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Research Article

Predicting Soccer Matches After Unconscious and Conscious Thought as a Function of Expertise

Ap Dijksterhuis,[1] Maarten W. Bos,[1] Andries van der Leij,[2] and Rick B. van Baaren[1]

[1]Radboud University Nijmegen and [2]University of Amsterdam

ABSTRACT—*In two experiments, we investigated the effects of expertise and mode of thought on the accuracy of people's predictions. Both experts and nonexperts predicted the results of soccer matches after conscious thought, after unconscious thought, or immediately. In Experiment 1, experts who thought unconsciously outperformed participants in all other conditions. Whereas unconscious thinkers showed a correlation between expertise and accuracy of prediction, no such relation was observed for conscious thinkers or for immediate decision makers. In Experiment 2, this general pattern was replicated. In addition, experts who thought unconsciously were better at applying diagnostic information than experts who thought consciously or who decided immediately. The results are consistent with unconscious-thought theory.*

When asked to make predictions—for example, to predict which movie will win the next Oscar or which country will win the next World Cup in soccer—people generally rely on conscious deliberation. People with relevant knowledge about the topic are especially likely to deliberate, believing this will lead to better predictions. Common wisdom dictates that conscious deliberation helps decision making in general, and there is indeed ample evidence for this idea (e.g., Edwards & Fasolo, 2001; Newell, Lagnado, & Shanks, 2007).

However, there is also evidence to the contrary: Sometimes conscious deliberation leads to worse decisions (Dijksterhuis & Nordgren, 2006; Igou & Bless, 2007; Pelham & Neter, 1995; Wilson & Schooler, 1991). A period of unconscious thought (whereby the unconscious processes information while conscious attention is directed elsewhere; see Dijksterhuis, 2004; Dijksterhuis & Nordgren, 2006)—reminiscent of laypeople's idea of "sleeping on it"—sometimes leads to better decisions than an equivalent period of conscious thought. In a typical experiment demonstrating this effect, participants choose between a few objects (e.g., apartments), each described by multiple aspects. The objects differ in desirability, and after reading the descriptions, participants are asked to make their choice following an additional period of conscious thought or unconscious thought. In the original experiments, unconscious thinkers made better decisions than conscious thinkers when the decisions were complex (Dijksterhuis, 2004; Dijksterhuis, Bos, Nordgren, & van Baaren, 2006). By now, this effect has been replicated in various laboratories across different stimulus domains (Bos, Dijksterhuis, & van Baaren, 2008; De Wit, van den Bos, Ham, & Muller, 2008; Ham & van den Bos, in press-a, in press-b; Ham, van den Bos, & van Doorn, 2009; Lerouge, in press; Pochwatko, Sweklej, Balas, & Godlewska, 2008; P.K. Smith, Dijksterhuis, & Wigboldus, 2008; Wilbur, Caron, & Campbell, 2008).

Unconscious thought is a goal-directed, active thought process. Two studies (Bos et al., 2008; Zhong, Dijksterhuis, & Galinsky, 2008) have compared people who were distracted after being given the goal to make a later decision with participants who were distracted in the absence of such a goal. Participants who had a goal—that is, who thought unconsciously—made better decisions than participants who were merely distracted. Hence, the finding that unconscious thought often improves decision making cannot be explained as due merely to distraction. Rather, the improvement in decision making is due to some form of active, task-relevant unconscious processing.

Address correspondence to Ap Dijksterhuis, Behavioral Science Institute, Radboud University Nijmegen, P.O. Box 9104, 6500 HE Nijmegen, The Netherlands, e-mail: a.dijksterhuis@psych.ru.nl.

Psychological Science RESEARCH, THEORY, & APPLICATION IN PSYCHOLOGY AND RELATED SCIENCES

One potential reason why unconscious thought sometimes leads to better decisions is that conscious and unconscious thinkers weight information differently. That is, unconscious thought may weight the importance of attributes appropriately, whereas conscious thought seems to suffer from a variety of biases that can jeopardize the weighting process (Dijksterhuis & Nordgren, 2006; Dijksterhuis et al., in press; Dijksterhuis & van Olden, 2006; Halberstadt & Levine, 1999; Levine, Halberstadt, & Goldstone, 1996; Nordgren & Dijksterhuis, 2009; Wilson et al., 1993; Wilson & Schooler, 1991). However, there is a scarcity of evidence for the notion of differential weighting, at least in part because it is difficult to find an appropriate procedure to test it. In one relevant experiment, participants rated the importance of decision attributes, and these ratings were used to see whether participants chose an alternative that was consistent with their own ratings (Dijksterhuis, 2004, Experiment 3). The results of this single experiment were inconclusive: Unconscious thinkers obeyed their own weighting better than conscious thinkers, but not significantly so. Moreover, the ratings of relative importance were themselves made on the basis of conscious thought, which, given that people are prone to errors when they consciously think about weighting (e.g., Levine et al., 1996; Nordgren & Dijksterhuis, 2009), makes them potentially flawed to begin with. Ideally, the relative importance of attributes in a decision problem should be determined objectively. Payne, Samper, Bettman, and Luce (2008) did this by using a gambling task with numerical stimuli, and found that conscious thinkers were, if anything, better at weighting than unconscious thinkers. However, unconscious thought is not capable of strictly following the kind of rules that are needed to work with complex numerical stimuli (Dijksterhuis & Nordgren, 2006; E.R. Smith & DeCoster, 1999), and the results of Payne et al. do not speak to weighting of nonnumerical stimuli.

Another problem is that in the few experiments that have looked at weighting, the information that had to be weighted was provided by the experimenter. In the real world, weighting often starts one step earlier. That is, proper weighting sometimes starts with the decision regarding what information to include or exclude in the first place. For at least some decisions, this initial selection process is the most important part of the weighting process. To investigate such a process requires a task in which the attributes of the decision alternatives are not given by the experimenter, but are generated by the participants themselves.

One such task is predicting future events such as sports games. To decide which of two teams will win a game, participants themselves would have to retrieve and select the information they want to use. An additional bonus of such a paradigm is that there is an objective criterion for the quality of a decision: whether each prediction turns out to be true.

There is no research on unconscious thought and the prediction of sports events, but Halberstadt and Levine (1999) investigated the relation between conscious deliberation and predictions of sports events. They showed that experts who predicted basketball games performed worse when they had to explain the reasons for their choices to other people than when they merely had to predict. From the results, one can conclude that conscious thought can jeopardize weighting, but not that unconscious thought improves weighting.

Unconscious-thought theory (UTT; Dijksterhuis & Nordgren, 2006) predicts that, because of superior weighting, unconscious thinkers will predict the outcome of sports events more accurately than conscious thinkers. That is, unconscious thinkers should be better able than conscious thinkers to differentiate between diagnostic and nondiagnostic information. In the study reported here, we tested this hypothesis, along with the additional idea that the effects of mode of thought on the accuracy of predictions are moderated by expertise. Unconscious thinkers with sufficient knowledge can be expected to benefit from superior weighting, but it is doubtful whether mode of thought will matter much for people without knowledge. Before one can determine what is diagnostic and what is not, one must have at least some domain-relevant knowledge.

The idea that unconscious thinkers may benefit more from expertise than conscious thinkers do is consistent with other findings and theorizing. When people base a decision on information retrieved from memory—as is the case in the experiments we report here—they can rely on gist memory, as well as on explicit, verbatim memory (Reyna & Brainerd, 1995). Over time, experts rely more on gist and less on verbatim memory, and reliance on gist has been shown to be unconscious, whereas reliance on verbatim information is conscious (Brainerd, Reyna, & Mojardin, 1999; Reyna & Lloyd, 2006). Often, unconscious gist-based judgments are superior to consciously derived verbatim-based judgments (e.g., Reyna & Brainerd, 1995).

Research on the verbal overshadowing effect (e.g., Schooler, Ohlsson, & Brooks, 1993) also points to the likelihood that unconscious thought may benefit from expertise more than conscious thought does. Experts learn to engage in more appropriate weighting, and they do this largely automatically. Unconscious thought is likely to foster automatic weighting, whereas conscious thought has been shown to disrupt it, because conscious thought may lead to verbal overshadowing that produces a disproportionate reliance on verbalizable information (e.g., Fallshore & Schooler, 1995).

Recent research on unconscious thought by Lassiter, Lindberg, González-Vallejo, Bellezza, and Phillips (2009) supports this idea. Lassiter et al. reasoned that unconscious thinkers rely on judgments made during on-line information processing, whereas conscious thinkers later engage in memory-based processing that interferes with reliance on on-line impressions. Although their conclusion that unconscious thinkers rely solely on on-line impressions is at odds with numerous findings showing that unconscious thinkers make different (i.e., better) judgments than people who judge immediately after having formed on-line impressions (Dijksterhuis, 2004; Dijksterhuis & van Olden, 2006; Ham & van den Bos, in press-b; Ham et al.,

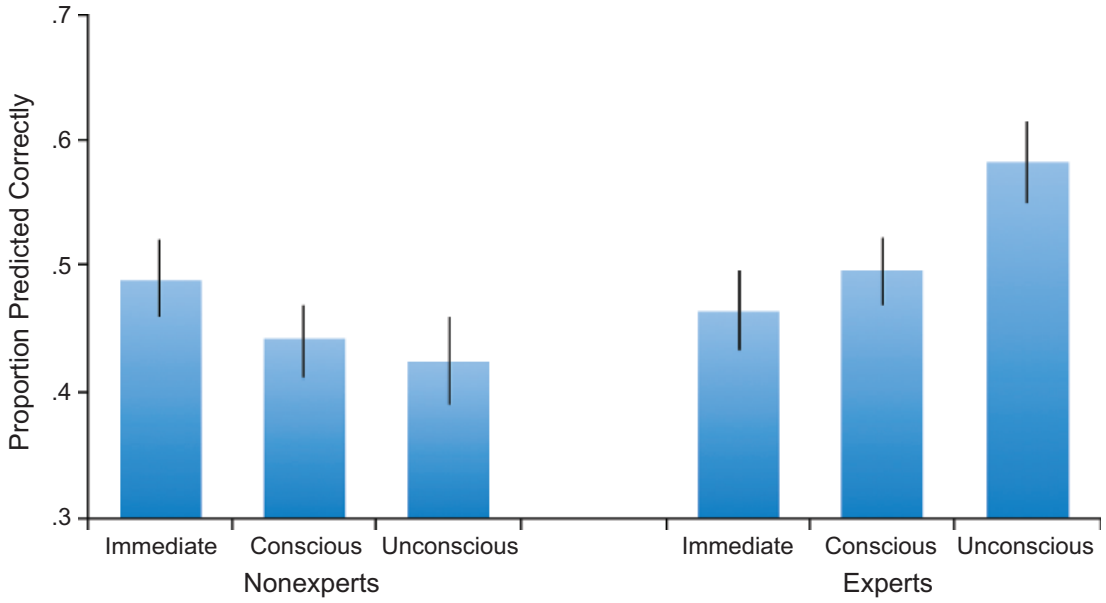

Fig. 1. Proportion of correctly predicted games as a function of expertise and thought condition in Experiment 1. Error bars represent standard errors of the mean.

2009; Lerouge, in press; Wilbur et al., 2008), the conclusion that conscious thought is memory based has merit. It is consistent with the idea that conscious thought can interfere with appropriate weighting or with reliance on gist memory, which in turn suggests that expertise may benefit more from unconscious than from conscious processes.

EXPERIMENT 1

Method

Three hundred fifty-two undergraduates from the University of Amsterdam participated in this experiment. The experiment was included as part of a set of experiments for which participants received course credits or €7.

On each of 6 weeks, a different group of participants was asked to predict four soccer matches from the highest Dutch league ("Eredivisie"). The four matches were randomly selected from nine possibilities for the second weekend following the experimental session. We did not have participants predict the coming weekend's matches because some students play Web-based games in which they predict soccer matches (i.e., "fantasy soccer"), and therefore some participants might have already thought about the coming weekend's matches prior to the experiment.

The experiment started with a question that assessed expertise. Participants indicated how much they knew about soccer, on a scale ranging from 1 (*nothing at all*) to 9 (*very much*). Afterward, they were told that they would be presented with four soccer matches and would have to predict the result of each one (1 = home-team win, 2 = away-team win, 3 = draw). Subsequently, participants were divided into three experimental conditions. In the immediate condition, participants saw the four matches on the computer screen and were asked to provide their answers in 20 s. In both the conscious-thought and the unconscious-thought conditions, participants saw the four matches on the computer screen for 20 s and were told they would have to predict the outcomes later on. Conscious-thought participants were told they had an additional 2 min to think about the matches. Unconscious-thought participants were told they would do something else for 2 min and performed a two-back task designed to occupy conscious processing (Jonides et al., 1997; see also Dijksterhuis, 2004). Impaired performance on this task implied that the manipulation intended to suppress conscious thought about the matches was not effective, but such impairment was observed for only a few subjects, and results did not change when those subjects were eliminated from analyses.

Results

We used a median split on responses to the expertise question to divide participants into experts (score of 5–9, $n = 172$) and nonexperts (score of 1–4, $n = 180$).[1] The proportion of correctly predicted matches was subjected to a 3 (thought condition: immediate vs. conscious vs. unconscious) × 2 (expertise: expert vs. nonexpert) analysis of variance. This analysis revealed a main effect of expertise, $F(1, 346) = 6.48$, $p < .02$, $p_{rep} = .93$, $\eta^2 = .02$, and, more important, a significant two-way interaction, $F(2, 346) = 4.49$, $p < .02$, $p_{rep} = .93$, $\eta^2 = .03$ (see Fig. 1). There were no differences between thought conditions for nonexperts ($F = 1.30$, n.s.), whereas the effect of thought condition

[1]The cell sizes are unequal because quite a number of participants chose the median response (5). We allocated participants with the median score to the experts, as allocating them to the nonexperts would have rendered the cell sizes even more unequal.

was significant for experts, $F(1, 169) = 3.75, p < .03, p_{rep} = .91$, $\eta^2 = .04$. Among experts, unconscious thinkers performed significantly better than both conscious thinkers and immediate decision makers (both ps $< .05$, p_{rep}s $= .88$).

Although we found a main effect of expertise, the overall correlation between expertise and the accuracy of predictions was low ($r = .14, p < .008, p_{rep} = .96$). The separate correlations for the three conditions were revealing. Immediate decision makers showed no correlation between expertise and accuracy ($r = .01$). In defense of the experts in this condition, one could argue that expertise is useful only if one actually has time to apply it. However, the correlation between expertise and accuracy was also low for conscious thinkers ($r = .16, p < .08, p_{rep} = .84$). Only for the unconscious thinkers was the correlation significant ($r = .26, p < .006, p_{rep} = .97$).

EXPERIMENT 2

One goal of Experiment 2 was to replicate the general pattern we found in Experiment 1. Another aim was to obtain more insight into the underlying process. We asked participants to predict the results of matches from the recent World Cup soccer tournament that had been held in Germany. The best single predictor for a World Cup match is the rank of the country on the world ranking list (WRL). This means that experts who know a country's world ranking should use this knowledge in predicting match outcomes. We expected that unconscious thinkers, because of superior weighting, would be more likely to do this than conscious thinkers or immediate decision makers.

Method

One hundred sixteen undergraduates from the University of Amsterdam participated in the experiment. The experiment was included as part of a set of experiments for which participants received course credits or €7.

The experiment was the same as Experiment 1, with only two exceptions. First, participants had to predict the results of five soccer matches from the World Cup. We randomly selected four sets of five matches, and the sets were randomly assigned to participants. Second, after self-reporting their expertise and making their predictions, participants estimated the rank in the WRL of each country in their set by typing a number. To score these estimates, we divided the WRL rankings into 10 categories (top 3, 4–6, 7–10, 11–15, 16–20, 21–30, 31–40, 41–50, 51–75, 76 and up). A response that placed a country in the correct category was scored as 9 points, a response that placed a country in the category adjacent to its correct category was scored as 8 points, and so on; maximum displacement resulted in the minimum score of 0 points.

Results

We used a median split on responses to the expertise question to divide participants into experts (score of 5–9, $n = 64$) and nonexperts (score of 1–4, $n = 52$).[2] The proportion of correctly predicted matches was subjected to a 3 (thought condition: immediate vs. conscious vs. unconscious) × 2 (expertise: expert vs. nonexpert) analysis of variance. This analysis revealed a main effect of expertise, $F(1, 110) = 8.39, p < .008, p_{rep} = .96$, $\eta^2 = .07$, and a significant two-way interaction, $F(2, 110) = 3.45, p < .04, p_{rep} = .89, \eta^2 = .06$. As illustrated in Figure 2, the pattern of results was the same as in Experiment 1. However, because of the limited number of participants, the simple effects were not significant, Fs < 1.91.

The overall correlation between expertise and the accuracy of predictions was again low ($r = .13$, n.s.). Immediate decision makers ($r = .02$) and conscious thinkers ($r = .06$) showed no correlation between these variables. Again, the correlation was significant only for the unconscious thinkers ($r = .38, p < .05$, $p_{rep} = .88$).

Did experts apply their knowledge about the WRL? First, we subjected participants' accuracy in estimating the WRL rankings to a 3 (thought condition: immediate vs. conscious vs. unconscious) × 2 (expertise: expert vs. nonexpert) analysis of variance. This analysis revealed only the trivial main effect of expertise, $F(1, 110) = 23.62, p < .001, p_{rep} = .99$. To get an indication of the extent to which experts applied this diagnostic information, we calculated the correlation between participants' accuracy in estimating the WRL rankings and their predictions for the matches. For both immediate decision makers ($r = .20$) and conscious thinkers ($r = .18$), the correlation was nonsignificant. Again, one can say in defense of the immediate decision makers that they were not given time to apply their knowledge. For conscious thinkers, however, this excuse does not hold. They simply engaged in poor weighting. As expected, the correlation between accuracy in WRL estimates and accuracy in predictions was very high for unconscious thinkers ($r = .60, p < .001$, $p_{rep} = .99$). The latter group engaged in appropriate weighting by applying the diagnostic information.[3]

The correlations between WRL estimates and accuracy should be interpreted with care, as participants estimated rankings after predicting the match outcomes. However, a mediation analysis with accuracy of WRL estimates as a mediator supported our interpretation. For unconscious thinkers, expertise correlated with accuracy of WRL estimates ($r = .52$), and accuracy of WRL estimates correlated very highly with the accuracy of predictions ($r = .60$). When the mediator was put in the equation, the direct effect of expertise on the dependent

[2]Even more than in Experiment 1, many participants chose the median response (5). Again, we allocated participants with this score to the experts group, to make the cell sizes as nearly equal as possible.

[3]One could argue that appropriate weighting should not necessarily lead to a high correlation between WRL estimates and the accuracy of predictions, but rather should result in a strong consistency between WRL estimates and predictions, regardless of accuracy. However, these two correlations are virtually the same, as the results of the matches we used were very much consistent with the WRL. Out of the 20 matches we used, 16 were won by the team higher on the WRL, 2 were lost by the higher-ranked team, and 2 ended in a draw.

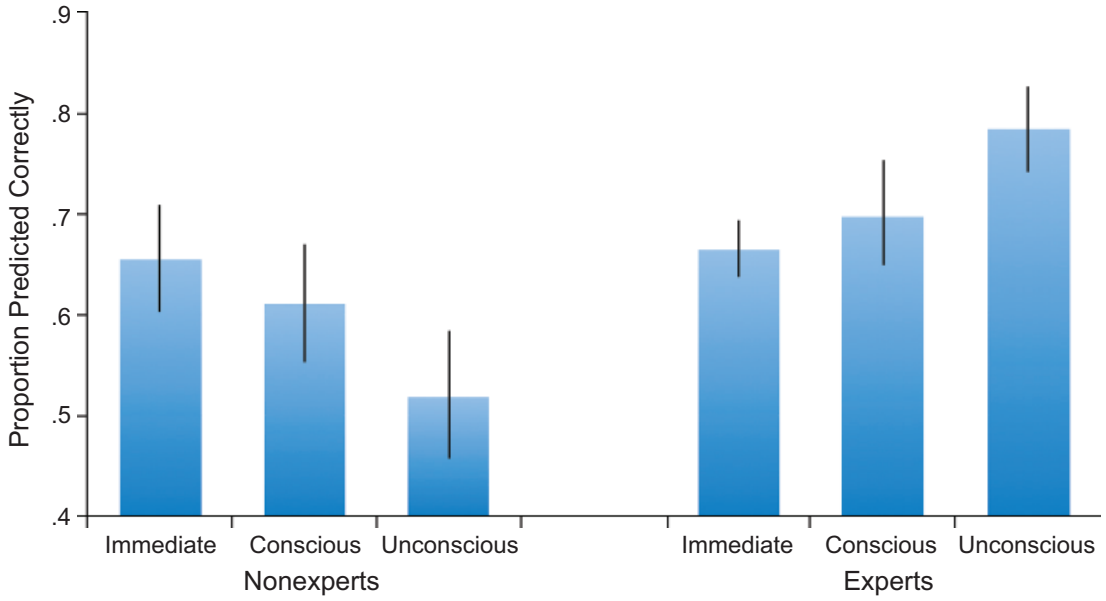

Fig. 2. Proportion of correctly predicted games as a function of expertise and thought condition in Experiment 2. Error bars represent standard errors of the mean.

variable ($r = .38$) diminished ($r = .09$), whereas the correlation between accuracy of WRL estimates and the dependent variable remained high ($r = .56$). In sum, unconscious thinkers engaged in appropriate weighting by applying the diagnostic information.

GENERAL DISCUSSION

These experiments demonstrate that among experts, unconscious thought leads to better predictions of soccer results than either conscious thought or quick, immediate guesses. Experiment 2 sheds light on why this may be so: Unconscious thinkers seem to be better at using the appropriate information to arrive at their estimates. Unconscious thinkers who had more accurate knowledge about the single best prediction criterion (world ranking) made better predictions. This was not true for conscious thinkers or for immediate decision makers.

Curiously, expertise did not help immediate decision makers or conscious thinkers at all. One could argue that immediate decision makers did not have the time needed to apply knowledge, but this argument does not hold for conscious thinkers. Our data point to the fact that, at least under some circumstances, conscious thought can lead to poor weighting, thereby jeopardizing decision making (e.g., Dijksterhuis & van Olden, 2006; Reyna, Lloyd, & Brainerd, 2003).

Our experiments are the first to investigate the relation between expertise and conscious versus unconscious thought. In our paradigm, in which participants had to generate the relevant attributes for the decision themselves (by retrieving information from memory), expertise seemed to favor unconscious thought and not conscious thought. It is not yet clear whether this result will generalize to situations in which the attributes are provided by the experimenter, as in most previous studies on unconscious thought. In such cases, conscious thought may also benefit from expertise because, when the information is fixed, expertise may cause the decision problem to become subjectively less complex. Earlier research (Dijksterhuis et al., 2006; Pochwatko et al., 2008) has shown that conscious thought becomes more beneficial with less complex decisions. Another question that may be addressed in future research is whether experts who engage in conscious thought make better predictions when they are given more time to think.

The current findings are supportive of UTT (Dijksterhuis & Nordgren, 2006), in that unconscious thinkers weighted the relative importance of diagnostic information more accurately than conscious thinkers did. They are also fully in line with fuzzy-trace theory (Reyna & Brainerd, 1995). Experts naturally make more gist-based decisions than novices, and, indeed, gist-based choices are generally better than verbatim-based choices (Reyna et al., 2003). Given that conscious thinkers make more verbatim-based decisions (Reyna & Brainerd, 1995; Schooler et al., 1993; see also Dijksterhuis, 2004; Dijksterhuis et al., in press) whereas unconscious thinkers make more gist-based decisions, fuzzy-trace theory also predicts that expert unconscious thinkers will make better predictions than expert conscious thinkers.

Does this mean that unconscious thought is always the mode of thought to rely on when one is faced with a complex decision? Such a simple conclusion is clearly unwarranted. Unconscious thought is not always superior. It is not skilled at processing complex numerical information, such as that used in gambling tasks (Payne et al., 2008); it is dependent on processing goals and on the way information is encoded (Bos et al., 2008; De Wit

et al., 2008; Lassiter et al., 2009; Lerouge, in press; P.K. Smith et al., 2008); and it is at least in part dependent on the kind of information involved (e.g., verbal vs. pictorial; Ham & van den Bos, in press-a). Additionally, some researchers have failed to find performance differences between unconscious thinkers and conscious thinkers (e.g., Acker, 2008; Newell, Wong, Cheung, & Rakow, 2009; Waroquier, Klein, Marchiori, & Cleeremans, 2008), and such results indicate that there are more moderators yet to be identified.

That being said, our findings are important, as they demonstrate the superiority of unconscious thought in a new domain. What is important about this study is not so much the sports predictions themselves, but rather the use of a decision problem requiring participants to generate information themselves, combined with an objective measure of prediction accuracy. Our results mean that unconscious thought may well be helpful in more situations than some people currently think.

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