Judgment and Decision Making, Vol. 4, No. 3, April 2009, pp. 235–247

Does unconscious thought outperform conscious thought on complex decisions? A further examination

Todd J. Thorsteinson*
University of Idaho

Scott Withrow
Bowling Green State University

Abstract

Two experiments examined the benefits of unconscious thought on complex decisions (Dijksterhuis, 2004). Experiment 1 attempted to replicate and extend past research by examining the effect of providing reasons prior to rating the options. Results indicated no significant differences between the conditions. Experiment 2 attempted to replicate the findings of Dijksterhuis, Bos, Nordgren, and van Baaren (2006) and determine if a memory aid could overcome the limitations of conscious thought on complex tasks. Results revealed that a memory aid improved decisions compared to the conscious thought condition. Participants in the unconscious thought condition did not perform significantly better than did participants in the conscious thought condition.

Keywords: conscious thought, decision making, unconscious thought.

1 Introduction

Conventional wisdom indicates that we should think "hard" about our options when faced with a difficult decision. By devoting attention and conscious thought to a difficult decision, one can carefully consider and weigh the various options and choose the option that best matches one's goals. Wilson and Schooler (1991) challenged this assumption when they found that participants asked to think about their reasons for a decision made apparently worse decisions than participants who did not reflect on their reasons for a decision. Recent work (Dijksterhuis, 2004; Dijksterhuis, Bos, Nordgren, & van Baaren, 2006) has cast further doubt on the benefits of consciously thinking about one's decisions by demonstrating that consciously thinking about complex tasks (i.e., tasks which consist of numerous attributes that participants must weigh in order to determine the best option) can lead to poorer performance than unconscious thought. Some recent attempts to replicate this effect have been unsuccessful (Acker, 2008; Newell, Wong, Cheung, & Rakow, 2009; Rey, Goldstein, & Perruchet, 2009). This paper attempts to replicate the beneficial effects of unconscious thought on complex tasks found by Dijksterhuis and colleagues and to examine some conditions that may limit the effect.

*We would like to thank Tanya Carr, Claudia Mahler, and Rylan Clark for assistance with Study 1. Address all correspondence to Todd Thorsteinson, Department of Psychology and Communication Studies, P.O. Box 443043, University of Idaho, Moscow, ID 83844-3043. Email: tthorste@uidaho.edu.

1.1 Thinking too much

A growing body of literature has found evidence that thinking too much can have detrimental effects on decision making and satisfaction with decisions (e.g., Halberstadt & Levine, 1999; Wilson & LaFleur, 1995; Wilson & Schooler, 1991). Wilson and Schooler (1991) examined how thinking about the reasons for one's decision may affect judgments. They proposed that thinking about how one feels about an object leads one to focus on plausible and salient factors, which may not be the real factors behind one's feelings. For example, an individual may justify his or her selection of a car based on the car's high gas mileage, but the person's preference for the car may be due to the image the car conveys (e.g., the car is "sporty"). It may be easier to justify, to oneself and others, the purchase of a car based on gas mileage than on the image the car conveys. In addition, thinking about multiple attributes, as opposed to just a few attributes, may highlight the fact that each alternative has some positive and negative attributes and lead to more moderate evaluations than if one had concentrated on a smaller subset of attributes (Linville, 1982).

Wilson and Schooler (1991) provided evidence for the detrimental effects of thinking about reasons on judgments. In Study 1, participants asked to think about their reasons for liking or disliking different types of jam showed less correspondence of their judgments with experts than did control participants. In Study 2, control participants were more likely to recall important information about courses and were more likely to preregister for highly rated courses than participants asked to think

about their feelings toward the courses. Thinking about reasons for judgments or decisions may lead to judgments that depart from expert or consensual judgments.

The apparent detrimental effects of thinking about reasons are not limited to subjective judgments about the taste of jam or characteristics that are important in college courses. Halberstadt and Levine (1999) examined the effect of thinking about reasons on predicting the outcomes of basketball games. Participants who were asked to think about reasons for their judgments performed worse at predicting winners of college basketball games than those who were asked to make judgments based on intuition or their "gut."

These studies (e.g., Halberstadt & Levine, 1999; Wilson & Schooler, 1991) documented possible harmful effects of thinking about reasons for making judgments. However, thinking carefully about a judgment or decision does not require individuals to focus on reasons. Tordesillas and Chaiken (1999) point out that there are different types of introspection and it is important to understand what types of introspection have negative effects on judgments. For example, Wilson and Schooler (1991, Study 2) had two introspection conditions. In one condition, the reasons condition, participants were asked to think about the reasons for liking or disliking the various college courses. In the other condition, the "rate-all" condition, participants were asked to think about each piece of information and rate how influential it was on their decision. Although both the reasons condition and the rate-all condition had detrimental effects on judgment, the rate-all condition had a greater negative impact than the reasons condition.

1.2 Conscious and unconscious thought

Although previous research has suggested that certain types of introspection can have detrimental effects (e.g., thinking about reasons), Dijksterhuis (2004; Dijksterhuis et al., 2006) has found that conscious thought performs worse than unconscious thought for complex decisions. Conscious thought refers to "cognitive and/or affective task-relevant processes one is consciously aware of while attending to a task," whereas unconscious thought refers to "cognitive and/or affective task-relevant processes that take place outside conscious awareness" (Dijksterhuis, 2004, p. 586). The research by Dijksterhuis (2004; Dijksterhuis et al., 2006) suggests that thinking about one's options, even when not explicitly instructed to consider reasons for one's decision, can harm the quality of decisions on complex tasks.

In the initial demonstration of the detrimental effects of conscious thought, Dijksterhuis (2004) conducted a series of studies examining whether unconscious thought outperforms conscious thought on complex tasks. In the first three studies, which used similar methodology, participants were randomly assigned to one of three conditions, an immediate condition, a conscious thought condition, or an unconscious thought condition. Participants in the immediate condition made their judgments immediately after viewing all the attributes of the target objects (i.e., apartments or roommates). Conscious thought participants were asked to carefully think about the target objects for a brief period (3 minutes in Experiments 1 & 2 and 4 minutes in Experiment 3). Unconscious thought participants were given a distracting task to complete right after presentation of the attributes, for the same brief period as participants engaged in conscious thought (3 or 4 minutes). Although the task differed across the three experiments, each task was complex, involving the processing of a large amount of information (e.g., 48 pieces of information in Experiment 1). In each task, one of the target objects was created to reflect the best option (i.e., most of its attributes were positive) and one object reflected the worst option (i.e., most of its attributes were negative). One or two filler objects was included in each experiment, which had an approximately equal mix of positive and negative attributes. Participants in the unconscious thought condition showed greater differentiation between attractive and unattractive target objects (i.e., greater difference in attractiveness ratings between the attractive object and the unattractive object). In Experiments 4 and 5, Dijksterhuis (2004) examined possible explanations for the results and discovered that unconscious-thought participants' recognition of attributes appeared to be more polarized (i.e., greater recognition of positive attributes of best roommate and negative attributes of worst roommate) and showed greater clustering in memory (i.e., similar traits were more likely to be recalled in order).

Dijksterhuis and Nordgren (2006) proposed a theory of unconscious thought that specified why conscious thought may impair decision making when faced with a complex decision. According to their unconscious-thought theory, conscious thought performs worse on complex decisions because it has limited capacity, suboptimal weighting of attributes, and engages in top-down processing that relies on schemata and expectancies. Conscious thought has limited capacity in that we can only hold a small amount of information in our consciousness, whereas the unconscious is considerably larger. Conscious thought interferes with the correct weighting of attributes because it focuses on the most plausible and salient attributes, which are not always the attributes that determine people's judgments. Finally, conscious thought relies more on schemata and expectancies because of the reduced demands on consciousness. Conscious thought does perform well on simple tasks because it follows rules and is precise.

In order to directly test whether conscious thought performs better on simple tasks and unconscious thought performs better on complex tasks, Dijksterhuis et al. (2006) conducted a series of studies on what they called the "deliberation-without-attention" effect. In Study 1, conscious thought participants performed poorly on a complex task but well on a simple task. Unconscious thought participants performed equally well on simple and complex tasks. In Study 2, they replicated the effects of Study 1 but this time with ratings of four cars (target objects) instead of a choice among them. In Study 3, they found a positive relationship between satisfaction with purchases and amount of conscious processing for simple products and a negative relationship between satisfaction with purchases and amount of conscious processing for complex products. Finally, Study 4 was conducted in a naturalistic environment, where shoppers at a store with complex products were compared to shoppers at a store with less complex products. For those shoppers at the less complex product store, conscious thought and satisfaction with purchases was positively related, whereas these measures were negatively related for those shoppers at the complex products store. These studies provided strong evidence for the benefits of unconscious thought for complex decisions.

Other researchers, however, have had difficulty replicating the benefits of unconscious thought over conscious thought for complex decisions. Some have argued that further conscious processing may interfere with decision making, so that it is not unconscious thought that is beneficial, but that extended conscious processing is detrimental (Payne, Samper, Bettman, & Luce, 2008; Rey et al, 2009). Payne et al. (2008) proposed that requiring conscious processing for a fixed time might be detrimental because it provides too much time to think, causing decision makers to focus on attributes that are less important to the decision. They included a conscious thought condition that was self-paced; that is, participants were able to think consciously about the various options as long as they wished. They created two gambling tasks where participants selected a lottery from four choices. One choice maximized the chances of winning and another choice maximized the expected value of the gamble. In the first gambling task, the option with the highest probability of winning and the option with the highest expected value had very similar expected values. Results indicated that the self-paced conscious thought condition and the unconscious thought condition performed equally well in terms of choosing options with high expected value, and both conditions outperformed the conscious thought condition. In the second gambling task, they included a tradeoff between the probability of winning and maximizing the expected value of the gamble, so that the option with the highest probability of winning did not have the highest expected value. Results indicated that the self-paced conscious thought condition outperformed both the conscious thought condition and the unconscious thought condition in terms of choosing options with the highest expected value. The findings were consistent with their hypotheses that unconscious thought is not good at taking into account magnitude and that conscious thought is detrimental when a fixed time is required.

Newell et al. (2009) also questioned whether unconscious thought would outperform conscious thought when making decisions about options with attributes of varying degrees of importance. They contrasted two rules, a weighted-additive model (WADD), where the valence of an attribute was weighted by its importance, with a simpler model where the option with the largest number of positive attributes is preferred (TALLY). Dijksterhuis and Nordgren (2006) proposed that unconscious thought is better than conscious thought at providing appropriate weights to attributes, but this was not tested in Dijksterhuis's (2004; Dijksterhuis et al., 2006) studies as they used the TALLY model to define the best option. Newell et al., in their first experiment, created a decision task involving four apartments similar to Dijksterhuis's (2004). They constructed the options so that the apartment with the largest number of positive attributes was not the "best" apartment based on the weighting of the attributes (WADD model; this apartment had fewer positive attributes, but the positive attributes were more important). The best apartment according to the WADD model was the most frequently chosen apartment for each condition. Participants in the unconscious thought condition performed similarly to participants in the conscious thought condition. The similarity in performance suggests that participants in the unconscious thought condition were sensitive to differences in magnitude of the apartments' attributes.

The purpose of our research was to replicate the findings of Dijksterhuis and colleagues regarding the benefits of unconscious thought over conscious thought on complex tasks and to explore the nature of the effect. Acker (2008) conducted a meta-analysis of studies comparing conscious and unconscious thought and found a great deal of variability in effect sizes across studies. We included a condition requiring participants to provide their reasons for their choice. This condition is similar to the conscious thought condition, but required participants to write down their reasons for or against each target object. Research has documented the detrimental effects of asking participants to provide reasons for their choices (Halberstadt & Levine, 1999; Wilson & Schooler, 1991) and we were interested in comparing the reasons condition to a conscious thought condition. A reasons condition would ensure that participants were engaging in considerable thought about the options, and might further im-

pair decision making relative to an unconscious thought condition. Providing reasons may lead participants to focus on more information, including information that is not important for distinguishing among options.

We also included a recall measure to help understand the findings. Tordesillas and Chaiken (1999) found that participants asked to introspect about their decisions had poorer recall of important information. We asked whether a similar effect might occur with conscious processing. Participants instructed to think carefully about a decision (conscious thought condition and reasons condition) may spend too much time on information that is unimportant to the decision.

2 Experiment 1

2.1 Method

2.1.1 Participants and design

Students (N = 153) were recruited from the psychology subject pool at the University of Idaho and participated in exchange for course credit. The sample was relatively evenly divided between men (n = 71) and women (n = 82). We asked participants to make attractiveness judgments about four apartments and to recall as many attributes as possible. We counterbalanced the order so that half the participants recalled the apartment attributes prior to judging the attractiveness of the attributes and half judged the attractiveness of the apartments and then recalled the apartment attributes.

Participants were randomly assigned to conditions in a 2 (order: judgment before recall or recall before judgment) x 4 (mode of thought: immediate judgment, conscious thought, reasons, and unconscious thought) x 4 (apartments) mixed design, with the last factor as within-subjects.

Manipulating the order of recall and attractiveness judgments poses a problem for the unconscious thought condition. Having participants in the unconscious thought condition recall information before making judgments is likely to disrupt unconscious thought and make the condition more similar to conscious thought. Our design allows us to test for this possibility and so we examined possible interactions with order on all our dependent measures.

2.1.2 Procedure and stimulus materials

Students participated in groups of up to five individuals. Stimulus materials were presented via computer using MediaLab software (Jarvis, 2006). Participants evaluated four apartments based on the information presented. Participants were not informed about the amount of information, but were told that each piece of information would be presented for four seconds. After participants read the instructions, 15 pieces of information about each apartment were presented one at a time for four seconds each. Apartments and apartment attributes were presented in an order randomized for each participant; however, all attributes of one apartment were presented before information about the next apartment was presented. Three attributes for each apartment were included that were not helpful in discriminating between the apartments, as the three attributes were either neutral in valence (e.g., type of trees near the apartment) or constant across all apartments (e.g., "washers and dryers are available in the building" was included in the description of all four apartments). The most attractive apartment was characterized by nine positive attributes, three negative attributes, and three neutral attributes. The least attractive apartment was characterized by nine negative attributes, three positive attributes, and three neutral attributes. Two filler apartments were included, both of which consisted of six positive attributes, six negative attributes, and three neutral attributes. (See the Appendix for listing of apartment attributes).

After the presentation of apartment attributes, the participants in the immediate judgment condition rated the attractiveness of the four apartments. Order of the attractiveness judgments was fixed (i.e., all participants rated Apartment A first, then Apartment B, etc.). Participants in the conscious thought condition deliberated for four minutes about which apartment they liked the best. In the reasons condition, participants spent four minutes listing their reasons for liking and disliking the four apartments. They were told the purpose was to organize their thoughts about which apartment they liked the best and that their responses would not be collected. Finally, participants in the unconscious thought condition worked on an n-back test (n-back of 2; Jonides et al., 1997) for four minutes as a distractor task.

Participants recalled as many attributes as possible about each apartment. Order of responses to the recall task was randomized for each participant (i.e., some participants recalled attributes of Apartment C first, some recalled attributes of Apartment D first, etc.). Prior to the recall task, participants were not aware that they would be asked to recall the apartment attributes. Half of the participants completed the recall task prior to rating the attractiveness of the apartments and the remaining half completed the recall task after rating the attractiveness of the apartments. At the end of the study, participants completed items about their satisfaction with the way in which they made the decision, their perceptions of the difficulty of the task, and some demographic items.

2.1.3 Measures

1. *Attractiveness of apartments.* Participants were asked to rate the attractiveness of each apartment on a 9-point scale ranging from 1 (not at all attractive) to 9 (extremely attractive). We considered the highest rated apartment to be the most attractive one to the participant.

2. *Decision satisfaction.* Six items were included to assess participants' satisfaction with their decision making process (e.g., "I am satisfied with the way I reached the judgments regarding the attractiveness of the apartments," "The process I used to judge the attractiveness of the apartments was effective"). These items were on a 9-point scale, ranging from 1 (strongly disagree) to 9 (strongly agree). We removed one item as it lowered reliability. Coefficient alpha for the five items was 0.87.

3. *Perceived ease of the task.* Participants responded to one item about the ease of the task ("The apartments were easy to evaluate"), which was assessed on a 7-point scale (1=strongly disagree to 7=strongly agree).

4. *Recall of attributes.* Participants listed as many attributes as they could recall about the four apartments. For each apartment, we coded the total number of items correctly recalled, number of positive items recalled, number of neutral items recalled, number of negative items recalled, number of errors, number of positive errors (i.e., attribute was negative but recalled as a positive attribute), and number of negative errors (i.e., attribute was positive but recalled as a negative attribute). Both authors coded this information and were blind to the participants' condition. Intraclass correlations, assessing consistency and agreement, ranged from .89 to .99 (LeBreton & Senter, 2008). Discrepancies between our ratings were resolved through discussion.

2.2 Results and discussion

Ratings of the attractiveness of the apartments were similar across mode of thought conditions. However, the order of the recall and judgment tasks did appear to affect participants in the unconscious thought condition. When judgments preceded recall, the difference in ratings between the best and worst apartment was larger than when recall preceded judgments for the unconscious thought condition. Thus, when judgment preceded recall, our findings were consistent with those reported by Dijksterhuis (2004; Dijksterhuis et al., 2006).

Our analysis of the recall data tested whether participants in the conscious thought condition would show greater recall of neutral attributes compared to participants in the unconscious thought condition. Our results indicated no support for this hypothesis, as participants in the unconscious thought condition recalled a higher proportion of neutral attributes than did participants in the conscious thought condition. Details regarding these analyses and the analyses involving perceptions of the task are provided below.

2.2.1 Attractiveness of the apartments

A 2 (order: recall first or judgment first) x 4 (mode of thought: immediate, conscious, reasons, unconscious) x 4 (apartment) mixed ANOVA was conducted to determine the effects of unconscious thought on ratings of the attractiveness of the apartments.[1] Order and mode of thought were between-subject factors and apartment was a within-subject factor. We found no main effect for mode of thought, $F(3,145) = 0.30$, $p = .82$, partial $\eta^2 = .01$, and no main effect for order, $F(1,145) = 0.86$, $p = .36$, partial $\eta^2 = .01$. None of the two-way or three-way interactions was significant (p's > .30, partial η^2 's < .01). The apartments were perceived as differing in attractiveness, $F(3,435) = 48.50$, $p < .001$, partial $\eta^2 = .25$. As expected, the best apartment was the most attractive ($M = 7.04$, $SD = 1.77$) and the worst apartment was the least attractive ($M = 4.54$, $SD = 1.67$). See Figure 1 for the attractiveness ratings for each apartment by mode of thought.

The pattern of the means suggested that requiring participants to recall the attributes prior to making their judgments might have been harmful to the judgments made by participants in the unconscious thought condition. The three-way interaction was not significant, but this may have reflected a lack of power, so we examined the two-way interaction between order and apartment for each condition. None of the two-way interactions between order and apartment approached significance for the immediate, conscious, and reasons conditions (p's > .70, partial η^2 's < .01). The order and apartment interaction appeared to have some effect in the unconscious thought condition, $F(3,108) = 2.41$, $p = .07$, partial $\eta^2 = .06$. As shown in Figure 2, the difference in attractiveness ratings between the best apartment and worst apartment was greater when judgment preceded recall than when recall preceded judgment. Asking participants to recall the attributes before making the judgments may have induced conscious thought in these participants. Easily recalled attributes might have exerted a stronger influence on their judgments of attractiveness.

[1] We conducted additional analyses to examine possible sex differences. In Experiment 1 and Experiment 3 of Dijksterhuis (2004), the difference in performance between the unconscious and conscious thought conditions was found for men, but not for women. A 2 (sex: male or female) X 4 (mode of thought: immediate, conscious, reasons, unconscious) X 4 (apartment) mixed ANOVA was conducted on attractiveness ratings to test for possible sex differences. We did not examine possible order effects because including that variable in the analyses would result in small sample sizes in each cell. There was no main effect of sex on attractiveness ratings, $F(1,145) = 1.18$, $p = .28$, partial $\eta^2 = .01$, and no interaction between sex and mode of thought on attractiveness ratings, $F(3,145) = 0.38$, $p = .77$, partial $\eta^2 = .01$.

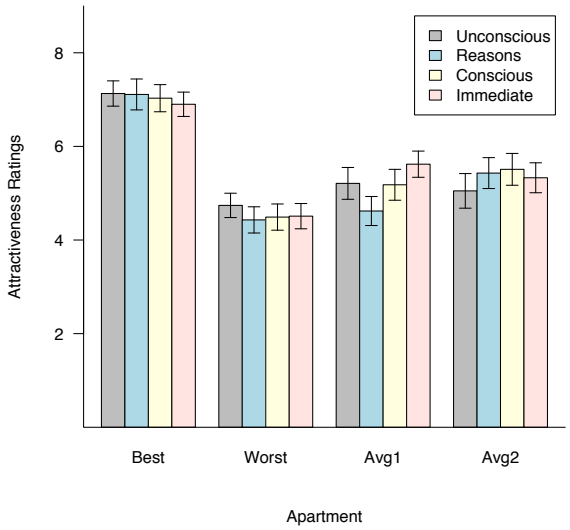

Figure 1: Attractiveness ratings of the four apartments by mode of thought. Error bars indicate one standard error.

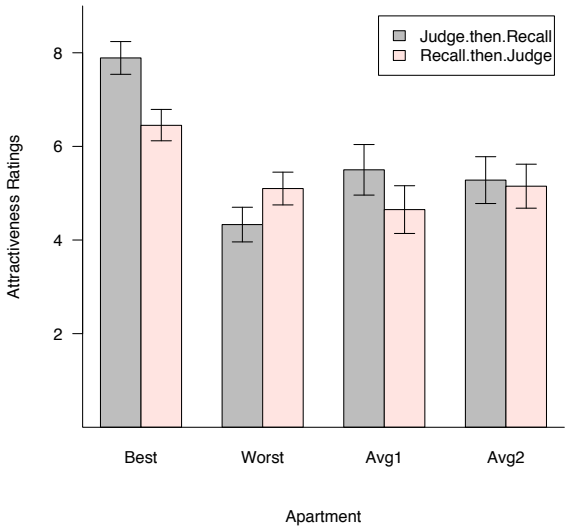

Figure 2: Attractiveness ratings in the unconscious thought condition. Error bars indicate one standard error.

Given that having the recall task precede the judgment task may have disrupted unconscious thought, we conducted a comparison between unconscious thought and conscious thought when judgment preceded recall. A 2 (mode of thought: unconscious thought vs. conscious thought) x 2 (apartment: best vs. worst) mixed ANOVA was conducted on attractiveness ratings. The interaction between mode of thought and apartment was not statistically significant, $F(1,36) = 1.10$, $p = .30$, partial $\eta^2 = .03$, nor was the main effect for mode of thought, $F(1,36) = 1.60$, $p = .21$, partial $\eta^2 = .04$, but the direction of the means was consistent with Dijksterhuis's findings. The difference between the best and worst apartment was greater for the unconscious thought condition ($M = 3.56$, $SD = 2.12$) compared to the conscious thought condition ($M = 2.70$, $SD = 2.81$; $d = 0.34$).

2.2.2 Recall of attributes

Conscious thought might perform more poorly relative to unconscious thought if it focuses on less important attributes. As there were differences in the number of attributes recalled, we divided the number of neutral items recalled by the total number of items recalled for each apartment to get the proportion of neutral information recalled. To examine whether conscious thought participants had better recall for neutral attributes compared to unconscious thought participants, a 2 (order) x 4 (mode of thought: immediate, conscious, reasons, unconscious) x 4 (apartment) mixed ANOVA was conducted on the proportion of neutral attributes recalled. There appeared to be some difference in proportion of neutral attributes recalled as a function of mode of thought, $F(3,99) = 1.99$, $p = .12$, partial $\eta^2 = .06$, but the pattern of means did not match our predictions. The unconscious thought ($M = 0.22$, $SD = 0.19$) and immediate conditions ($M = 0.22$, $SD = 0.16$) recalled a higher proportion of neutral attributes than the conscious thought ($M = 0.16$, $SD = 0.13$) and reasons conditions ($M = 0.16$, $SD = 0.12$), suggesting that neutral attributes did not receive undue focus from conscious thought participants.

The pattern of means suggested an interaction between mode of thought and apartment on proportion of neutral attributes recalled, $F(9,297) = 1.63$, $p = .11$, partial $\eta^2 = .05$. As shown in Figure 3, the conscious thought and reasons condition had similar patterns of recall of neutral attributes. Unconscious thought participants recalled a higher portion of neutral attributes for the worst apartment, which may have interfered with their ability to attend to the more relevant attributes of the worst apartment.

The interaction between order and mode of thought appeared to affect the proportion of neutral attributes recalled, $F(3,99) = 2.30$, $p = .08$, partial $\eta^2 = .07$. As shown in Figure 4, all the mode of thought conditions, except the unconscious thought condition, showed a higher proportion of recall of neutral attributes when judgment preceded recall. This pattern was reversed in the unconscious thought condition. Recalling attributes prior to judging the options may have been especially disruptive to unconscious thought participants. Instead of relying

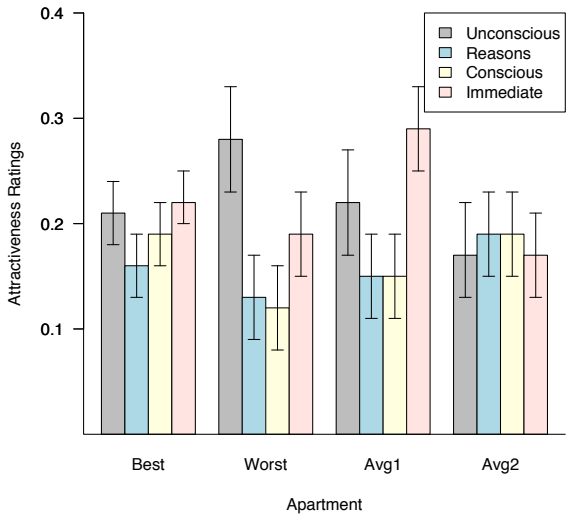

Figure 3: Mean proportion of neutral attributes recalled by mode of thought and apartment. Error bars indicate one standard error.

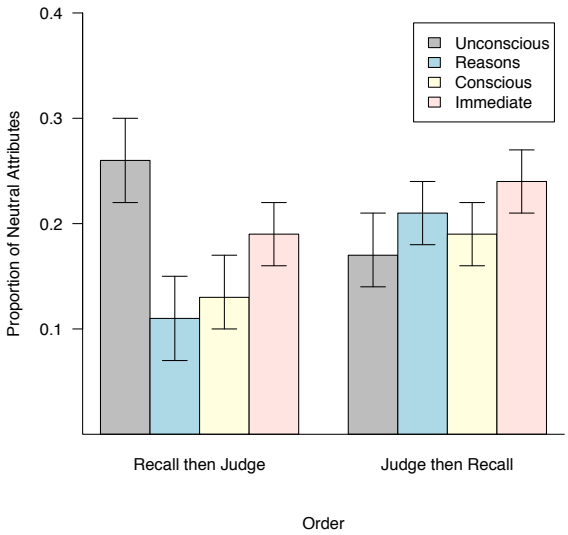

Figure 4: Mean proportion of neutral attributes recalled by order and mode of thought. Error bars indicate one standard error.

on their holistic judgment obtained through unconscious processing, participants may have relied on their memories of attributes when completing the rating task. Dijksterhuis (2004; Experiment 2) found that participants in the unconscious thought condition were more likely to report making a global impression or judgment (55.6%) than did participants in the conscious thought condition (26.5%). Having the recall task precede the judgment task may have altered the decision strategy for participants in the unconscious thought condition.

The analysis of the recall of neutral attributes revealed that participants in the conscious thought condition were not overly focused on neutral attributes compared to participants in the unconscious thought condition. Contrary to expectations, participants in the unconscious thought condition were not better at ignoring the neutral attributes compared to conscious thought participants.[2]

[2]We also examined differences in recall of positive and negative attributes across modes of thought. Dijksterhuis (2004) reported evidence that unconscious thought participants recognized positive attributes of the best option and negative attributes of the worst option more frequently than negative attributes of the best option and positive attributes of the worst option. We examined whether a similar effect would occur with recall. We divided the number of positive attributes recalled for each apartment and divided it by the total number of positive attributes for each apartment, giving us a proportion of positive attributes recalled. Likewise, we divided the number of negative attributes recalled for each apartment and divided it by the total number of negative attributes for each apartment, giving us a proportion of negative attributes recalled. A 2 (order) x 4 (mode of thought) x 2 (apartment) x 2 (valence) mixed ANOVA was conducted, with the last two factors (i.e., apartment and valence) as within-subject factors. Evidence consistent with Dijksterhuis (2004) would be reflected in a three-way interaction between mode of thought, apartment, and valence. The three way interaction was not significant, $F(3,124) = 0.05$, $p = .99$, partial $\eta^2 = .00$, and an inspection of the means indicated that the pattern was not consistent with Dijksterhuis (2004).

2.2.3 Decision satisfaction and perceived ease of task

We expected that unconscious thought participants would be less satisfied with the decision process because they were unable to devote significant time to consider the apartments. This prediction was not supported, as there were no differences between the mode of thought conditions in satisfaction, $F(3,145) = 0.60$, $p = .62$, partial $\eta^2 = .01$. The main effect for order (i.e., whether recall occurred prior to or after judgments of the apartments) was not significant, $F(1,145) = 0.01$, $p = .94$, partial $\eta^2 = .00$, but the interaction between mode of thought and order accounted for a small effect, $F(3, 145) = 1.80$, $p = .15$, partial $\eta^2 = .04$. Follow-up analyses of the interaction revealed that the effect of order on satisfaction with the decision process was most pronounced in the unconscious thought condition. Unlike the other mode of thought conditions, participants in the unconscious thought condition were more satisfied with the decision process when judgment preceded recall than when recall preceded judgment, $F(1,36) = 3.76$, $p = .06$, partial $\eta^2 = .10$ (see Figure 5).

We also examined whether participants would differ in their perceptions of the ease of the task. No significant differences for the mode of thought conditions on percep-

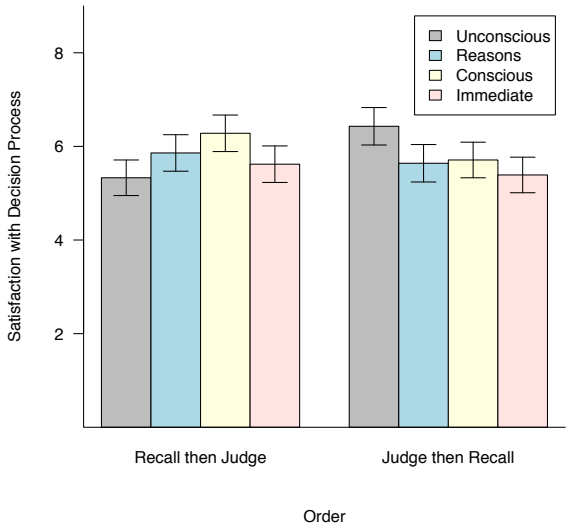

Figure 5: Satisfaction with the decision process by mode of thought. Error bars indicate one standard error.

tions of ease was found, $F(3,145) = 0.36$, $p = .78$, partial $\eta^2 = .01$. There was no effect due to order of recall and judgment, $F(1,145) = 0.02$, $p = .89$, partial $\eta^2 = .00$, and no interaction effect between order and mode of thought, $F(3,145) = 0.90$, $p = .44$, partial $\eta^2 = .02$. Participants found the task to be neither overly difficult nor overly easy, as the mean response was near the midpoint of the scale ($M = 4.38$, $SD = 1.54$).

2.2.4 Conclusions

Although participants in the unconscious thought conditions did not perform better on the task than conscious thought participants, the pattern of means, when the recall task occurred after the ratings, was consistent with the findings of Dijksterhuis (2004). We found no difference between the reasons condition and the other conditions, suggesting that asking participants to provide reasons for their decision does not interfere with decision making more than asking participants to think about their options. Thinking about reasons may be detrimental because it may focus decision makers on factors that are easy to articulate and justify to others. Our failure to find detrimental effects of the reasons condition compared to the other conditions may be because the task involved descriptions of the options without experiencing them. Visiting apartments may provide decision makers with impressions about apartments that are influential in their final choice, but may be difficult to articulate. Thinking about reasons may force decision makers to consider attributes that they can state clearly, as opposed to impressions, even though it is the impressions of the apartments that are driving the decision.

3 Experiment 2

The differences between our stimulus materials and the stimulus materials used by Dijksterhuis may explain our inability to replicate his results. We conducted a second experiment using the stimulus materials from Study 1 of Dijksterhuis et al. (2006) to address this possibility. We also sought to investigate whether the poor performance of conscious thought is due to memory limitations. Dijksterhuis and Nordgren (2006) proposed that a major weakness of conscious thought for complex decisions is its limited capacity. However, decision makers may utilize aids to help overcome this limitation.

Two recent studies investigated whether memory limitations may explain the relatively poor performance of conscious thought. Rey et al. (2009), utilizing the stimulus materials from Dijksterhuis et al. (2006), included a conscious thought condition where all 48 attributes were written on a sheet of paper and provided to participants as they deliberated for four minutes. Performance in this condition was compared to an unconscious thought condition and an immediate condition. No statistically significant differences were found among the conditions, but participants in the immediate condition made the largest number of correct choices (80%), followed by the unconscious thought condition (63.3%), and the conscious thought condition (50%). Unfortunately, their study lacked a conscious thought condition where participants relied on their memory for the attributes, making it difficult to determine the benefits of providing all the attribute information.

Newell et al. (2009) addressed this issue in their second experiment. They included an immediate condition, an unconscious thought condition, a conscious thought condition (where participants had to rely on their memory), and a conscious thought with information condition (where participants were provided with an information board displaying all the attributes for the options while they deliberated). Memory difficulties did not appear to be a problem as the conscious thought condition and the conscious thought with information conditions chose the best apartment at similar rates (82.6% and 78.3%, respectively). The conscious thought conditions chose the best apartment more frequently than did participants in the unconscious thought condition (65.2%), but the difference was not statistically significant.

We expanded on this research by investigating the effects of a memory aid on conscious processing. Presenting all the attributes of the options overcomes memory limitations, but it may disrupt conscious processing if it

leads participants to focus on attributes that are relatively unimportant to them. Payne et al. (2008) suggested that thinking too much about a decision leads to a dilution effect, as less important information receives too much attention. In Experiment 2, we examined whether the poor performance of conscious thought could be overcome with a memory aid (i.e., asking participants to take notes during the presentation of the attributes). Not only does this overcome memory limitations, but it also allows participants to record attributes that they believe are the most relevant to their decision and leave off less important attributes.

3.1 Method

3.1.1 Participants and design

We recruited participants (N = 162) from a psychology subject pool at the University of Idaho. Participants were randomly assigned to one of four conditions: an immediate decision condition, a conscious thought condition, a conscious thought with notes condition, and an unconscious thought condition. Seven participants were eliminated from the data for not following directions (e.g., failing to take notes) or responding randomly, resulting in a final sample of 155.

3.1.2 Procedure and stimulus materials

The stimulus materials were from Dijksterhuis et al. (2006). Students participated in groups of up to five individuals. Stimulus materials were presented via computer using MediaLab software (Jarvis, 2006). Participants chose the car they liked best from four cars. Forty-eight attributes (twelve attributes for 4 cars) were presented one at a time, in random order, for eight seconds. Each piece of information described a positive or negative feature of the car. The "best" car (i.e., the Hatsdun) was categorized by 75% positive attributes and the "worst" car (i.e., the Nabusi) was characterized by 25% positive attributes. Two additional cars, the Kaiwa and Dasuka, were included with 58% and 50% positive attributes, respectively (there was an error in the stimulus materials listed in Dijksterhuis et al., 2006, so that the Kaiwa had 58% positive attributes as opposed to 50%).

Participants in the conscious thought condition had four minutes after the presentation of the information to think carefully about the cars. In the unconscious thought condition, participants were distracted from thinking about the cars for four minutes by working on a series of anagrams. After four minutes had passed, participants chose the car they liked the best. Participants in the conscious thought with notes condition were asked to take notes on the cars and were told that the notes would not be collected. After the presentation of the information, they had four minutes to think carefully about the cars before they made a choice. Participants in the immediate decision condition made their choice immediately following the presentation of the car attributes.

After participants chose the car they liked the best, they rated the importance of each of the 12 attributes (e.g., handling, gas mileage) on a scale of 1 (not at all important) to 7 (very important). After rating each attribute, participants answered some demographic questions and were debriefed.

3.2 Results and discussion

Our results failed to replicate Dijksterhuis et al. (2006). The unconscious thought condition and conscious thought conditions chose the best car (Hatsdun) at similar levels. Participants in the conscious thought with notes condition chose the best car more frequently than the other conditions, but this difference was significant only for the comparison with the conscious thought condition.

We analyzed participants' ratings of subjective importance of the car attributes to determine if unconscious thought participants made choices more consistent with their importance ratings than other conditions. The unconscious thought condition did not perform significantly better than the other conditions.

3.2.1 Car choice

The conscious thought with notes condition had the highest percentage of correct decisions (i.e., chose the car, Hatsdun, with the most positive attributes; 70.7%), followed by the unconscious thought condition (56.8%), the immediate thought condition (52.5%), and the conscious thought condition (48.6%; see Figure 6).

As demonstrated in Table 1, participants in the unconscious thought condition did not perform significantly better than the other conditions. We did find that the conscious thought with notes condition made significantly more correct decisions than did participants in the conscious thought condition.

3.2.2 Importance ratings

Consistent with Dijksterhuis (Dijksterhuis, 2004; Dijksterhuis et al., 2006), we defined the most attractive car as the one with the largest number of positive attributes. However, depending on which attributes were most important to an individual, a car with fewer positive attributes may have been perceived as more attractive. Using participants' ratings of attribute importance, we examined how well participants' judgments matched up with their subjective ratings of importance (similar to the

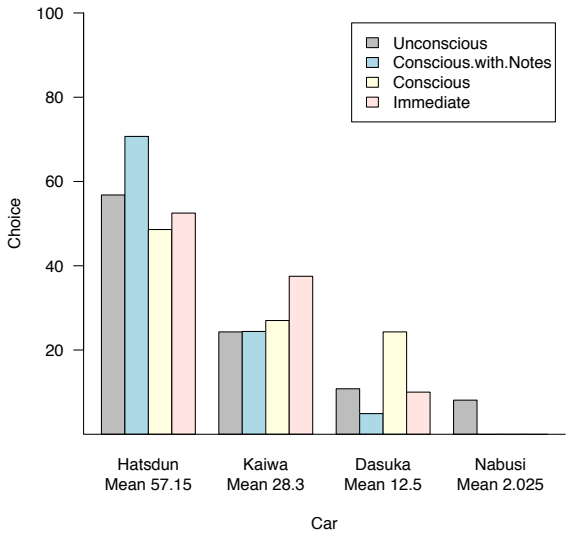

Figure 6: Car choices by mode of thought.

Table 1: Results of comparisons between modes of thought on choice.

Comparison	$\chi^2(1)$	p	ϕ
Unconscious vs. immediate	0.14	.708	.04
Unconscious vs. conscious	0.49	.485	.08
Unconscious vs. conscious with notes	1.65	.199	.15
Conscious vs. conscious with notes	3.96	.047	.23

Table 2: Mean difference between maximum score and score for chosen car by mode of thought.

Mode of thought	n	M	SD
Unconscious	37	10.54	19.15
Conscious with Notes	41	4.44	9.70
Conscious	37	9.57	11.87
Immediate	40	7.55	10.27

analysis in Experiment 3 of Dijksterhuis, 2004). For each of the four cars, we added the importance ratings for the positive attributes and subtracted the importance ratings for the negative attributes. This provided a score for each car for each participant. We calculated the difference between the maximum score and the score for the chosen car.[3] Thus, if participants chose the car with the highest score, the difference would be zero. The larger the difference score, the poorer the choice. As shown in Table 2, the conscious with notes condition had the smallest difference score, suggesting that they were choosing the car that best matched their subjective importance ratings. A oneway ANOVA was conducted to test whether the difference scores were affected by mode of thought. No overall difference was found, $F(3,151) = 1.65$, $p = .18$, $\eta^2 = .03$, but linear contrasts were conducted to explore possible differences among the conditions. The conscious with notes condition had a smaller mean difference than the mean difference for the other three conditions combined, $t(151) = 1.99$, $p = .05$, $d = .36$. No significant difference was found between the conscious and unconscious thought conditions, $t(151) = 0.32$, $p = .75$, $d = .06$. These results suggest that our inability to find a beneficial effect for unconscious thought is not due to subjective preferences of the car attributes.

3.2.3 Sex differences

We also checked for sex differences on performance, as Dijksterhuis (2004; Experiments 1 and 3) found that female participants performed equally well in the conscious and unconscious conditions, but men performed significantly better in the unconscious condition compared to the conscious condition. We found that women chose the best car more frequently (62.4%) than men (48.1%), $\chi^2(1) = 2.91$, $p = .09$, $\phi = .14$. However, our results are not consistent with Dijksterhuis, as male participants in our study performed equally poorly in the conscious thought condition and in the unconscious thought condition (see Figure 7). Male and female participants may have adopted different strategies for choosing among the cars.

[3]We thank Jonathan Baron for suggesting this analysis.

4 General discussion

Two experiments examined the benefits of unconscious thought on complex decisions. Both experiments failed to find a significant difference on performance between participants in the conscious thought condition and those in the unconscious thought condition. Experiment 1 found that a reasons condition, where participants had to list their reasons for their ratings, resulted in similar judgments to the conscious thought condition. Experiment 2 revealed that conscious thought combined with a memory aid resulted in better judgments than conscious thought. This highlights an important boundary condition for research on unconscious thought. If decision makers take notes or review information, they can compensate for the limited capacity of conscious thought.

Although neither of our experiments found statistically significant differences between performance in the con-

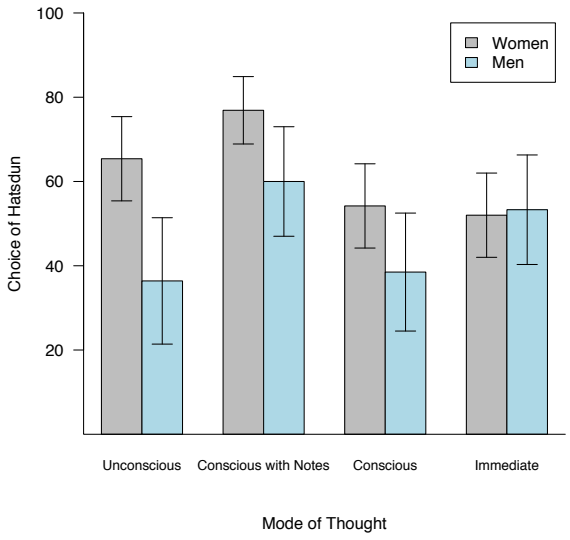

Figure 7: Percentage of men and women selecting the best car by mode of thought. Error bars indicate one standard error.

scious and unconscious thought conditions, the patterns of means were in the predicted direction. Our results, combined with the recent work by Acker (2008), suggest that the beneficial effects of unconscious thought may be relatively small. In Experiment 1, when the recall task was completed after the ratings of attractiveness, participants in the unconscious thought condition showed greater discrimination between the most and least attractive apartment (mean difference of 3.56) compared to conscious thought participants (mean difference of 2.70). Unconscious thought participants in Experiment 2 also made more correct decisions (56.8%) than did conscious thought participants (48.6%). The size of these differences is similar to the mean effect size of 0.25 reported by Acker (2008). Acker (2008) reported a large amount of variability between effect sizes suggesting a need for examination of moderator variables. Payne et al. (2008) identified one possible moderator variable. They provided evidence that conscious thought performs worse than unconscious thought when a four minute time requirement for conscious processing is imposed, but that self-paced conscious thought outperforms unconscious thought.

The present results failed to replicate those of Dijksterhuis and colleagues. The difficulty of replicating the effect suggests that it may occur only under specific conditions. Studies that do and do not find similar effects as Dijksterhuis will help advance our understanding of the conditions required for the benefits of unconscious thought to occur. Acker (2008) pointed out that most of the published research finds support for the benefits of unconscious thought, whereas unpublished data have shown less support for the advantages of unconscious thought. A better understanding of the nature of the effect requires making available results that are supportive and not supportive of the benefits of unconscious thought.

4.1 Why did our results fail to replicate Dijksterhuis and colleagues?

To understand the implications of our findings, we discuss some of the possible reasons why our results failed to replicate the results reported by Dijksterhuis and colleagues. One possibility is that the response mode (i.e., judgment vs. choice) may be a factor. Noncompensatory strategies, which simplify the task, are likely to be more common when making choices in comparison to judgments (Billings & Scherer, 1988). However, Dijksterhuis and colleagues (Dijksterhuis, 2004; Dijksterhuis et al., 2006) have demonstrated that unconscious thought outperforms conscious thought on complex tasks using a choice task and a judgment task. Both of our studies failed to find the beneficial effects of unconscious thought even though different response modes were used in the two studies.

Our Experiment 2 produced similar results to Experiment 2 of Dijksterhuis (2004). Our unconscious thought participants correctly chose the best car (56.8%), whereas their unconscious thought participants chose the best apartment (59.3%). Our conscious thought participants chose the best car (48.6%), whereas their conscious thought participants chose the best car (47.1%). The only noticeable difference is that our immediate condition outperformed (52.5%) their immediate condition (36.4%). Participants in our study may have adopted a noncompensatory strategy, focusing on one or two salient attributes, which may explain the lack of differences found across our conditions.

The first experiment may not have been sufficiently complex to yield the benefit for unconscious thought. Participants in our Experiment 1 may have perceived the task as easier than did participants in the Dijksterhuis (2004) studies. The difference between ratings of the most attractive and least attractive apartment was considerably larger in our study than in Experiment 1 of Dijksterhuis (2004; note that we used a 9-point scale and Dijksterhuis used a 10-point scale). However, the difference between our ratings of the most attractive and least attractive apartment (mean difference of 2.50) was similar to Experiment 3 of Dijksterhuis (2004; mean difference of 2.65). Thus, it would appear that our task was sufficiently complex for the beneficial effects of unconscious thought to appear, assuming such an effect exists.

4.2 Conclusions

Our results combined with the results of Acker (2008) suggest that it is too soon to conclude that unconscious thought outperforms conscious thought on complex decisions. Our results demonstrate that conscious thought for complex decisions can be improved by incorporating a memory aid. Because of the limited capacity of conscious thought, some assistance is needed for complex decisions to ensure that decision makers can remember all the relevant information. Our results suggest a memory aid may be a better strategy than relying on unconscious thought.

References

Acker, F. (2008). New findings on unconscious versus conscious thought in decision making: Additional empirical data and meta-analysis. *Judgment and Decision Making, 3*, 292–303.

Billings, R. S., & Scherer, L. L. (1988). The effects of response mode and importance on decision-making strategies: Judgment versus choice. *Organizational Behavior and Human Decision Processes, 41*, 1–19.

Dijksterhuis, A. (2004). Think different: The merits of unconscious thought in preference development and decision making. *Journal of Personality and Social Psychology, 87*, 586–598.

Dijksterhuis, A., Bos, M. W., Nordgren, L. F., & van Baaren, R. B. (2006). On making the right choice: The deliberation-without-attention effect. *Science, 311*, 1005–1007.

Dijksterhuis, A., & Nordgren, L. F. (2006). A theory of unconscious thought. *Perspectives on Psychological Science, 1*, 95–109.

Halberstadt, J. B., & Levine, G. M. (1999). Effects of reasons analysis on the accuracy of predicting basketball games. *Journal of Applied Social Psychology, 29*, 517–530.

Jarvis, W. B. G. (2006). MediaLab (Version 2006.1.35). [Computer software]. New York, NY: Empirisoft.

Jonides, J., Schumacher, E. H., Smith, E. E., Lauber, E. J., Awh, E., Minoshima, S., & Koeppe, R. A. (1997). Verbal working memory load affects regional brain activation as measured by PET. *Journal of Cognitive Neuroscience, 9*, 462–475.

LeBreton, J. M., & Senter, J. L. (2008). Answers to 20 questions about interrater reliability and interrater agreement. *Organizational Research Methods, 11*, 815–852.

Linville, P. W. (1982). The complexity-extremity effect and age-based stereotyping. *Journal of Personality and Social Psychology, 42*, 193–211.

Newell, B. R., Wong, K. Y., Cheung, J. C. H., & Rakow, T. (2009). Think, blink, or sleep on it? The impact of modes of thought on complex decision making. *The Quarterly Journal of Experimental Psychology, 62*, 707–732.

Payne, J. W., Samper, A., Bettman, J. R., & Luce, M. F. (2008). Boundary conditions on unconscious thought in complex decision making. *Psychological Science, 19*, 1118–1123.

Rey, A., Goldstein, R. M., & Perruchet, P. (2009). Does unconscious thought improve complex decision making? *Psychological Research, 73*, 372–379.

Tordesillas, R. S., & Chaiken, S. (1999). Thinking too much or too little? The effects of introspection on the decision-making process. *Personality and Social Psychology Bulletin, 25*, 623–629.

Wilson, T. D., & LaFleur, S. J. (1995). Knowing what you'll do: Effects of analyzing reasons on self-prediction. *Journal of Personality and Social Psychology, 68*, 21–35.

Wilson, T. D., & Schooler, J. W. (1991). Thinking too much: Introspection can reduce the quality of preferences and decisions. *Journal of Personality and Social Psychology, 60*, 181–192.

Appendix: Apartment attributes in Experiment 1

Apartment A (Best Apartment)	**Apartment B** (Worst Apartment)
Rent is cheaper than comparable apartments	Rent is more expensive than comparable apartments
Short walk to places you frequent	Long drive to places you frequent
Average size	Above average in size
Heating bill is average	Heating bill is high
No air conditioning	Has air conditioning
Has a dishwasher	No dishwasher
Attractive interior and exterior	Okay looking interior and exterior
New	Old
Quiet	Somewhat noisy
Free high speed internet	High speed internet not included
Reserved parking space next to building	Parking available on street only
Landlord is unfriendly	Landlord is friendly
Apartment complex was named after a local community leader	Apartment complex was named after a former president
Lots of apple trees on the property	Lots of maple trees on the property
Washers and dryers are available in the building	Washers and dryers are available in the building
Apartment C (Average Apartment)	**Apartment D** (Average Apartment)
Rent is cheaper than comparable apartments	Rent is more expensive than comparable apartments
Long drive to places you frequent	Short walk to places you frequent
Above average in size	Average size
Heating bill is high	Heating bill is average
Has air conditioning	No air conditioning
Has a dishwasher	No dishwasher
Attractive interior and exterior	Okay looking interior and exterior
Old	New
Somewhat noisy	Quiet
High speed internet not included	Free high speed internet included
Parking available on street only	Reserved parking space next to building
Landlord is friendly	Landlord is unfriendly
Apartment complex was named after a local community leader	Apartment complex was named after a former president
Lots of oak trees on the property	Lots of elm trees on the property
Washers and dryers are available in the building	Washers and dryers are available in the building