Expertise Effects on Immediate, Deliberate and Unconscious Thought in Complex Decision Making

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Abstract

In this study we examined the claim that unconscious thought would lead to better choices in complex decision making than immediate and deliberate thought. We doubted whether this would also be true for experts in a domain. Participants were students and experienced real-estate agents with expertise in choosing between houses. In three problems, differing in difficulty and/or task requirements, participants decided upon the best house by rank-ordering and evaluation. No support was found for beneficial effects of unconscious thought, neither for experts, nor for students. In line with our hypothesis we found that experts could take advantage of deliberate thinking in complex decision making. They were also better than students in immediate choices. These results corroborate other studies that question the generalizability of the deliberation-without-attention hypothesis, and provide further evidence that it is helpful to deliberately think when making complex decisions. The advice is to rely on experts or to build expertise, instead of leaving thinking to the unconsciousness.

Keywords: expertise; task complexity; decision making; unconscious thought; deliberation; intuition.

Introduction

Imagine you want to buy a house. Probably you have some ideas what it should look like, what it may cost, and where you would like to live. You start orienting yourself and find out what is realistic in the price range you are looking for. If you are lucky, you immediately find what you want and can decide quickly. However, it is more likely that you will have to make some compromises; otherwise you need to take the time to wait for your dream. In case you need to reconsider your wishes, you may set priorities, and evaluate the characteristics of a house against your standards. When comparing several houses you can make lists with pros and cons to help you weigh and choose. In this process you can also ask a real-estate agent for advice, who may integrate his view on the technical details and the possible rearrangements. Finally, you can let all information sink in, and take the decision when you feel what to do.

This example shows the different types of decision processes that might be involved when buying a house. An immediate process of matching characteristics to criteria has a satisfactory result when the problem is easy, a house meets your wishes or it does not. A deliberate process of listing and weighing pros and cons will be invoked when you are not immediately convinced and the decision is tougher. An unconscious process of information processing, furthermore, might take place when you are indecisive and put the problem at rest.

This last option of unconscious information processing has recently received a lot of attention, since Dijksterhuis (2004) found an advantage of this type of processing above immediate decision making and deliberate thinking before deciding. Based on his experiments, he gave the following advice for making complex decisions: "..after a little initial conscious information acquisition, avoid thinking about it consciously. Take your time and let the unconscious deal with it" (pp. 597). This advice has been taken quite seriously in the public media, not the least in The Netherlands. However, scientifically it raised considerable debate. Several researchers failed to replicate the findings of Dijksterhuis (Acker, 2008; Newell, Wong, Cheung, & Rakow, 2009). Attempts to specify the conditions in which the unconscious thought effect would arise (Newell et al., 2009; Payne, Samper, Bettman, & Luce, 2008), as well as a meta-analysis (Acker, 2008), indicated that there was no clear evidence that unconscious thought contributed to better decision making. On the contrary, conscious deliberation about choice alternatives might have been handicapped by the experimental tasks used, so it could not help to make complex decisions.

Dijksterhuis and colleagues argued that conscious processing capacity is too small to handle complex

problems (Dijksterhuis, 2004; Dijkstherhuis, Bos, Nordgren, & van Baren, 2006), as it can only focus on a few attributes simultaneously, so hindering the association and integration of the other information. Theoretically it may only be possible to take in and weigh all relevant information in simple decisions. In the present study, we will focus on the variable of complexity. This relates to the complexity of the task and to the expertise of the decision maker: What is complex for some might be simple for others.

Although the knowledge and skills of people underlie their cognitive processing of information in all sorts of tasks, expertise is underemphasized as a topic in the decision making literature. Therefore, we tested the effects of expertise on thinking in a within-subject experiment with three problems using the Dijksterhuis (2004) paradigm. To keep close to the original study, we asked both students and experienced real-estate agents to rank order and evaluate four houses in each problem. Two problems varied in difficulty to investigate shifts in the beneficial effects of the different modes of thought. Furthermore, in one problem we slightly changed the task, so differences in and consequences of immediate judgments could be better assessed.

Before describing the method of study and the hypotheses per problem, we will explain the Dijksterhuis paradigm (2004) and his ideas about the working of unconscious thought, as well as some basic findings from expertise research.

Unconscious Thought and the Research Paradigm

Dijksterhuis and colleagues describe unconscious thought as an active process of information integration that proceeds in the background while attention is directed elsewhere (Dijksterhuis, 2004; Dijksterhuis & Nordgren, 2006; Dijksterhuis et al., 2006). They emphasize that it is not constrained by processing capacity like conscious thought but is the result of bottom-up or aschematic processing that yields an unbiased holistic judgment. Therefore, it would be particularly apt to process complex decision problems in which many attributes and alternatives are involved. It was also named 'deliberation-without-attention'.

In a series of experiments, Dijksterhuis (2004) showed that people made better decisions when they were diverted for some time from the target task compared to both immediate responses and decisions deliberated upon for the same period. Participants were presented with a large number of attributes for each of several alternatives (apartments or roommates) asking them to form an impression of the alternatives and to evaluate or choose among them later. The assignment of attributes created normatively better and worse options. In two of the three experiments the attributes of all alternatives were randomly presented. This resulted in a rather unrealistic and taxing task. The final judgments were made in three different conditions. In the immediate decision condition, participants were not given time to consciously think as they had to make a judgment immediately after information processing. In the conscious thought condition, participants were instructed to think carefully about the information for a few minutes. Finally, in the unconscious thought condition, participants performed a fully attention-demanding distractor task (n-back task or anagram task) preventing them to consciously think about the task.

Interestingly, Dijksterhuis (2004) not only looked at differences in judgments in the three conditions, but also at the representations that underlie these judgments. The positive effect of unconscious thought on decision making was suggested to be the result of further organizing of the information in mental representations and, thus, indeed of thinking processes.

Expertise

Many experts learn to deal with complex problems and can become very fast and accurate in representative problem solving. The general explanation is that, through study and experience, knowledge becomes organized in such a way that it allows immediate recognition of a situation, and subsequently, immediate appropriate action (Anderson, 1996; Chi, Feltovich & Glaser, 1981; Ericsson, 2005). The crucial mediator here is the representation of the problem to be solved. In interpreting the problem, situation-specific information and knowledge interact forming a mental representation. Other cognitive elements representing, for example, possible actions and strategies, are associated with this representation. The better developed this functional system of integrated representations, the better the performance. The acquisition of expertise, therefore, often leads to dramatic increases in domain specific working memory capacities, functionally expanding one's ability to encode and represent highly complex information.

In medicine, for example, experienced physicians come up with accurate diagnostic hypotheses very early in the patient encounter, which guide further questioning and examination (Elstein & Schwarz, 2002). Students also generate and test hypotheses in interacting with a patient but their hypotheses are less accurate. They have to fall back on analytical processing of case information in trying to understand the patient's problem. Physicians only do that when they are confronted with complex and difficult problems. In routine problem solving, the appropriate actions come immediately to their minds. (Schmidt, Norman, & Boshuizen, 1990; Norman, Eva, Brooks, & Hamstra, 2006).

Method

Participants

Participants were 60 undergraduate students (34 women and 26 men) of Maastricht University and 60 real-estate agents (15 women and 45 men) working in the south of the Netherlands. The average age of the students was 21.70 (*SD* = 2.76). The real-estate agents were on average 36.73 years (*SD* = 9.31), and their work experience after completing relevant studies and internships varied from 1 to 49 years, (*M* =7.74; *SD* = 7.81).

Students participated for course credits or a € 7,50 gift certificate. Real-estate agents were approached by phone (response rate of 62%) and unexpectedly received a bottle of wine afterwards.

Material

The materials for each task consisted of information about four hypothetical houses, labelled House 1-4. Depending on the task 12 or 18 attributes per house were presented. The attributes were positive, negative or neutral and assembled in such a way that it led to normatively more and less favourable options per task.

The stimulus material was developed in cooperation with three independent experienced real-estate agents to assure that the presented information would be congruent with practices in their domain of expertise. A list of relevant dimensions, such as date of building, number of bedrooms, and garden, was formulated first to guide attribute selection. To enhance representativeness of the materials attributes were selected from existing houses. The order of attributes for each house was determined in agreement with the real-estate agents, so it resembled the order in which they commonly process the information. Two important constraints in searching for a house, price and location, were preset and not included in the attribute lists. Pictures were not included as they may dominate the decision making process. In line with the experiments of Dijksterhuis (2004) the materials were restricted to short verbal descriptions that were not extremely positive or negative.

Procedure

In recruiting, the participants were told that they would have to choose between several houses as we were interested how decisions of real-estate agents would differ from those of students. They were explained that characteristics of four houses would appear on a computer screen and that their task would be to rank-order the houses and to evaluate each house for attractiveness.

The participants were individually tested with a laptop. Students were tested at the university and real-estate agents were tested in their offices. The experimenter explained that they would be given 3 decision problems and a practice problem. To increase representativeness of the task participants were asked to imagine a concrete real-life situation. Real-estate agents were instructed to imagine that they had spoken to a young couple in the process of buying their first house. The couple had communicated their wishes and said they wanted a house situated near the city of Maastricht. They could afford a house in a price range of €170.000 to €180.000 and asked the real-estate agent for advice which house to buy. Students were instructed to imagine that their parents had decided to buy a house in Maastricht as an investment. They were told that they would be allowed to live in the house with a friend during their years as a student. The parents were able to afford a house in a price range of €170.000 to €180.000. After some research on the internet they found various houses in the proposed price range, that the students might choose from. Their task was to decide which house was the best for them to buy.

For each problem, the houses were sequentially presented on a computer screen, each attribute appearing in the centre of the screen for 2 seconds. The boundaries between houses were marked by a 2 second pause (Problems 1 and 2) or an extra evaluation task (Problem 3). The order in which the houses were presented was randomized.

Participants were asked to form a good impression of the houses and they were told that they would be asked to choose one of them later. This was operationalized as rank-ordering and evaluation. They first had to rank-order the houses by typing the house numbers in positions, putting the most attractive house on top, and the least attractive house at the bottom. Subsequently, they evaluated whether they would like to buy, or would advise to buy, each house on a VAS-scale (0-100 mm) ranging from *definitely not* to *definitely* with a neutral point in the middle.

After the presentation of the four houses, following the Dijksterhuis (2004) paradigm, specific instructions for the three thought conditions were given. In the *immediate thought condition*, participants were asked to provide a rank-order of the houses and to do this as quickly as possible. In the *deliberate thought condition*, participants were asked to think carefully about what they thought about the four houses for four minutes. A clock indicated the remaining time. In the *unconscious thought condition*, participants performed a distractor task for four minutes aimed at occupying conscious thought before rank-ordering the houses. The distractor task was a 2-back task (Jonides et al., 1997) in which participants were presented with a sequence of digits between 1 and 5 appearing one by one on the computer screen. For each digit they had to decide whether it matched the digit "2-back" in the sequence.

The order of the decision problems was balanced over the participants, as well as the order of the thinking conditions that were nested within the problems. The whole procedure took about 35 minutes.

Analysis

Decision Quality

The rank-order data were analyzed to assess the quality of the decision; when participants chose the attractive house as the first-ranked alternative and the unattractive house as the last-ranked alternative their decision was coded as correct. To test the relationship between the different categorical variables, a 3×2×2 loglinear analysis of mode of thought (immediate vs deliberate vs unconscious), level of expertise (student vs real-estate agent), and rank-order (correct vs incorrect) was performed. Separate chi-square tests were performed to further examine the obtained effects. Effect sizes were specified by odds-ratios.

Difference Scores

Following Dijksterhuis (2004), difference scores were calculated by subtracting the evaluation scores for the

unattractive house from the evaluation scores for the attractive house. The difference scores were subjected to a 3×2 analysis of variance (ANOVA) of mode of thought (immediate vs deliberate vs unconscious) and level of expertise (student vs real-estate agent). Effect sizes were computed for the focused comparisons by converting *F*-values to the Pearson's correlation coefficient (Field, 2005).

Problem 1

The task in problem 1 was similar to the task used by Dijksterhuis (2004) in Experiment 1 (apartments) and experiment 3 (roommates). However, to make the task more representative and less taxing we did not present the attributes of all four houses in randomized order, but presented the attributes per house in a sequence that is common among real-estate agents. We hypothesized that because of their task-relevant expertise real-estate agents would perform better than the students. We expected this effect especially in the immediate thought condition as the experts may instantly recognize relevant patterns, but also in the deliberate thought condition as the experts could use their knowledge in organizing their thoughts about the houses. If first impressions are already quite accurate, we do not expect that unconscious thought would add anything.

Method Specification

The materials used in problem 1 were four houses, each comprising 12 attributes. Normatively more and less attractive houses were created by differential distribution of positive and negative attributes over the houses. The distribution was similar to that used by Dijksterhuis (2004) in Experiment 1. The most attractive house was described by 8 positive and 4 negative attributes, the least attractive house by 4 positive and 8 negative attributes, and the two filler houses were of medium attractiveness with 6 positive and 6 negative attributes.

Results

Decision Quality

The percentage of correct rank-orders was 58% for experts, and 38% for students. The three-way log-linear analysis of the rank-order data produced a final model that retained all effects. The likelihood ratio of this model was χ^2 (0) = 0, p = 1. This indicated that the highest order interaction (mode of thought × level of expertise × rank-order) was significant, χ^2 (2) = 6.93, p = .031.

To break down this effect, separate chi-square tests were performed on level of expertise and rank-order for each thought condition. Only in the deliberate thought condition, a significant association was found between level of expertise and rank-order, χ^2 (1) = 10.42, p = .001. Odds ratios indicated that, after a period of deliberation, real-estate agents were 10.52 times more likely to provide a correct rank-order of the houses than students.

To further investigate the differences in performance between the three thought conditions, chi-square tests were performed separately for real-estate agents and students. Only for real-estate agents, there was a significant association between mode of thought and rank-order, χ^2 (2) = 12.48, p = .002. Odds ratios indicated that real-estate agents in the deliberate thought condition were 3.78 more likely to make a correct judgment than in the immediate thought condition, and 13.22 times more likely than in the unconscious thought condition. Furthermore, real-estate agents were 3.50 times more likely to make a better judgment in the immediate thought condition than in the unconscious thought condition. In contradiction with the findings of Dijksterhuis (2004), the association between mode of thought and rank-order was non-significant for the students, χ^2 (2) = .56, p = .75.

Difference Scores

Analysis of the difference scores revealed a significant effect of expertise, F(1, 114) = 4.64, p = .033, r = .20, a non-significant effect of condition, F(2, 114) = .669, p = .51, and a non-significant interaction, F(2, 114) = .153, p = .86, indicating that the real-estate agents in all three conditions were better able to differentiate between the attractive and the unattractive house (M = 57.25, SD = 34.73) than the students (M = 43.70, SD = 33.48). The data suggest that this was due to a more negative evaluation of the unattractive house by the real-estate agents than by the students. This was confirmed in a separate ANOVA for the unattractive house, F(1, 118) = 7.37, p = .008. r = .24.

Problem 2

The second problem was designed to compare the achievements of novices and experts in a more difficult decision problem. To enhance the level of difficulty the number of positive and negative attributes describing each of the four houses was increased. Furthermore, besides an attractive house, an unattractive house and a filler, a moderately attractive house was added. The differences between the number of positive and negative attributes describing the attractive and moderately attractive house were decreased in order to create more complexity. We hypothesized that when the problem was indeed difficult for experts, they would perform less well in the immediate condition, as it would be harder to recognize the best option right away. They rather might benefit from deliberate processing by ordering attributes and options. However, according to the deliberation-without-attention hypothesis (Dijksterhuis et al. 2006), unconscious thought would also be best for experts in this complex problem.

Method Specification

Concerning the materials of problem 2, 18 attributes per house were presented. The attractive house was described by 11 positive and 7 negative attributes. The moderately attractive house was described by 10 positive and 8 negative attributes. The least attractive house was described by 7 positive and 11 negative attributes and the neutral house was described by 9 positive and 9 negative attributes.

Results

Decision Quality

The evaluation data showed that the problem was indeed difficult, as both the students and real-estate agents could not differentiate between the two best houses. Therefore, the rank-order criterion was set as the correct recognition of the unattractive house as the worst alternative. This was correctly done by 68% of experts and 48% of students. The three-way log-linear analysis produced a final model that retained the expertise level x rank-order interaction, χ^2 (1) = 4.98, p = .026. The likelihood ratio of this model was χ^2 (8) = 2.01, p = .98. The odds ratio indicates that over all three thought conditions the real-estate agents were 2.31 times better in recognizing the least attractive house. The data suggest that expertise effects were particularly strong for the deliberate thought condition, the real-estate agents being 3.50 times more correct than the students. This was confirmed by a significant association between expertise and rank-order for this condition, χ^2 (1) = 3.64, p = .029 (one-sided), and no significant associations for the other conditions.

Difference Scores

Analysis of the difference scores revealed a significant effect of expertise, F(1, 114) = 8.56, p = .004, r = .26, a non-significant effect of condition, F(2, 114) = .940, p = .39, and a non-significant interaction, F(2, 114) = 1.02, p = .36. Thus, in all three conditions the real-estate agents were better able to differentiate between the attractive and the unattractive house (M = 40.02, SD = 33.20) than the students (M = 19.72, SD = 42.26). Similar as in Problem 1 this was due to a more negative evaluation of the unattractive house by the real-estate agents.

Problem 3

The paradigm used for Problem 3 deviated slightly from the paradigm used in Problems 1 and 2. Besides rank-ordering and evaluating after processing the four houses, participants evaluated each house directly after its presentation. This task was added as we thought participants would immediately have an impression of each house. Only measuring them after all information of the four houses was processed might distort these first impressions. As Newell et al. (2009) outlined, the discrete and sequential presentation of attributes makes it an on-line judgment task in which impressions are continuously updated. Therefore, we expected that the immediate judgments might better grasp the advantage experts have in processing familiar information. We hypothesized that experts would perform better than students in these initial evaluations, and would be able to make better choices through the strengthening of their immediate impressions.

Method Specification

The distribution of positive and negative house attributes over alternatives was similar as in Problem 1. In addition to the instruction to form a good impression of the houses and to choose one of them later, in this problem, they were also told that they would be asked to evaluate each house immediately after its attributes were presented. So after the presentation of the 12 attributes of a house they indicated their judgment on a VAS-scale. Condition instructions were provided after the evaluation of the fourth house.

The evaluation and difference scores in the initial and final evaluation conditions were compared by GLM repeated measures.

Results

Decision Quality

The percentage of correct rank-orders was 57% for experts, and 47% for students. The loglinear analysis of the rank-order data revealed a final model that retained the mode of thought × rank-order interaction, χ^2 (2) = 6.15, p = .046. The likelihood ratio of this model was, χ^2 (6) = 4.26, p = .64. The data showed that participants performed worse in the unconscious condition. Odds ratios indicated that participants made a correct rank-order 3.10 times more often in the immediate than in the unconscious thought condition, 1.84 times more often in the deliberate than in the unconscious thought condition, and 1.68 times more often in the immediate than in the deliberate thought condition. The last effect seemed to be mainly due to the experts who performed best in the immediate thought condition, which was confirmed by a significant association between expertise and rank-order for this condition, χ^2 (2) = 4.00, p = .047. Separate chi-square tests for the two expertise groups showed that the association between mode of thought and rank-order was only significant for the real-estate agents, χ^2 (2) = 7.06, p = .029, but not for the students, χ^2 (2) = 1.74, p = .42.

Difference Scores

Analysis of the difference scores derived from the initial evaluations revealed an effect of level of expertise, F(1, 114) = 5.19, p = .025, r = .21, indicating better differentiation between the attractive and unattractive house by the real-estate agents (M = 66.03, SD = 23.32) than by the students (M = 56.78, SD = 21.10). Although evaluation results suggest that the difference score in the final evaluation was larger for the real-estate agents (M = 54.72, SD = 36.41) than for the students (M = 44.29, SD = 31.73), this effect was non-significant, F(1, 114) = 2.85, p = .094, r = .16. This can be explained by less extreme judgments in the final evaluation task compared to the initial judgments, as described in the attitude order section.

For both the initial and final evaluations there was no significant effect of thought condition, (F(2, 114) = 1.01, p = .37, and F(2, 114) = 1.68, p = .19, respectively, and no significant interaction effect, (F(2, 114) = 1.01, p = .37, F(2, 114) = 1.14, p = .24.

Discussion

This study was performed to examine expertise effects on immediate, deliberate, and unconscious thought in a choice and evaluation task. The results of all three problems in our within-subject design experiment showed that expertise positively affected the decisions made. However, we did not find support for the deliberation-without-attention hypothesis (Dijksterhuis et al., 2006). We did not replicate the findings that thinking which proceeds unconsciously while performing another task leads to better decisions as compared to either immediate or deliberate thought conditions (Dijksterhuis, 2004). There was no difference in either expert or student groups. This corroborates the results of other studies on this phenomenon (Acker, 2008; Newell et al., 2009; Payne et al., 2008) and questions the generalizability of Dijksterhuis' findings.

Moreover, in problems 1 and 2 we found that experts benefited from deliberate thought as compared to students. In problems 1 and 3, we further found that experts made better decisions in the immediate than in the unconscious thought condition. These findings support our hypothesis on the usefulness of immediate and deliberate thinking for experts in complex problems.

One key theoretical implication of the present study is the confirmation of the value of expertise and deliberative thinking (Ericsson, 2005). Results converge with other research and remind us that it is often better to ask for advice of an expert rather than to leave decision making to the unconscious. Deliberation might be valuable to explore one's own preferences and is needed to acquire expertise in a field. Thinking might make a complex problem simpler.

With regard to the present study, we could check whether the normative approach chosen led to the same best options as would be indicated by weighing of attributes in a WADD procedure (Newell et al., 2009). For each problem, however, ranking of options based on evaluation scores was similar to the normative order, which showed that the stimulus materials were meaningful for participants. The experimental tasks could have been more realistic to fully grasp expertise, but this would have hampered replication. The within-subject design did not lead to carry-over effects between problems, as similar results were found in analyzing the problems that were presented first. The extreme scores given by the experts in evaluating the unattractive alternatives is an interesting phenomenon to be followed up. The difference in results of rank-ordering and evaluations suggests that rank-orders are stricter and possibly better indicators of right choice behavior.

In further research on the cognitive processes underlying decision making, manipulating expertise and task complexity might be a fruitful approach. This may shed new light on the interactive contributions of immediate, intuitive and controlled, deliberate thinking (Kahneman, 2003). The use of representative tasks that require the application of relevant domain knowledge then is particularly important.

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