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The benefits of "sleeping on things": Unconscious thought leads to automatic weighting

Maarten W. Bos *, Ap Dijksterhuis, Rick B. van Baaren

Radboud University Nijmegen, The Netherlands

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Abstract

We tested and confirmed the hypothesis that unconscious thought leads to an automatic weighting process whereby important decision attributes receive more weight, and unimportant decision attributes receive less weight. In three experiments, participants chose between cars with few important positive attributes and many unimportant negative attributes ("Quality cars"), and cars with many unimportant positive attributes and few important negative attributes ("Frequency cars"). In all experiments, unconscious thinkers showed a stronger preference for Quality cars than immediate decision makers, showing that unconscious thought indeed evokes an automatic weighting process. An alternative explanation is refuted and implications are discussed.

Keywords: Unconscious thought; Decision making; Weighting

People who face important decisions are often advised to "sleep on it". People—especially parents and grandparents, so it seems—have an intuitive sense that decision making should not be hurried. However, the notion of sleeping on things does not suggest that the additional time taken to decide should be used to deliberate, but rather that the decision should be "put aside" for a while. But why should we do this? In what way will it improve our decision?

When we decide between alternatives, we often have to engage in weighting the relative importance of different attributes. For a new car, a great safety record and the presence of cup holders are positive attributes. However, the first should receive more weight as it is far more important than the second. Whereas the above example poses a very easy weighting problem, weighting is often difficult. When we buy a house we have to weight the relative importance of many attributes, and some of these are affective and difficult to verbalize. Still, proper weighting of such attributes can cause us to be happy rather than much less happy for years to come. Here, we address the question whether it is possible that putting a decision problem aside for a while helps us with weighting.

Recent research on unconscious thought—reminiscent of lay people's idea of sleeping on things—suggests that this may indeed be the case. In most experiments on unconscious thought, participants are presented with a choice problem after which they are distracted before they make their choice. Compared to participants who make their decisions immediately, "unconscious thinkers" usually make better decisions (Dijksterhuis, 2004; Dijksterhuis, Bos, Van der Leij, & van Baaren, 2009; Dijksterhuis & van Olden, 2006; Ham, van den Bos, & Van Doorn, 2009; Lerouge, 2009; Messner & Wänke, in press; see Strick et al., 2010 for a meta-analysis; see also Dijksterhuis, Bos, Nordgren, & van Baaren, 2006), which may open the possibility that unconscious thought sometimes enables better weighting than conscious thought. Indeed, Wilson et al. (1993) have long ago posited that we often weight appropriately when we do this unconsciously, a position that is also adopted by Unconscious Thought Theory (UTT; Dijksterhuis & Nordgren, 2006).

However, the general evidence that unconscious thought can help decision making does not yet demonstrate that this is caused

* Corresponding author. Behavioural Science Institute, Radboud University Nijmegen, P.O. Box 9104, 6500 HE Nijmegen, The Netherlands.
E-mail address: m.bos@psych.ru.nl (M.W. Bos).

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by superior weighting. Indeed, evidence that unconscious thought leads to an automatic weighting process is limited. Payne, Samper, Bettman, and Luce (2008) investigated weighting among unconscious thinkers and immediate decision makers and did not find superior weighting among unconscious thinkers. However, the decisions their participants made were based solely on numerical stimuli. The advantage of their approach is that appropriate weighting was objectified perfectly, but the disadvantage is that it lacks ecological validity: real life decision making is sometimes a numbers' game, but often it is not. Moreover, as specified in UTT (Dijksterhuis & Nordgren, 2006), unconscious thought is most likely not suitable for tasks that require the active use of propositional rules such as needed in arithmetic (Smith & DeCoster, 1999).

Evidence in favor of the idea that unconscious thought causes automatic weighting is incomplete and to some extent indirect. Wilson et al. (1993), asked participants to choose one poster from a set of five. Some made their choice immediately after seeing the posters, whereas yet others engaged in unconscious thought. Later interviews among participants—who took their favorite posters home—demonstrated that unconscious thinkers were more satisfied with their choice than participants in other conditions. This finding was replicated by Dijksterhuis and van Olden (2006). In other experiments, Dijksterhuis et al. (2009) showed that experts predicting the results of soccer matches did best after unconscious thought. In addition, they took the most diagnostic predictor (the World Ranking list) into account when making their predictions, whereas immediate decision makers did not. Using rather than neglecting the best predictor can be seen as a form of good weighting, but it is admittedly a simple form.

To turn back to the example of buying a car, sound weighting requires that attributes that are objectively important become even more dominant through weighting, whereas attributes that are secondary become less dominant. We hypothesize, in line with UTT, that this is what happens during a period of unconscious thought. This hypothesis will be tested in three experiments. We used a paradigm from Alba and Marmorstein (1987) in which participants had to choose between alternatives with different numbers of positive and negative attributes. Some alternatives had many unimportant positive attributes and a few important negative attributes, whereas others had many unimportant negative attributes and a few important positive attributes. People who fail to engage in weighting should choose the former alternative, whereas appropriate weighting should lead to a relative preference for the latter alternative.

Experiment 1: Method

Participants and design

Thirty undergraduate students from the Radboud University Nijmegen were randomly assigned to one of two conditions: an immediate decision condition and an unconscious thought condition. They either received course credits or money (8 Euros) for their participation.

Procedure and materials

The experiment was part of a longer session with various unrelated experiments. Participants worked in cubicles and were told that they would be presented with information about four hypothetical cars (labeled Cars 1–4). Each car was described by 12 attributes, for a total of 48 pieces of information. These 48 attributes were presented in random order. Each attribute was presented for 4 s in the center of the screen, automatically followed by the next attribute. Importantly, two of the four cars (the "Quality cars") had 8 negative and 4 positive attributes (see Appendix 1 for a list of the attributes). For the positive attributes we selected the 4 most important car attributes from a pilot-test (scoring higher than 6.5 on a 9 points-scale of "how important do you think this attribute is in a car") and for the negative attributes we selected the 8 least important attributes from the same pilot-test (scoring lower than 6.5 on a 9 points-scale). The remaining two cars (the "Frequency cars") were the opposite. They had 8 unimportant positive attributes, and 4 important negative attributes.

After participants read all the information, they were randomly allocated to one of two conditions. In the "immediate decision" condition, they were immediately asked to give their attitude towards each of the four cars. The questions were phrased "How would you judge Car….?" Participants were asked to indicate their answer on a 20-point scale ranging from 1 (*extremely negative*) to 20 (*extremely positive*).

In the unconscious thought condition, participants were told that they had to choose between the cars later, and that they had to do a different task first. These participants performed a distracter task aimed at preventing conscious thought: The "*n*-back task" (e.g., Jonides et al., 1997). In this task, participants are presented with a series of digits and for each digit they have to decide whether it matches the digit that preceded it by *n* places. Here participants completed a 2-back task. This task affects executive functioning quite severely and can successfully eliminate conscious thought. Participants performed the 2-back task for 5 min (excluding a 20 s instruction screen). After 5 min, they were asked to indicate their attitudes towards the cars. After completing the attitude questions, all participants were debriefed, thanked and dismissed.

Results

We subtracted the ratings of the two Frequency cars from those of the two Quality cars. Participants who did not (appropriately) weight the relative importance of attributes should prefer the Frequency cars over the Quality cars, whereas appropriate weighting should lead to a relative preference for the Quality cars. Although participants in both experimental conditions showed some weighting, unconscious thinkers ($M=14.2$, $SD=9.3$) did this significantly more than immediate decision makers ($M=5.5$, $SD=9.6$) F $(1,28)=6.11$, $p=.02$, $\eta^2=.18$. Unconscious thinkers and immediate decision makers took an equal amount of time for their judgments ($F<1$). These findings support the hypothesis that unconscious thought leads to automatic weighting.

Experiment 2

In Experiment 1, the relative importance of attributes was determined by a pilot study. Although we used relatively extreme attributes, it is still possible that participants' personal preferences diverge. In Experiment 2, we replicate Experiment 1, but in addition, we ask participants after the experiment how important or unimportant they regard the different attributes. This way, we can assess whether weighting was appropriate from participants' own, subjective, perspective.

Method

Participants and design

Seventy-two undergraduate students from the Radboud University Nijmegen were randomly assigned to one of two conditions: an immediate decision condition and an unconscious thought condition. They either received course credits or money (8 Euros) for their participation.

Procedure and materials

The experiment was exactly the same as Experiment 1, with one addition. This experiment was part of a longer session with various unrelated experiments, whereby the first part of the experiment was done in the beginning of this session. The second part, the new addition, was done at the end of the session.

In this second task, we measured the relative importance of the attributes. All the attributes that were used in the earlier experiment were again presented, and participants had to indicate the importance of each attribute on a 9-point scale, ranging from 1 (*extremely unimportant*) to 9 (*extremely important*).

Results

As in Experiment 1, participants in both experimental conditions showed weighting by preferring Quality over Frequency cars. However, unconscious thinkers ($M=10.7$, $SD=11.8$) did this significantly more than immediate decision makers ($M=5.5$, $SD=10.3$) F (1,70)=4.08, $p=.05$, $\eta^2=.06$. There was no significant correlation between performance on the distraction task and performance on the decision task ($p>.58$).

In addition, we assessed to what extent participants obeyed their own weighting scheme. We subtracted the mean importance score of the unimportant attributes from the mean importance score of the important attributes. This difference score was then correlated with the difference in rating of the Quality and Frequency cars. Perfect weighting should lead to a correlation of 1, whereas the absence of weighting should lead to a correlation of 0. Whereas unconscious thinkers showed a significant correlation ($r=.48$, $p=.005$), there was no correlation for immediate decision makers ($r=.17$, ns). The two correlations did not differ significantly from each other however ($p=.14$).

Experiment 3

Both Experiment 1 and Experiment 2 showed that unconscious thinkers engage in weighting. That is, compared to participants who rated the cars immediately, unconscious thinkers gave more weight to important attributes and/or less weight to unimportant attributes. UTT proposed that this weighting process takes place during unconscious thought, but there is an alternative explanation that needs to be ruled out.

It is possible that, during the distraction period, participants forget some of the decision attributes, and it is not far fetched to assume that the unimportant attributes are the ones that are forgotten most often. If participants base their ratings on what they can remember, and if unconscious thinkers remember fewer unimportant attributes than immediate decision makers, they rate the Quality cars higher than the Frequency cars.

To rule out this possibility, we replicated Experiment 1 with two additions. First, we added a free recall measure to see whether participants indeed forget some of the attributes. Second, we added a third condition, a "mere distraction" condition. Earlier research (Bos, Dijksterhuis, & van Baaren, 2008) showed that when participants are distracted in the *absence* of a goal to make a decision later, unconscious thought does not take place, and decisions do not change or improve compared to immediate decision makers. This additional condition is ideal for the present purposes, as participants in the mere distraction condition are distracted for the exact same time as unconscious thinkers, and hence, they are subject to potentially the same memory loss due to mere delay.

Method

Participants and design

Two-hundred and three undergraduate students from the Radboud University Nijmegen were randomly assigned to one of three conditions: an immediate decision condition, a mere distraction condition, and an unconscious thought condition. They either received course credits or money (8 Euros) for their participation.

Procedure and materials

The experiment was exactly the same as Experiment 1, with two exceptions.

First, we added a third condition. Mere distraction participants received the same distracter task as the unconscious thinkers. However, whereas the latter group was told prior to the distraction period (but after the presentation of the attributes) that they would be asked to choose among the cars later on, participants in the mere distraction condition were told that they would not be asked anything about the cars.

Second, a free recall measure was added. After participants had rated each car, they were given 4 min to type in as many of the attributes as they could recall.

Results

As in Experiments 1 and 2, participants in all experimental conditions showed weighting by preferring Quality over Frequency cars. However, unconscious thinkers ($M=14.2$, $SD=12.8$) did this significantly more than immediate decision makers ($M=9.1$, $SD=11.4$) F (1,136)=5.95, $p=.02$, $\eta^2=.04$,

and than participants in the mere distraction condition ($M=9.7$, $SD=12.0$) F (1,123)=4.05, $p=.05$, $\eta^2=.03$.

Participants in the mere distraction condition ($M=178.4$, $SD=20.8$) and in the unconscious thought condition ($M=177.9$, $SD=19.0$) performed equally well on the distraction task ($F<1$). In addition, there were no significant correlations between performance on the distraction task and performance on the decision task ($p>.38$). These results indicate that participants in the unconscious thought and mere distraction condition were equally engaged during the distraction task.

We coded the recall protocols so that we could analyze them in a 2 (Cars: Quality versus Frequency cars)×2 (Valence: positive versus negative attributes) within-subjects×3 (experimental condition) between-subjects analysis of variance. Overall, 35.0% ($SD=26.4$) of items were recalled. No main effect or interaction effect involving experimental condition was even close to significant (all Fs<1). The only two effects that were significant were the main effects of Valence (positive attributes were recalled better than negative ones), F (1,162)= 43.17, $p=.0001$, and the two-way interaction between Valence and Car (especially positive attributes of the Quality cars were recalled well), F (1,162)=32.49, $p=.0001$. These findings demonstrate that better weighting by unconscious thinkers was not caused by differences in free recall.

General discussion

Three experiments demonstrated that unconscious thought causes automatic weighting, thereby providing empirical evidence for the hypotheses of Wilson and colleagues (Wilson & Schooler, 1991; Wilson et al., 1993) and UTT (Dijksterhuis & Nordgren, 2006), that a period of distraction benefits a weighting process. The finding that even immediate decision makers showed a preference for Quality cars demonstrates that participants already weight during information acquisition or immediately afterwards, however, the weighting process continues during a period of unconscious thought.

Our findings clearly speak against an alternative account for unconscious thought effects that was published recently (Lassiter, Lindberg, Gonzalez-Vallejo, Belleza, & Phillips, 2009; see also Cleeremans et al., 2009). They argued that unconscious thinkers merely recall an on-line impression made earlier and that no such thing as unconscious thought exists. However, such an explanation cannot explain why unconscious thinkers outperformed immediate decision makers—who most certainly would also be able to remember their on-line impression—and participants who were merely distracted (see Strick, Dijksterhuis, & van Baaren, 2010, for additional evidence against this alternative account). In a recent meta-analysis, it was indeed confirmed that across many studies, unconscious thought produces better decisions than when people decide immediately (Strick et al., 2010). In sum, the current findings, as well as many others (Bos et al., 2008; Dijksterhuis, 2004; Ham et al., 2009; Lerouge, 2009, Strick et al., 2010) support the idea that unconscious thought is an active process contributing to decision making.

Although in our current experiments participants did not actually sleep on their decision, the benefit of a period of rest is clear. It would be an interesting next step to investigate the effects of letting participants sleep a night over their decisions. Is "sleeping on it" a qualitatively different thing than a period of rest without sleep? There is a literature on learning and memory consolidation during sleep (Power, 2004; Stickgold, 2005; Stickgold, Hobson, Fosse, & Fosse, 2001), but the underlying role of sleep in learning and memory consolidation is not completely clear (Maquet, 2001; Siegel, 2001). Would sleep lead to better weighting? Or is a period of rest and distraction just as beneficial as sleeping on it and therefore even more practical? Answering these questions would require opening the black box of the beneficial period of rest and may require an approach of more ecologically valid experiments, combined with neuro-cognitive experiments.

When your grandparents advised you to "sleep on" a decision first, they may have intuitively sensed the benefits of letting a decision rest to get a clear grasp of one's priorities. It feels as if a period of rest allows us to differentiate between the vital and the irrelevant aspects. The current research shows that our grandparents were right.

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Appendix 1. Materials; car attributes

Quality cars:

Car x does not have cup holders
Car x has no sliding roof
Car x comes in few colors
Car x has no light metal rims
Car x has one exhaust pipe
Car x has no spare tire
Car x has no tinted windows
Car x has no spoiler
Car x has good road-holding
Car x has an easy transmission
Car x is environmentally friendly
Car x has good mileage

Frequency cars:

Car x has cup holders
Car x has a sliding roof
Car x comes in many colors
Car x has light metal rims
Car x has two exhaust pipes
Car x has a spare tire
Car x has tinted windows
Car x has a spoiler
Car x has no good road-holding
Car x has a difficult transmission
Car x is not very environmentally friendly
Car x has bad mileage

References

Alba, J. W., & Marmorstein, H. D. (1987). The effects of frequency knowledge on consumer decision making. *Journal of Consumer Research*, *14*, 14−25.

Bos, M. W., Dijksterhuis, A., & van Baaren, R. B. (2008). On the goal-dependency of unconscious thought. *Journal of Experimental Social Psychology*, *44*, 1114−1120.

Cleeremans, A., Waroquier, L., David, M., & Klein, O. (2009). To think or not to think? A critique and reappraisal of "Unconscious Thought Theory". Manuscript in preparation.

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., Bos, M. W., Van der Leij, A., & van Baaren, R. B. (2009). Predicting soccer matches after unconscious and conscious thought as a function of expertise. *Psychological Science*, *20*, 1381−1387.

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

Dijksterhuis, A., & van Olden, Z. (2006). On the benefits of thinking unconsciously: Unconscious thought increases post-choice satisfaction. *Journal of Experimental Social Psychology*, *42*, 627−631.

Ham, J., van den Bos, K., & Van Doorn, E. (2009). Lady Justice thinks unconsciously: Unconscious thought can lead to more accurate justice judgments. *Social Cognition*, *27*, 509−521.

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

Lassiter, G. D., Lindberg, M. J., Gonzalez-Vallejo, C., Belleza, F. S., & Phillips, N. D. (2009). The deliberation-without-attention effect: Evidence for an artifactual interpretation. *Psychological Science*, *20*, 671−675.

Lerouge, D. (2009). Evaluating the benefits of distraction on product evaluations: The mindset effect. *Journal of Consumer Research*, *36*, 367−379.

Maquet, P. (2001). The role of sleep in learning and memory (2001). *Science*, *294*, 1048−1051.

Messner, C., & Wänke, M. (2010). Unconscious information processing reduces information overload and increases product satisfaction. *Journal of Consumer Psychology*, doi:10.1016/j.jcps.2010.09.010.

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

Power, A. E. (2004). Slow-wave sleep, acetylcholine, and memory consolidation.*Proceedings of the National Academy of Sciences*, *101*(7) 1795–1796l.

Siegel, J. M. (2001). The REM sleep–memory consolidation hypothesis. *Science*, *294*, 1058−1063.

Smith, E. R., & DeCoster, J. (1999). Associative and rule-based processing: A connectionist interpretation of dual-process models. In S. Chaiken & Y. Trope (Eds.), *Dual-process theories in social psychology* (pp. 323−336). New York: Guilford.

Stickgold, R. (2005). Sleep-dependent memory consolidation. *Nature*, *437*, 1272−1278.

Stickgold, R., Hobson, J. A., Fosse, R., & Fosse, M. (2001). Sleep, learning, and dreams: Off-line memory reprocessing. *Science*, *294*, 1052−1057.

Strick, M., Dijksterhuis, A., & van Baaren, R. B. (2010). Unconscious thought effects take place off-line, not on-line. *Psychological Science*, *21*(4), 484−488.

Strick, M., Dijksterhuis, A., Bos, M.W., Sjoerdsma, A., Van Baaren, R.B., & Nordgren, L.F. (2010). A meta-analysis on unconscious thought effects. Manuscript in preparation. See www.unconsciouslab.com.

Wilson, T. D., Lisle, D., Schooler, J. W., Hodges, S. D., Klaaren, K. J., & LaFleur, S. J. (1993). Introspecting about reasons can reduce post-choice satisfaction. *Personality and Social Psychology Bulletin*, *19*, 331−339.

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.