the decision context, we attempted to minimize individual differences in weightings assigned to dimensions by providing a priori weightings in terms of core vs. noncore dimensions.

In the decision-making literature, the strategy presumed to underlie effective performance with intuitive materials is referred as tallying (e.g., counting positive attributes), whereas that associated with deliberative materials is referred to as the weighted additive rule (WADD). The latter is a compensatory decision strategy in which individuals assign weights to each decision cue and add these weights to determine the optimal choice (Shah & Oppenheimer, 2008). Notably, the cognitive demands associated with tallying are thought to be considerably less than those associated with WADD, and aging is associated with decreased use of latter strategy (Mata et al., 2007).

Background/ability measures—Participants completed a general background questionnaire along with the SF-36 Health Questionnaire (Ware, 1993) before starting the experiment. Additionally, participants completed the Letter/Number sequencing task, the Digit Symbol task, and the Vocabulary subtests from the Wechsler Adult Intelligence Scale III (WAIS-III; Wechsler, 1997) after the experimental portion of the study.

Procedure

Presentation order of the intuitive and deliberative information conditions as well as the decision context (apartment vs. bank) was counterbalanced across participants within age groups. The procedure for the two decision tasks was identical, and it was clearly explained—along with the nature of the specific instructions associated with the assigned thought condition—prior to presentation of the first task. For each task, participants read a short description of the decision context. The same description was used regardless of information or thought condition.

The presentation format of the choices closely followed that used in Dijksterhuis (2004). All information was presented via a computer. To be sure that older participants could read the materials clearly, information was presented on 22 in. LCD monitors in large text. The four choice options appeared in random order as did the twelve attributes for the options. The first choice was presented on the computer for 30 s in vertical list format[2], with the choice label at top and the twelve attributes immediately below. After 30 s had elapsed, the next option appeared to the right of the first option for the same amount of time. The third and fourth options were added in the same manner. Each choice was presented in a different color font to help distinguish them from each other. At the conclusion of the presentation, the screen went blank and the participants were given instructions based on their thought condition.

[2]We used a somewhat longer presentation time than did Dijksterhuis (2004) to accommodate normative age differences in processing speed.

The thought instructions were identical to those used by Dijksterhuis (2004). In the conscious thought condition, participants were given 3 min to actively deliberate on the choice options. They were told to utilize this time to reflect carefully on their thoughts of each option. Participants in the unconscious thought condition were given a set of moderately difficult anagrams to solve for the same amount of time.

After 3 min, participants in both conditions were asked to choose the apartment or bank that they considered optimal. After making this decision, participants evaluated each of the four choices on a 10-point scale. Participants were not permitted to re-read the materials for this task. After a brief rest period, the second decision task was presented.

After completion of the second task, participants were administered the three subtests from the WAIS-III. Source memory was assessed next. For each decision, all attributes from the four choice options were presented individually on the computer screen in random order, and participants were asked to determine whether or not each attribute was associated with the option they chose. Finally, the attributes used for each decision were presented one more time, and participants rated on a scale of 1–10 how important they felt each attribute was to the specific decision task presented in each condition. These data were used as a manipulation check to ensure that participants were distinguishing between core and non-core attributes.

Results

The results relating to the decision task are presented in four sections. In the first, we examine participant's ratings of the importance of individual attributes as a manipulation check. We next examine decision data, in terms of selection of the optimal alternative and evaluations of all choice alternatives. Finally, we examine source memory for individual attributes as a means for investigating choice-supportive memory.

Accuracy in Representation of the Decision Context

Our predictions regarding age and thought relied on participants aligning their decisions with the constraints of the decision context, with primary emphasis given to the core attributes. Thus, prior to examining performance in the decision task, we gauged the accuracy of representation of the decision context as reflected in the relative importance assigned to core versus noncore attributes. Mean importance ratings for attributes obtained from our manipulation check were examined using a 2 ×2 × 2 (Age Group ×Relevance [core vs. noncore] ×Valence [positive vs. negative]) ANOVA. (Five older adults were excluded from these analyses due to missing data.) Core attributes were rated as more important than noncore attributes (*M*s = 6.9 vs. 4.8), F (1, 130) = 393.50, $p < .001$, $\eta_p^2 = .75$, indicating that participants were viewing the attributes' relevance to the decision task as intended. Unexpectedly, positive attributes were also rated as more relevant than negative attributes (*M*s = 6.1 vs. 5.7), F (1, 130) = 31.89, $p < .001$, $\eta_p^2 = .19$, although the difference was not large. There were also significant Relevance ×Valence, F (1, 130) = 81.61, $p < .001$, $\eta_p^2 = .39$, and Age Group ×Relevance, F (1, 130) = 7.18, $p < .05$, $\eta_p^2 = .05$, interactions. These effects reflect the fact that the difference in ratings for core versus noncore features was greater (a) for positive (*M*s = 7.4 vs. 4.8) than for negative (*M*s = 6.5 vs. 4.8) attributes, and (b) for younger (*M*s = 7.1 vs. 4.6) than for older (*M*s = 6.9 vs. 4.9) adults.

Whereas these results indicated that participants discriminated between core and noncore attributes as intended, there was also variability across individuals and age groups. Older adults in particular appeared less accurate in using information about the decision context to evaluate the importance of choice attributes. Given that our primary interest in age differences in decision *processes* required that all participants view the materials in a manner consistent with the decision context, we decided to categorize participants on this basis in order to examine the potential impact of representation accuracy in our analyses. To do this, participants' own importance ratings were used to calculate favorability scores for each alternative. We then examined whether these favorability scores were ordered in a manner consistent with our a priori expectations. Since the discrimination between core and noncore attributes was most critical in the deliberative information condition—where the number of core features and overall evaluative content were placed in opposition to each other—we used this as the primary basis for discriminating between participants.

Favorability scores for each alternative within the deliberative information condition were created by multiplying the participant's importance rating by the valence of each attribute, and then summing these values across all 12 attributes within each alternative. Thus, attributes assigned high relevance ratings had more influence on favorability ratings than those with low ratings. For example, a highly relevant but negative attribute lowered favorability scores more than a less relevant negative attribute. We then used these favorability scores to divide participants into two groups. Participants were categorized as *accurate* with our a priori expectations if their favorability ratings corresponded to the following ordering of choice alternatives, which reflects the number of positive core attributes (see Table 1): Alternative 2 > Alternatives 1 and 4 > Alternative 3. Participants were categorized as *inaccurate* if their scores were ordered primarily in terms of total evaluative content: Alternative 1 > Alternatives 2 and 3 > Alternative 4. By allowing one pairing in each set of comparisons to deviate from this pattern, we were able to place all individuals into these two categories. The number of younger adults in the accurate group was greater than that in the inaccurate group (*n*s = 36 vs. 26, respectively), whereas the opposite was true for older adults (*n*s = 28 vs. 42). This distribution of individuals across categories varied significantly as a function of age group, $X^2(1) = 4.30$, $p = .04$, again reinforcing the conclusions from the original analysis that older adults were less accurate in maintaining the original decision context. Category assignment was unrelated to thought condition. In order to examine differences between accurate and inaccurate older adults, several logistic regressions were conducted with accuracy as the outcome variable. Although none of our ability measures were significant predictors, being classified as accurate was associated with more years of education, $\beta = 0.23$, OR = 1.26, $p < .05$.

The mean favorability score for each alternative is presented in Table 2b as a function of accuracy group. (Once participants were divided on the basis of accuracy, there were no age differences in ratings, so the presented means are collapsed across age groups.) As can be seen, the ordering of alternatives in the inaccurate group was essentially consistent with total evaluative score, with the mean score for Alternative 1 being significantly higher than those for alternatives 2 and 3, which in turn were significantly higher than that of Alternative 4 (all *p*s < .001). In contrast, the ordering of means in the accurate group was clearly influenced by the number of positive core attributes, with the mean score for Alternative 2 being significantly greater than those of Alternatives 1 and 4 (which possessed 4 positive core attributes), which were significantly greater than that for Alternative 3, which possessed the fewest positive core attributes (all *p*s < .002). Given this clear variation in participants' perceptions of the stimuli, we incorporated this accuracy grouping variable into our analyses following our initial examination of the data.

We also calculated favorability scores for the alternatives in the intuitive information condition, but found little variability across participants. When alternatives were rank-ordered by favorability, 85% of young and 91% of older adults had rankings that were consistent with our a priori ordering. In addition, the optimal item had the highest favorability rating for 97% of the participants in each group. This consistency can be seen in Table 2b, where participants in both of the previously identified accuracy groups clearly ordered the alternatives consistent with total evaluative content. The absence of an impact of variations in importance ratings for core versus non-core attributes on favorability ratings in this condition makes sense since the four alternatives in this condition all have equal numbers of positive and negative core attributes. Thus, variations across groups in importance attached to these features should not matter that much in discriminating between alternatives.

Choice

The proportion of the entire sample of participants choosing the optimal choice (Alternative 1 in the intuitive condition, Alternative 2 in the deliberative condition) is presented in Table 3 by condition. In general, it can be seen that older adults performed more poorly than younger adults, but performance also varied across conditions. When binomial tests were conducted to compare performance in each condition to chance (i.e. .25), the data were generally consistent with expectations.[3] Younger adults performed above chance in the intuitive information condition, with performance being somewhat higher in the unconscious than in the conscious condition. In contrast, young adults' performance in the deliberative information condition was significantly above chance in the conscious thought condition, but not in the unconscious thought condition. When the older group was examined, those in the intuitive information condition exhibited above-chance performance, with little variation as a function of thought condition. When exposed to deliberative materials, neither the older adults in the conscious nor unconscious thought conditions performed above chance. When only those participants in the accurate representation group were examined, however, the pattern of performance was somewhat similar across age groups. Although older adults still performed more poorly than younger adults, their performance was best when there was a match between type of thought processing and the demands of the task. In contrast, for inaccurate participants in both age groups, performance was best with intuitive materials, where performance was significantly or marginally ($p < .10$) above chance in both thought conditions.[4] For deliberative materials, all inaccurate groups performed at chance. Thus, the anticipated pattern of age differences obtained with the full sample appeared to be based in older adults being less likely to accurately represent the decision context. One final point of interest is that the performance of accurate participants in both age groups was best in the deliberative materials-conscious thought condition, a direct contradiction to expectations based on Dijksterhuis and Nordgren (2006).

Choice Ratings

We next examined optimality ratings in order to better examine sensitivity to the evaluative information contained in each alternative. Ratings for each alternative were initially examined using a 2 (Age Group) ×2 (Thought) ×2 (Information Type [intuitive vs. deliberative]) ×4 (Evaluative Content [+4, 0, 0, −4]) repeated measures. On the last factor, we ordered the alternatives in both information conditions as depicted in Table 2 based on overall evaluative content to be consistent with Dijksterhuis (2004). If participants' evaluations of the choices were based on the total number of positive attributes, then their ratings should be systematically ordered in terms of the total evaluative content displayed in Table 2. If participants focused on the total number of core attributes, then the original ordering of the alternatives should be disrupted in the deliberative information condition, where number of core positive features is uncorrelated with total evaluative content. Remember that for deliberative information, the optimal alternative (Alternative 2) actually has an equivalent number of positive and negative attributes, and thus would be rated as a mediocre choice if the focus was primarily on global evaluative content.

[3]Given the number of tests conducted for the choice analysis, we took a conservative approach by using two-tailed significance tests.

[4]Although the patterns of performance of inaccurate participants with intuitive materials appears to vary somewhat across ages, we are reluctant to read too much into this given the relatively small number of participants in these groups.

Because we were most interested in how ratings varied across alternatives, we report only effects involving evaluative content. First, there was a main effect of evaluative content, *F* 3, 393) = 55.19, $p < .001$, $\eta_p^2 = .30$, with ratings decreasing with the overall evaluative content of the alternatives: 6.36, 5.16, 4.22, and 4.40. There was also a significant Information ×Evaluative Content interaction, *F* (3, 393) = 12.49, $p < .001$, $\eta_p^2 = .09$, due to ratings in the intuitive condition (6.79, 4.78, 4.66, 4.20) being more clearly ordered in terms of total evaluative content (+4, 0, 0, −4) than ratings in the deliberative condition (5.90, 5.53, 3.77, 4.60). These latter ratings also appeared to be influenced by total core content (+2, +6, −2, +2), suggesting that participants were focusing on the subset of core features when evaluating alternatives in this condition. We predicted that age and thought condition would moderate this interaction, but the only other significant interactions were between age group and evaluative content, *F* (3, 393) = 2.65, $p < .05$, $\eta_p^2 = .02$, and age, content, and information condition, *F* (3,393) = 5.88, $p = .001$, $\eta_p^2 = .04$. These effects were due to the previously described interaction being significant for the young ($p < .001$), but not for the old ($p = .36$) In other words, younger adults were more likely than older adults to focus on the core attributes in the deliberative information condition. Consistent with expectations, older adults' ratings in both information conditions were more in line with global evaluative information associated with individual attributes. Inconsistent with expectations derived from the theory of unconscious thought (Dijksterhuis & Nordgren, 2006), however, there was no effect of thought condition.

When accuracy in representation of the decision context was considered as an additional between-groups variable, however, the following significant interactions were obtained: (a) Accuracy ×Evaluative Content, *F* (3, 366) = 7.65, $p < .001$, $\eta_p^2 = .06$; (b) Accuracy ×Information ×Evaluative Content, *F* (3, 366) = 5.76, $p = .001$, $\eta_p^2 = .05$; and (c) Accuracy ×Thought Condition ×Evaluative Content, *F* (3, 366) = 3.44, $p = .02$, $\eta_p^2 = .03$.[5] Interestingly, the previously obtained Age ×Information ×Evaluative Content interaction remained significant, F(3,366) = 4.71, p =.01, $\eta_p^2 = .04$, suggesting that this effect does not simply reflect age differences in representational accuracy. To facilitate interpretation of these effects, we conducted separate ANOVAs within accuracy groups. In the inaccurate group (Table 4, bottom), in which participants ignored core features and focused on total evaluative content of the alternatives, the only significant effects obtained were due to evaluative content, *F*(3, 186) = 38.89, $p < .001$, $\eta_p^2 = .39$, and its interaction with information condition, *F*(3, 186) = 3.64, $p = .01$, $\eta_p^2 = .06$. This effect was fundamentally different than that observed in the main analysis in that Alternative 1 was clearly preferred to alternatives 2, 3 and 4 in both the intuitive condition (6.62, 4.54, 4.70. 4.24) and the deliberative condition (6.62, 4.70, 3.71, 4.48). The interaction had to do with slight variations across groups on the last two alternatives. Thus, these participants were clearly choosing the alternative with the highest total evaluative content, regardless of information or thought condition. The focus on general evaluative content in making decisions also eliminated age differences in performance, consistent with our expectations that age differences would be minimal when decisions used such information. Interestingly, there was no evidence that thought condition moderated the pattern of ratings (*p*s > .24.) even though this condition might be viewed as most similar to those used in Dijksterhuis (2004).

For individuals who viewed the materials in the manner intended, the results more closely matched expectations (Table 4, top). Specifically, the significant main effect of evaluative content, *F*(3, 180) = 27.03, $p < .001$, $\eta_p^2 = .31$, was again moderated by information condition, *F*(3, 180) = 14.3, $p < .001$, $\eta_p^2 = .19$, but the effect was clearly different than that observed in the inaccurate group. Specifically, whereas the ratings in the intuitive condition continued to

[5]This analysis excluded data for the 5 older adults who could not be placed into accuracy groups due to missing data for relevance ratings. Note, however, that excluding their data from the initial analysis without the Accuracy condition—which was based on these ratings—resulted in the same effects.

correspond to overall evaluative content (6.87, 4.97, 4.36, 4.14), those in the deliberative condition clearly reflected differential attention to core attributes, with Alternative 2 being the clearly preferred item (5.19, 6.31, 3.64, 4.73). Age further moderated this interaction, $F(3, 180) = 3.79$, $p = .01$, $\eta_p^2 = .06$. This reflected the greater differentiation in ratings across information conditions for younger adults, $F(3, 102) = 19.04$, $p < .001$, $\eta_p^2 = .36$, than for older adults, $F(3, 78) = 2.05$, $p = .11$, $\eta_p^2 = .07$.

A Thought × Evaluative Content interaction was also observed, $F(3,180) = 2.93$, $p = .04$, $\eta_p^2 = .05$. This reflected a tendency for ratings to align more closely with overall evaluative content when engaging in unconscious versus conscious thought.

Source Memory

We next examined the accuracy of individual's source memory for individual choice attributes to determine the extent to which people's memory for positive versus negative information was biased in the direction of reinforcing their choice. To do so, the proportion of attributes for both the chosen alternative and nonchosen alternatives that were attributed to the former was subjected to an Age ×Thought Condition ×Material ×Source (Chosen vs. Nonchosen alternatives) ×Attribute Valence ANOVA. As would be expected, attribution rates were higher for attributes from chosen than from nonchosen alternatives (.59 vs. .34), $F(1, 129) = 288.62$, $p < .001$, $\eta_p^2 = .69$. This effect was moderated by age, $F(1, 129) = 15.63$, $p = .001$, $\eta_p^2 = .11$. In addition to these results, there was a main effect of valence, $F(1, 129) = 133.38$, $p < .001$, $\eta_p^2 = .51$, suggesting that participants were more likely to attribute positive than negative attributes to their choice (*M*s = .56 vs. .37, respectively). In contrast to previous research, however, older adults were not more supportive of their choices than younger adults, $F < 1$. Subsequent analyses including accuracy of representation of the decision context did not moderate any source effects.

Discussion

The current study examined decision making using a variant of Dijksterhuis' (2004) methodology associated with studying the deliberation without attention effect. We had two primary goals. First, we wanted to examine the boundary conditions associated with the benefits of unconscious thought. Second, using this same methodology, we examined age differences in deliberative versus intuitive processing. We discuss the results relevant to each goal in turn.

Conscious versus Unconscious Thought

With respect to our first goal, we predicted that unconscious thought would be most beneficial when decisions could be based on global evaluative information. Conversely, we hypothesized that conscious thought would be a more appropriate information-processing strategy when effective decision making required individuals to not only consider the evaluative implications of the attributes associated with each alternative, but also to discriminate between relevant and irrelevant attributes. The results were somewhat consistent with these expectations when choice accuracy was examined, particularly when focusing specifically on the performance of those who perceived the decision-making material accurately. Of particular note, and inconsistent with predictions of unconscious-thought theory (Dijksterhuis & Nordgren, 2006), there was no clear support for the benefits of unconscious thought. In fact, the highest level of performance in the choice accuracy data was for those individuals engaging in conscious thought with deliberative materials. It should be noted that, not unlike the current study, several researchers have called the effectiveness of unconscious thought into question, (e.g., Acker, 2008; Newell et al., 2009).

Only one other effect relating to thought was obtained: ratings of alternatives in each choice task were more consistent with overall evaluative content with unconscious thought than with conscious thought. This effect reinforces our perspective that unconscious thought operates primarily through relatively automatic evaluation associated with the processing of summary evaluative information. Unfortunately, when such information does not form the primary basis for an effective decision—as in our deliberative information condition—unconscious thought can actually lead to nonoptimal decisions. These results are consistent with those of a recent study by Payne et al. (2008). Although these researchers found that unconscious thought was sensitive to frequency information regarding positive attributes, it was not as sensitive as conscious thought to the magnitude of evaluative information. These results combined with ours suggest that the benefits of unconscious thought may be specific to situations that rely on simple frequency information regarding the positivity or negativity of choice attributes.

Age Differences in Performance

With respect to our second goal, conclusions regarding the effects of age on decision making depended upon the level of analysis. When data from all participants were considered, the results were generally consistent with expectations. The predicted interaction between thought condition and information condition was most evident in the younger group, as older adults appeared to rely more on global evaluations in making decisions about each choice alternative. Importantly, however, this pattern of performance was partially reflective of age differences in accuracy of representing the decision context. Older adults were less likely than younger adults to discriminate between attributes based on their relevance to the decision-making context, which resulted in their greater reliance on general evaluative information in making decisions. Of significance is the fact that age differences were minimized when solely considering participants who accurately perceived the decision-making information. That is, both young and older adults who clearly differentiated between core and noncore attributes were likely to place greater weight on core attributes when evaluating choice alternatives. Even in the accurate group, however, older adults still exhibited lower levels of differentiation between optimal and less optimal choices in the deliberative information condition. Older adults' performance was best when decisions could be based on global evaluative information.

The efficiency of older adults' decision making under these latter circumstances is further supported by the ratings of those individuals who inaccurately represented the decision context information. Given the lack of discrimination between core and noncore attributes, these individuals were clearly focusing on general evaluative information in making their ratings. Furthermore, older adults were just as effective as the young in identifying the optimal alternative based on such information. These results are consistent with the hypothesis that older adults are more dependent than younger adults on intuitive processes in making decisions (Peters et al., 2007). Thus, age differences in the ability to make optimal decisions are most probable when the decision maker is required to engage in deliberative processing. Even under these circumstances, however, age differences are dramatically reduced if individuals are accurate in representing the decision context.

Our findings suggest that older adults' problems with maintaining the decision parameters may represent an important source of age-related variability in decision-making performance. Such failures could be conceived of as a failure to maintain context, which Braver et al. (2001) have suggested is a key component underlying aging-related decrements in cognitive functioning, When we attempted to identify the basis for individual differences in maintenance of the decision context, we did not find any relationships involving ability. This could reflect the fact that the ability measures collected in this study were not the best indicators of executive functions. We did find, however, that higher levels of education were associated with accuracy in older adults, suggesting some basis in ability. Explication of the relationship awaits further study.

We also examined source memory as a means of investigating age differences in choice supportive memory as well as the impact of intuitive versus deliberative thought. As predicted, older adults had poorer source memory than younger adults. We also found that all participants evidenced choice-supportive memory, as reflected in their greater willingness to attribute positive than negative attributes to the highest rated alternative. Interestingly, our results did not replicate the findings of Mather and Johnson (2000) in that there were no significant age differences between older and younger adults' choice-supportive memory. This may be due to the complexity of our material compared to the decision-making information used in the Mather and Johnson study. More specifically, participants in their study were presented with decisions which only included two choices of equal weighting. The amount of information and the differential weighting of the choice attributes in the current study may have affected the age differences in choice-supportive source monitoring. This suggests that age differences in choice supportiveness may be minimized as information complexity increases, resulting in higher cognitive demands on younger as well as older adults. In addition to older adults not being differentially biased toward remembering positive attributes, it is also noteworthy that there was no evidence that they considered positive attributes as more important in determining decision outcomes than did younger adults. In other words, there was little evidence of an age-related positivity bias.

Caveats

Several caveats should be kept in mind while considering our findings. One concerns the similarity between the conditions associated with the decision-making task in our study and those found in real-world decision contexts. In the present case, participants were given a limited amount of time to deal with a relatively large amount of information. Although it could be argued that it is rare that individuals make important decisions under such circumstances, people are often required to make time-constrained choices. Indeed, older adults have been shown to make relatively complex and potentially consequential decisions with little deliberation (e.g., Meyer et al., 2007), suggesting that the present methodology may be an effective way to assess their decision making. In addition, it is important to note that additional time is not necessarily beneficial. For example, Payne et al. (2008) found that self-paced deliberation was more effective than providing an extended period of time to think about the choice. Similarly, our study demonstrated that it is not so much the time provided for making the decision, but rather the match between the task and the nature of processing that is important.

Another issue to consider relates to the comparison of conscious and unconscious decision making using the Dijksterhuis (2004) methodology. Given that deliberation is not directly assessed, the basis of any thought condition effects is somewhat open to interpretation. At the very least, it would be useful to determine whether participants are actually actively thinking about their choices. In the present study, if we take accuracy of the decision context as a possible stand-in for engagement in the task, it is evident that conscious thought is as beneficial as unconscious thought (see Table 4) regardless of task demands. It also suggests that conscious thought was associated with some form of deliberation. For those individuals who are less engaged (i.e., inaccurate group), unconscious thought appears more beneficial, particularly when decisions can be based on global evaluative information. It is important for future work in this area to assess the extent to which individuals engage in deliberation as well as the nature of deliberation in order to get a better handle on the relative efficacy of conscious versus unconscious thought. Given that one of our goals in this study was to replicate Dijksterhuis' findings, we closely followed his methodology and did not provide participants with decision aids during the conscious thought task. Although it may be hypothesized that such aids would be beneficial to decision makers, recent research has shown no significant differences between participants who engage in conscious thought with decision aids and those who deliberate without a visual depiction of the choice information (Newell et al., 2009; Thorsteinson & Withrow, 2009).

Research on multi-attribute decision making is difficult in that choice attributes are likely to be subject to the decision maker's own preferences or experiences. We attempted to control for this problem by providing participants with the decision context. Although there were subtle differences in attribute weightings, perhaps based on the participants' experiences, the assignment of weightings reflects something specific about the individuals' value of the weights, not the failure of the provided decision context. Given that the intuitive condition required participants to consider information that was irrelevant to the decision context (i.e., non-core attributes), participants exposed to this condition first might then have unduly weighed such attributes in subsequent decisions involving deliberative materials. To investigate this possibility, we conducted analyses to examine if order of exposure to the intuitive and deliberative material influenced adherence to the decision context. There were no effects of order, suggesting that participants who saw the intuitive material first relied on the decision context for the deliberative material to the same extent as those who were presented with the intuitive materials second.

Conclusions

The results of the present study suggest that the benefits of unconscious thought are moderated by the nature of the decision-making task. Unconscious processing—as operationalized by the Dijksterhuis (2004) methodology—appears most beneficial when the decision can be based on a simple, evaluative summary of all information presented. Active deliberation may actually interfere with the effective use of this automatically processed information. In contrast, active deliberation appears more beneficial when processing complex information (e.g., participants must distinguish between relevant and irrelevant attributes). These results regarding complexity and the benefits of unconscious thought are in direct opposition to expectations derived from Dijskterhuis and Nordgren (2006), while also indicating that the benefits of unconscious thought appear to be selective.

An alternative interpretation of the present results, based in recent work by Lassiter et al. (2009), suggests that the findings might be further explained without any reference to conscious or unconscious processing. Specifically, given that participants were engaging in on-line processing—in that they were actively evaluating the choice alternatives during study—variations in performance across conditions could be explained by the degree to which the thought and information conditions fostered or hindered such processing. With intuitive materials, on-line processing should be facilitated due to participants being able to form general impressions of each alternative based on summary evaluative information, with the best choice being the most positive impression. Prevention of active deliberation should not affect performance. In fact, it might actually interfere as participants perhaps rely on faulty information in memory to modify their initial impressions. In contrast, decision making with deliberative materials might benefit from additional thought due to the added complexity of the task associated with the differential weighting of attributes. Clearly, further investigation into the basis of the "deliberation-without-attention" effect (Dijksterhuis & Nordgren, 2006) is needed.

The results regarding age partially reinforce previous findings that emphasize older adults' lessened ability to efficiently engage in active deliberation, though their ability to use automatic processing is relatively well-preserved. Our results also suggest that age differences in the ability to accurately represent or maintain the decision context may be an important factor underlying age-related problems in decision making when active deliberation is necessary to support performance. Deficits in context maintenance, however, would not necessarily impair decision making when performance can depend on automatic processing or, alternatively, is conducive to on-line processing. These findings have implications for the manner in which materials might be most efficiently structured for older adults in decision making contexts, including cues designed to highlight the most important dimensions to the decision at hand.

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Table 1

Participant Characteristics

	Young		Old	
	Mean	***SD***	**Mean**	***SD***
Age	19.44	2.00	70.95	5.95
Education	13.19	1.20	16.07	2.35
Physical health	46.53	5.47	43.32	6.96
Mental health	41.28	6.19	47.19	6.00
Letter-Number Sequencing	13.10	3.28	10.40	2.59
Vocabulary	43.39	7.63	50.82	10.67
Digit-Symbol Substitution	63.69	10.97	46.60	10.31

Note: SF-36 data are T-scores. Letter-Number Sequencing scores could range from 1–21, Digit-Symbol scores could range from 1–133, & Vocabulary scores could range from 1–66.

Table 2

Information about Choice Alternative: (a) Characteristics Associated with Distribution of Attibutes; and (b) Favorability Scores based on Subjective Ratings of Attribute Importance

	Information Condition and Alternative							
	Intuitive				**Deliberative**			
	1[a]	**2**	**3**	**4**	**1**	**2[a]**	**3**	**4**
(a) Choice Alternative Characteristics								
+/− Core Attributes	4/2	4/2	4/2	4/2	4/2	6/0	2/4	4/2
+/− Non-Core Attributes	4/2	2/4	2/4	0/6	4/2	0/6	4/2	0/6
Total Evaluative Content	**+4**	**0**	**0**	**−4**	+4	0	0	−4
Core Evaluative Content	+2	+2	+2	+2	**+2**	**+6**	**−2**	**+2**
(b) Favorability Scores								
Accurate Group	28.0	6.9	6.7	−11.6	21.4	26.1	−12.9	−0.9
Inaccurate Group	30.9	2.7	5.2	−20.7	28.9	10.7	−2.2	−20.3

Note. Evaluative content determined by subtracting the number of relevant negative features from the number of relevant positive features. The bolded information in each information condition reflects the ordering of alternatives based on relevant information in that condition.

[a]Denotes the optimal choice in each information condition.

Table 3

Proportion of Participants Selecting Optimal Choice

Information Condition	Age Group	Thought Condition	All participants (*n*)	Accurate participants (*n*)	Inaccurate participants (*n*)
Intuitive	Young	Unconscious	.72* (32)	.72* (18)	.71* (14)
		Conscious	.62* (29)	.67* (18)	.55* (11)
	Old	Unconscious	.47* (36)	.50a (12)	.43a (21)
		Conscious	.46* (39)	.44a (16)	.52* (21)
Deliberative	Young	Unconscious	.41a (32)	.61* (18)	.14 (14)
		Conscious	.50* (30)	.83* (18)	.00* (12)
	Old	Unconscious	.28 (36)	.33 (12)	.24 (21)
		Conscious	.38a (39)	.62* (16)	.19 (21)

Note. Significance indicates performance above chance (.25) as determined by binomial tests.

* $p < .05$

a $p < .10$

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Table 4

Mean Ratings for Alternatives for Participants Who Perceived Materials Accurately and Inaccurately

		Intuitive				Deliberative			
	Thought condition	**1**	**2**	**3**	**4**	**1**	**2**	**3**	**4**
		Accurate participants							
Young	Unconscious	8.0	5.2	5.1	3.7	5.7	6.5	3.5	5.3
	Conscious	7.6	5.3	4.7	4.1	5.5	7.5	4.1	5.0
Old	Unconscious	6.2	4.0	4.5	3.8	5.0	5.2	3.8	3.7
	Conscious	5.3	5.1	3.0	4.9	4.4	5.5	3.1	4.5
		Inaccurate participants							
Young	Unconscious	7.8	4.3	5.3	4.4	7.4	5.1	3.8	5.0
	Conscious	7.1	4.9	6.4	4.2	7.7	5.0	4.1	5.0
Old	Unconscious	5.7	4.1	3.7	4.5	5.8	4.6	3.1	4.6
	Conscious	6.4	4.8	4.1	3.8	6.2	4.2	4.0	3.7