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Are complex decisions better left to the unconscious? Further failed replications of the deliberation-without-attention effect

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Abstract

The deliberation-without-attention effect occurs when better decisions are made when people experience a period of distraction before a decision than when they make decisions immediately or when they spend time reflecting on the alternatives. This effect has been explained (e.g., Dijksterhuis, 2004) by the claim that people engage in unconscious deliberation when distracted and that unconscious thought is better suited for complex decisions than conscious thought. Experiments 1, 2A, and 2B in this study included a dominant alternative and failed to find evidence for this effect. Experiment 3 removed the dominant alternative and manipulated mode of thought within-subjects to eliminate alternative explanations for the failed replication. In all experiments participants did not make better decisions after unconscious thought; decisions were consistently better than chance when made immediately after the encoding of information. Encouraging people not to think about complex decisions appears to be unwarranted.

Keywords: decision making, conscious thought, unconscious thought.

1 Introduction

When making a complex decision such as which car to purchase, should one take time to carefully consider information about each alternative or should one review the information, stop thinking about it, and wait for the best alternative to become known? A benchmark prescriptive model of decision making, the weighted additive (WADD) strategy (e.g., Edwards & Newman, 2003), suggests several steps in making complex decisions: 1) list important attributes, 2) weigh each attribute, 3) assess alternatives on all attributes, 4) multiply alternatives' scores on each attribute with that attribute's weight, 5) sum the products for each alternative, and 6) select the alternative with the greatest sum. Unconscious Thought Theory (UTT, Dijksterhuis & Nordgren, 2006) proposes that conscious thought is incapable of following these steps in complex decisions because of its capacity limitations, but that unconscious thought is able to reach conclusions that are similar to the prescriptions of WADD. Therefore, UTT claims that for complex decisions it is best to encode all of the necessary information and then stop consciously thinking about the alternatives and let the unconscious arrive at a decision.

Evidence for UTT's claim comes from a series of studies by Dijksterhuis and colleagues. In these studies, participants are given positive and negative attributes of a few alternatives. All alternatives have the same number of attributes, but one alternative has the most positive attributes and one has the fewest positive attributes. These are designated as the best and worst alternatives, respectively. After the information is presented, some participants are instructed to carefully consider the information that had been presented for a specified duration before deciding which alternative is the best. Other participants are distracted (e.g., by completing anagrams) for the same duration before making decisions and, in some experiments, another group makes decisions immediately after the presentation of the attributes. These three groups are referred to as the conscious thought, unconscious thought, and immediate groups, respectively.

People are generally more likely to select the best alternative after unconscious thought than when these decisions and judgments are made immediately or after conscious thought (e.g., Dijksterhuis, 2004). This finding is referred to as the *deliberation-without-attention effect*. The deliberation-without-attention effect has been demonstrated with complex (e.g., 12 attributes per alternative), but not simple (e.g., 4 attributes per alternatives) decisions (Dijksterhuis, Bos, Nordgren, & van Baaren, 2006). This effect occurs only when participants are informed that they will be making a decision or judgment after some duration and not when they are given information with no goal (Bos, Dijksterhuis, & van Baaren, 2008). Furthermore, this effect disappears when par-

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ticipants are primed to think of themselves as powerful (Smith, Dijksterhuis, & Wigboldus, 2008). Dijksterhuis and colleagues have also suggested that many decisions are made unconsciously (Dijksterhuis, Smith, van Baaren, & Wigboldus, 2005, but see Simonson, 2005) and found evidence that people are more satisfied with decisions made after a period of unconscious thought (Dijksterhuis & van Olden, 2006).

Because of the importance of the implications of these findings (e.g., that people should stop consciously deliberating complex decisions), others have attempted to replicate the deliberation-without-attention effect but found little supporting evidence. Several studies have employed methods similar to Dijksterhuis (2004) or Dijksterhuis et al. (2006) and failed to find an advantage of unconscious thought (Acker, 2008; Newell, Wong, Cheung, & Rakow, 2009; Rey, Goldstein, & Perruchet, 2009; Thorsteinson & Withrow, 2009). Payne, Samper, Bettman, and Luce (2008) allowed some participants to consciously deliberate for as long as they needed and found that judgments made after self-paced conscious thought led to judgments at least as good as (and sometimes better than) judgments made after a period of unconscious thought. Runnion (2009) asked participants to form an impression of four cars after the acquisition phase and found that those in the unconscious condition did not form better memory-based judgments of the best car than conscious deliberators. Furthermore, Gonzales-Vallejo, Lassiter, Bellezza, and Lindberg (2008) criticized UTT for being inconsistent with findings in social and cognitive psychology and concluded clear evidence for the deliberation-without-attention effect is lacking because of problems with the Dijksterhuis method.

One criticism of the Dijksterhuis method concerns the definition of the normatively best alternative (Gonzales-Vallejo et al., 2008; Newell et al., 2009). Dijksterhuis (2004) claims that the alternative with the most positive (and fewest negative) attributes is the best choice. To illustrate the problem with this definition, consider the following example: Suppose one is deciding between two cars, each with three known attributes. Car A has cupholders and a sunroof, but gets poor gas mileage, while Car B has no cupholders or sunroof, but gets good gas mileage. Car A has two positive and one negative attribute and Car B has one positive and two negative attributes. According to Dijksterhuis' definition of normativity, one should choose Car A. However, a person who weighs gas mileage more than the sum of the weights for cupholders and sunroofs should select Car B over Car A.

Because the weighing of attributes is idiosyncratic, when positive and negative attributes vary between alternatives, it is difficult to know which alternative one ought to select. Acker (2008) and Newell et al. (2009) asked participants which attributes were important for their decisions so that normativity could be determined on an individual basis. To avoid the problems of attribute weighing, Gonzales-Vallejo et al. (2008) tested for the deliberation-without-attention effect using a dominant alternative. One alternative dominates another if it is better on at least one attribute and at least as good on every other attribute. For example, if what is good about Car A is also present in Car B, but Car B also has at least one positive attribute not possessed by Car A, then Car B dominates Car A. No matter how a person weighs attributes, it is irrational to select (or judge as better) a dominated alternative (e.g., Kahneman & Tversky, 1984; Mellers, Weiss, & Birnbaum, 1992). Gonzales-Vallejo et al. (2008) found that, after a period of distraction, participants could not select the dominant alternative more often than chance. However, all participants engaged in unconscious thought so performance could not be compared to immediate decisions or those after a period of conscious thought.

Despite the failed replications of the deliberation-without-attention effect, further tests are warranted. Recent meta-analyses have reported mean effect sizes of g = .251 in favor of unconscious thought when compared to conscious thought (Acker, 2008) and g = .402 in favor of unconscious thought when compared to both conscious thought and immediate judgments and decisions (Strick et al., 2009). New findings continue to be published showing an advantage of unconscious thought over conscious thought. For example, Dijksterhuis, Bos, van der Leij, and van Baaren (2009) found that soccer experts are better at predicting the outcome of soccer matches after a period of unconscious thought than they are when making predictions immediately or after a period of conscious deliberation. Furthermore, UTT and supporting findings have influenced theories in applied areas such as job design (George, in press). It is imperative that UTT continue to be tested and supporting results continue to be replicated.

In the current set of experiments, participants were given four alternatives, one of which dominated the others (except in Experiment 3). Experiment 1 compared simple and complex decisions made by participants after conscious and unconscious thought. In Experiments 2A, 2B, and 3 participants judged the four alternatives after receiving attributes of each. The difference between judgments of the best and worst alternatives for participants who engaged in unconscious thought was compared with those of participants who engaged in conscious thought (Experiments 2A and 2B) and those who made immediate judgments (Experiments 2A, 2B, and 3). UTT predicts that participants who engage in unconscious thought will select the best car more often than chance and more often than those who engage in conscious thought (Experiment 1). Furthermore, participants who engage in unconscious thought will rate the best car significantly higher

than the worst car, and this difference will be greater than the difference for those who engage in conscious thought (Experiments 2A and 2B) or make immediate judgments (Experiments 2A, 2B, and 3).

Order of alternatives was also examined in Experiment 1 (alternatives were not blocked in Experiments 2A, 2B, and 3). Newell et al. (2009) suggest that if impressions about alternatives are formed during the presentation of attributes, there should be a recency effect: information presented later should have a greater impact on decisions than information presented earlier. This suggests that when the best alternative is presented last, participants would be more likely to select it than when it is presented earlier in the sequence of alternatives.[1]

Table 1: Percentage of participants choosing the best, the worst, and the two mediocre cars in Experiment 1 (number of participants in brackets).

	Car Chosen		
	Best (9+)	Mediocre (6+)	Worst (3+)
Simple			
Conscious	65 [13]	30 [6]	5 [1]
Unconscious	80 [16]	15 [3]	5 [1]
Complex			
Conscious	90 [18]	5 [1]	5 [1]
Unconscious	80 [16]	20 [4]	0 [0]

2 Experiment 1

2.1 Method

Participants and design. Eighty participants from California State University San Marcos participated as a partial fulfillment of a research requirement in an undergraduate psychology course. There were 57 females and 23 males and they ranged in age from 18 to 51 years (M = 20.46, SD = 4.12). This experiment employed a 2 (Mode of Thought: conscious, unconscious) x 2 (Complexity: simple, complex) between-subjects factorial design. The dependent variable was the car selected by each participant.

Materials and procedure. Eight sets of attributes of four fictitious cars' attributes were used. The cars (Dasuka, Hatsdun, Kaiwa, and Nabusi) and attributes were taken from Dijksterhuis et al. (2006; retrieved from www.sciencemag.org/cgi/data/311/5763/1005/DC1/1). Four of the sets were created for simple decisions, containing four attributes per car. Each of these four sets contained one car with three positive and one negative attribute (the best car), two cars with two positive and two negative attributes (the mediocre cars), and one car with one positive and three negative attributes (the worst car). The attributes were selected so that the best car dominated the other three and the two mediocre cars dominated the worst car. The four simple sets varied by which car received the most positive attributes, so that the Dasuka, Hatsdun, Kaiwa, and Nabusi were each the best car for an equal number of participants. The other four sets were created for complex decisions, containing 12 attributes per car. The best car in each set had nine positive and three negative attributes, the two mediocre cars had six positive and six negative attributes, and the worst car had three positive and nine negative attributes. As with the simple sets, the best car dominated the others, the worst car was dominated by the others, and the four complex sets varied by which car was the best for an equal number of participants.

Of the 80 participants, 20 were assigned to each Mode of Thought-Complexity condition. Data were collected from participants individually or with one other participant in the same experimental condition. Participants were presented with cars' attributes via computer at a rate of one attribute every eight seconds. All participants received the attributes for the Dasuka first, then the Hatsdun, Kaiwa, and the Nabusi. After the final attribute, participants in the conscious conditions were asked to think for four minutes about the information they had just seen and then asked to select the car that they thought was the best. In the unconscious conditions, they were given difficult problems to solve for four minutes and then they selected the best car. These problems were taken from an online intelligence test.[2] In both conditions, participants were informed that they would be making a decision after the four minutes had elapsed.

2.2 Results

Each participant selected one car as the best. The percentages of participants who chose the best car, the worst car, and the two mediocre cars are presented in Table 1. UTT predicts that participants in the unconscious-complex condition will select the best car more often than those in the conscious-complex condition and that participants in the conscious-simple condition will select the best car more often than those in the unconscious-simple condition. Overall, participants selected the best car more

[1] Newell et al. (2009) predicted and found a slightly different recency effect: when an alternative has more positive attributes presented toward the end of the series, it is judged more favorably than negative attributes are presented toward the end. The materials in the current study do not allow to test for this kind of recency effect.

[2] http://www.mensa.org/workout2.php, at the time of the study.

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than the other cars [$\chi^2(2, N = 80) = 123.8, p < .001$]. For complex decisions, participants who engaged in conscious thought were no more likely to select the best car than those who engaged in unconscious thought [$\chi^2(1, N = 40) = 0.78, p = .38$].[3] The same was true for simple decisions [$\chi^2(1, N = 40) = 1.13, p = .29$].

The effect of alternative order was also examined. When the best car was presented first, 17 out of the 20 participants selected it; when it was second, 12 of those 20 participants selected it; when it was third, 19 out of 20 participants selected it; and when it was last, 15 out of the 20 participants selected it. Overall, order was related to the selection of the best car [$\chi^2(3, N = 80) = 8.00, p = .046$], but the data did not show a recency effect.

2.3 Discussion

Participants selected the best car at a frequency greater than chance, but this occurred at similar frequencies for complex and simple decisions and for unconscious and conscious thinkers. These results conflict with Dijksterhuis et al.'s (2006) finding that for simple decisions conscious thinkers perform better than unconscious thinkers, but for complex decisions unconscious thinkers perform better than conscious thinkers. The small differences that existed in Experiment 1 were in the opposite direction of those reported by Dijksterhuis et al. Unlike the results reported in Gonzales-Vallejo et al. (2008), unconscious thinkers making complex decisions were able to select the dominant alternative more often than chance, but, as in other studies (Acker, 2008; Newell et al., 2009; Thorsteinson & Withrow, 2009), they were no better at doing this than conscious thinkers. However, performance was quite high in all conditions, suggesting that there may be a ceiling effect masking these differences. In Experiments 2A and 2B, the task was made more difficult.

3 Experiment 2A

Experiment 2A was designed based on the results of Acker's (2008) meta-analysis. After reviewing 17 studies comparing decisions made after conscious and unconscious thought, Acker concluded that there is an advantage of unconscious over conscious thought, but that this effect varies considerably from study to study. He also identified some variables that lead to a greater advantage of unconscious thought (most of these were trends not reaching statistical significance): shorter attribute presentation time lead to a greater advantage of unconscious thought and shorter thought intervals lead to a greater advantage of unconscious thought.

Experiment 2A differed from Experiment 1 in several aspects: 1) participants made only complex decisions, since UTT predicts that unconscious thought is better than conscious thought only with complex decisions; 2) information was presented for two seconds per attribute rather than eight seconds per attribute; 3) the thought interval was reduced from four minutes to three minutes; 4) the attributes of the four alternatives were presented in a random order rather than being blocked by car; 5) a group of immediate deciders was included; 6) participants judged all four cars rather than selecting one of them; and 7) participants in the unconscious condition solved anagrams rather than difficult problems. In sum, Experiment 2A was designed to maximize the benefits of unconscious thought. The immediate deciders were included to test the possibility that judgments are made while the information is being presented (i.e., on-line) rather than after deliberation. The task was changed because the judgment task is more sensitive than the decision task, and the distracter task was changed to be more similar to the one used by Dijksterhuis (2004).

3.1 Method

Participants and design. Sixty students participated from the same participant pool as Experiment 1. There were 45 females and 15 males, ranging in age from 18 to 48 years ($M = 21.53$, $SD = 5.21$). This experiment employed a multi-group design. The independent variable (Mode of Thought: immediate, conscious, unconscious) was manipulated between-subjects and the dependent variable was the difference in ratings of the best and worst cars for each participant.

Materials and procedure. The materials consisted of one of the four complex sets of attributes from Experiment 1. For all participants, the Nabusi was the best car (i.e., it dominated the others), the Dasuka and Kaiwa were mediocre, and the Hatsdun was the worst car (i.e., it was dominated by the others). Twenty participants (15 females and 5 males[4]) were assigned to each Mode of Thought condition. The procedure differed from that of

[3] Based on the previously reported effect sizes and the observed sample sizes, the power to detect a difference between unconscious and conscious thought in complex decisions (with $\alpha = .05$) in Experiment 1 was .20 one-tailed, .12 two tailed (with $\alpha = .10$, power was .30 one-tailed, .20 two-tailed), based on effects reported in Experiment 2 of Dijksterhuis (2004). Based on the effects reported in Experiment 1 of Dijksterhuis (2004), this power (with $\alpha = .05$) was .40 one-tailed, .29 two-tailed (with $\alpha = .10$, power was .55 one-tailed, .40 two-tailed) in Experiments 2A and 2B of the current study; and in Experiment 3 this power (with $\alpha = .05$) was .39 one-tailed, .28 to-tailed (with $\alpha = .10$, power was .53 one-tailed, .39 two-tailed). All observed effects were in the opposite direction of the predictions based on Dijksterhuis (2004).

[4] Gender ratio was held constant in both conditions. Dijksterhuis (2004) found a Gender x Mode of Thought interaction in his first experiment. However, Acker's (2008) meta-analysis showed that gender was a poor predictor of effect size.

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Table 2: Mean ratings of the four cars in Experiments 2A and 2B (SD in parentheses).

	Car			
	Nabusi (9+)	Dasuka (6+)	Kaiwa (6+)	Hatsdun (3+)
Experiment 2A				
Immediate	7.00 (2.32)	5.05 (1.82)	4.95 (1.99)	4.90 (1.59)
Conscious	7.00 (2.00)	6.20 (2.14)	5.65 (2.30)	5.25 (1.97)
Unconscious	6.85 (3.00)	5.35 (1.84)	4.35 (1.87)	5.40 (2.09)
Experiment 2B				
Immediate	6.50 (2.14)	5.35 (1.76)	5.25 (1.71)	4.75 (1.77)
Conscious	5.80 (1.91)	5.35 (1.87)	5.65 (1.69)	5.05 (2.19)
Unconscious	5.65 (2.16)	5.55 (2.21)	5.35 (2.23)	5.15 (1.87)

Experiment 1 in two ways. Attributes were presented at a rate of one attribute every two seconds and the attributes of all four cars were presented in a random order. After the final attribute, participants in the immediate condition judged the four cars. Participants in the conscious condition were asked to think about the information for three minutes before making judgments, while participants in the unconscious condition were given anagrams to solve for three minutes before making judgments. All judgments were made on a 10-point scale, with 10 being the highest rating. The order of the cars on the judgment sheet was counterbalanced so that each car appeared first, second, third, and fourth an equal number of times.

3.2 Results

Participants provided judgments of four cars. The mean ratings of the four cars are presented in Table 2. To determine if participants are considering car's attributes when making judgments, each participant's judgment of the worst car was subtracted from the judgment of the best car. UTT predicts that participants in the unconscious condition will judge the best car higher than the worst car and that the difference in the judgments of the best and worst car will be greater in the unconscious condition than in the immediate and conscious conditions. Across all participants, the difference between judgments of the best and worst cars (M = 1.77, SD = 3.01) was significantly greater than zero [$t(59) = 4.55$, $p < .001$, d = .59]. The difference between the best and worst cars was also compared to zero for each Mode of Thought. In the immediate (M = 2.10, SD = 2.45) and conscious (M = 1.75, SD = 2.69) conditions, the difference was greater than zero [$t(19) = 3.84$, p = .001, d = .86; $t(19) = 2.91$, p = .009, d = .65, respectively], while in the unconscious condition (M = 1.45, SD = 3.83), it was not [$t(19) = 1.69$, p = .107, d = .38]. However, an ANOVA showed that the mean difference between judgments of the best and worst car in the three conditions did not differ from one another [$F(2, 57) = .23$, p = .78, η^2 = .01].

An ANOVA that compared the ratings of all four cars by mode of thought was also conducted, which showed that ratings differed among the four cars [$F(3, 171) = 11.17$, $p < .001$, η^2 = .16]. Post hoc analyses (Bonferroni) revealed that ratings of the Nabusi were higher than the other three cars (all $p < .001$), and no other pairwise comparisons were significant. Mode of thought did not have an effect on ratings, and these two factors did not interact.

3.3 Discussion

Overall, participants' judgments of the dominant car were better than their judgments of the worst car. However, this occurred only for the conscious thought and the immediate groups and not for the unconscious thought group. This is the exact opposite of what is predicted by UTT and of what was found by Dijksterhuis and colleagues (Bos et al., 2008; Dijksterhuis, 2004; Dijksterhuis et al., 2006). The inability of participants to judge the dominant alternative higher than the worst alternative after unconscious thought was similar to what was reported by Gonzales-Vallejo et al. (2008) with a decision task.

Experiment 2A was designed to maximize the advantages of unconscious thought, yet did not find any evidence for its superiority over immediate judgments or those made after conscious thought. The finding that only judgments after unconscious thought show no difference between the best and worst alternatives is problematic for UTT.

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4 Experiment 2B

Experiment 2B differed from Experiment 2A in one aspect: participants received all of the information about the four cars simultaneously rather than serially. Acker's (2008) meta-analysis showed that the advantages of unconscious thought are greater when information is presented simultaneously than when it is presented serially. Taken with the steps included in Experiment 2A, Experiment 2B was designed to be the optimal situation for unconscious thought.

4.1 Method

Participants and design. Sixty participants from the same participant pool as Experiments 1 and 2A were included in Experiment 2B. There were 45 females and 15 males, ranging in age from 18 to 58 years (M = 22.20, SD = 7.11). The design was identical to that of Experiment 2A.

Materials and procedure. The materials were identical to those in Experiment 2A, while the procedure differed in one aspect. Rather than being presented with the 48 attributes serially at a rate of one every two seconds, participants were given all 48 attributes simultaneously for 96 seconds. The attributes were listed on the screen in the same random order as they appeared serially in Experiment 2A.

4.2 Results

Participants provided judgments of four cars. The mean ratings of the four cars are presented in Table 2. The differences between participants' judgments of the best and worst cars were computed. Again, UTT predicts this difference will be greater than zero in the unconscious condition and will be greater in the unconscious condition than in the immediate and conscious conditions. Across all participants, the difference between judgment of the best and worst cars (M = 1.00, SD = 2.58) was significantly greater than zero [$t(59) = 3.00$, $p = .004$, $d = .39$]. The difference was significant in the immediate condition (M = 1.75, SD = 2.10) [$t(19) = 3.73$, $p = .001$, $d = .83$], but not in the conscious (M = 0.75, SD = 3.24) or unconscious (M = .50, SD = 2.21) conditions [$t(19) = 1.03$, $p = .314$, $d = .23$; $t(19) = 1.01$, $p = .325$, $d = .23$, respectively]. However, an ANOVA revealed that Mode of Thought did not have an effect on the difference between judgments of the best and worst cars [$F(2, 57) = 1.33$, $p = .274$, $\eta^2 = .04$].

Another ANOVA examined ratings of all cars by mode of thought. Ratings differed by car [$F(3, 171) = 3.60$, $p = .015$, $\eta^2 = .06$], with post hoc analyses (Bonferroni) showing that the only significant pairwise comparison was between the ratings of the Hatsdun and Nabusi ($p = .023$). Mode of thought did not have an effect on ratings and there was no interaction between these two factors.

4.3 Discussion

As in Experiment 2A, across all conditions, participants were able to distinguish the best and worst car in their judgments of these. Also similar to Experiment 2A, participants made this distinction in the immediate group, but not in the unconscious group. One difference from Experiment 2A is that in Experiment 2B participants in the conscious group did not make this distinction. The results are again problematic for UTT and inconsistent with those reported by Dijksterhuis and colleagues (Bos et al., 2008; Dijksterhuis, 2004; Dijsterhuis et al., 2006).

5 Experiment 3

One possible explanation for why the deliberation-without-attention effect has not replicated with dominant alternatives is that the decision becomes simple when there is dominance. If three attributes are positive in every alternative and three are negative, the alternatives vary on only six attributes. Dijksterhuis et al. (2006) found that unconscious deliberation is beneficial only with complex decisions, so perhaps the failure to find evidence for the superiority of unconscious deliberation is due to the simplicity created by the dominance of alternatives. However, performance was not at ceiling in Experiments 2A and 2B, so this was probably not the case. Another (albeit unlikely) possible explanation is that the random assignment of participants to conditions has resulted in poor judges being assigned to the unconscious conditions in the previous experiments.

To test these explanations, participants in Experiment 3 were given four sets of judgments, each with four alternatives, none of which dominated any others. Two sets of judgments (one simple and one complex) were made immediately after the presentation of the attributes, and two sets (one simple and one complex) were made after a period of distraction. The conscious deliberation condition was excluded from Experiment 3 since the largest differences in Experiments 2A and 2B were observed between the immediate and unconscious conditions. If the deliberation-without-attention effect is not found, it cannot be attributed to the inclusion of dominant alternatives simplifying the decisions or to confounding variables related to the assignment of participants to conditions.

5.1 Method

Participants and design. Thirty-eight students from an undergraduate cognitive psychology laboratory course

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participated in Experiment 3. There were 11 males and 27 females with a mean age of 25.21 years (SD = 6.05 years). The experiment employed a 2 (Mode of Thought: immediate, unconscious) x 2 (Complexity: simple, complex) within-subjects factorial design. The dependent variable was the difference between the judgment of the best and worst alternatives.

Materials and procedure. Four sets of attributes were used, each set with four alternatives. Two sets (jobs and roommates) were for simple judgments, containing four attributes per alternative, while the other two sets (cars and apartments) were for complex judgments, containing twelve attributes per alternative. For each set, one alternative had 75% positive attributes and 25% negative, two had 50% positive and 50% negative, and one had 25% positive and 75% negative attributes. The positive and negative attributes were randomly determined for each alternative and no alternative dominated another. Attributes for all four alternatives in a set were randomized and presented to participants at a rate of one attribute every two seconds.

All participants made four sets of judgments, each containing judgments of four alternatives, on a scale from 1–10. One simple and one complex judgment were made immediately after the presentation of attributes, while the other two judgments were made after three minutes of solving anagrams. Half of the participants (n = 19) made the simple-immediate judgment first, followed by the simple-unconscious, complex-immediate, and complex-unconscious judgments. The other half made the complex-unconscious judgments first, followed by the simple-immediate, simple-unconscious, and complex-immediate judgments. Furthermore, the best and worst alternatives were determined randomly for each half of the participants (e.g., Apartment A might have been the best and D the worst for half of the participants, but Apartment C was the best and B the worst for the other half).

5.2 Results

The difference between the best and worst alternatives was computed for each participant's judgments. Across all decisions, this difference (M = 1.92, SD = 1.19) was significantly greater than zero [$t(37) = 9.97$, $p < .001$, d = 1.61]. UTT predicts that this difference in judgments will be greatest in the complex-unconscious condition (since people are good at making complex judgments after a period of unconscious deliberation). This difference (all condition means are presented in Table 3) was significant in the simple-immediate condition [$t(37) = 6.89$, $p < .001$, $d = 1.12$], the simple-unconscious condition [$t(37) = 6.87$, $p < .001$, $d = 1.13$], and the complex-immediate condition [$t(37)$ = 4.58, p < .001, d = .74], but not the complex-unconscious condition [$t(37)$ = 1.68, p = .101, d = .27]. An ANOVA revealed that complexity had an effect on the differences in ratings between best and worst [$F(1, 37) = 18.42$, $p < .001$, $\eta^2 = .33$], with simple judgments (M = 2.62, SD 1.44) resulting in a greater difference than complex judgments (M = 1.24, SD = 1.65). The effect of mode of thought did not reach significance [$F(1, 37)$ = 1.52, p = .226, η^2 = .04] and it did not interact with complexity [$F(1, 37) = 1.94$, $p = .172$, $\eta^2 = .05$].

Table 3: Mean difference between ratings of the best and worst alternatives in Experiment 3 (SD in parentheses).

	Complexity	
	Simple	Complex
Immediate	2.58 (2.31)	1.79 (2.41)
Unconscious	2.66 (2.39)	0.68 (2.51)

Simple effects tests were conducted to test additional predictions of UTT. UTT predicts that 1) when judgments are complex, unconsciously deliberated judgments will be better than immediate judgments, and 2) when judgments are made after unconscious deliberation, they will be better when they are complex than when they are simple. Neither of these predictions was supported. The difference between complex-immediate and complex-unconscious was marginally significant in the opposite of the predicted direction [$t(37) = 1.87$, p = .069, d = .33] and the difference between simple-unconscious and complex-unconscious was significant in the opposite direction [$t(37) = 3.42$, p = .002, d = .55].

5.3 Discussion

As in Experiments 2A and 2B, participants were able to distinguish the best and worst alternatives in their judgments. This distinction occurred in every condition except when complex judgments were made after a period of unconscious deliberation. This is the exact condition predicted by UTT to result in a large difference between the best and worst alternative. None of UTT's predictions was supported in Experiment 3. The results are again problematic for UTT and inconsistent with those reported by Dijksterhuis and colleagues.

6 General discussion

UTT claims that people are better at making complex decisions after a period of distraction than after a period of conscious thought, a finding known as the deliberation-without-attention effect. The experiments reported here

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found no evidence for this effect, even in situations designed to maximize the benefits of unconscious thought. In all experiments, people were no better after unconscious thought than after conscious thought. Furthermore, in Experiments 2A, 2B, and 3 unconscious thinkers were unable to distinguish between the best and worst alternatives in a complex set, while immediate deciders were able to do this. (Conscious thinkers were able in Experiment 2A, but not Experiment 2B.) These findings cannot be explained by UTT.

The difference between the first set of experiments in the current study and Dijksterhuis' experiments (e.g., Dijksterhuis, 2004) is the inclusion of a dominant alternative. Dijksterhuis defined the normatively best alternative as the one with the most positive attributes, ignoring the possibility that some attributes are more important than others. The present experiments included a dominant alternative which was better than the other alternatives no matter how participants weighed the attributes and even if they followed more simple strategies than WADD, such as Dawes' rule (Dawes, 1979) or the Take the Best heuristic (Gigerenzer & Goldstein, 1999). Unconscious thought should result in better judgments in complex sets of information. It is possible that the dominant alternative simplified the judgment task, but this is an unlikely explanation for the lack of a deliberation-without-attention effect since performance was not at ceiling in two of the experiments employing a dominant alternative (Experiments 2A and 2B), and no evidence was found for this effect in Experiment 3, which did not include a dominant alternative.

The results of the present study suggest that some decisions might be better made without any deliberation. Only immediate deciders performed consistently better than chance. Because of the manner in which attributes are presented, it is likely that participants were forming judgments "on-line" as they received the attributes, so that deliberation was not necessary and, perhaps, even detrimental. Hastie and Park (1986) made this distinction between on-line judgments and those made from memory and claimed that on-line judgments are more common than those from memory. Judgments made from memory should benefit from deliberation, while those made on-line should not. Data from the present study are consistent with the notion that the Dijksterhuis paradigm results in judgments being made on-line. Participants appear to process each attribute as it is presented and update their attitude toward that alternative. Others have reported similar patterns and provided similar explanations (Lassiter, Lindberg, Gonzalez-Vallejo, Bellezza, & Phillips, 2009; Newell et al., 2009; Rey et al., 2009). If judgments are made on-line, the order of the alternatives should affect judgments, resulting in a recency effect. However, the effect of order in Experiment 1 was not in the direction of a recency effect. The results of the present study are consistent with evidence that quick, intuitive decisions are sometimes as good as or better than slower, more deliberate ones (e.g., Gigerenzer, 2007; Plessner, Betsch, & Betsch, 2008). The optimal mode of thought may depend on the nature of the decision task.

The deliberation-without-attention effect is similar to the incubation effect. A period of distraction sometimes benefits tasks such as problem solving (e.g., Goldman, Wolters, & Winograd, 1992, but see Olton & Johnson, 1976) and resolving tip-of-the tongue states (Choi & Smith, 2005). This has led to explanations of the incubation effect which claim that unconscious thought occurs while distracted (e.g., Dijksterhuis & Nordgren, 2006; Wallas, 1926). Most current explanations of the incubation effect, however, minimize the role of unconscious thought (e.g., Segal, 2004). Vul and Pashler (2007) warn against the notion that one should stop working on a problem in order to reach a solution more quickly. Likewise, Newell et al. (2009) warn against the notion that one should stop thinking about complex decisions in order to make better decisions. Data from the current experiments illustrate the importance of Newell et al.'s warning. While it might be possible to over-think a decision (e.g., Wilson & Schooler, 1991), advising against the conscious deliberation of alternatives appears to be an unwarranted suggestion based on the conflicting findings reported to date.

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