including recommendations to let the unconscious guide one's decisions (Dijksterhuis & Nordgren 2006). Newell and Shanks (N&S) have done a commendable job questioning the efficacy of seductive claims regarding unconscious processing. We focus on the Unconscious Thought Theory (UTT) and paradigms used to argue for deliberation-without-attention. Although we agree with the broad claims made in the target article against UTT, N&S do not directly address the role of attentional mechanisms involved in distracted or supposedly unconscious thought. The role of attentional processes in the lens model discussed by N&S is also not clear, although they point to attentional or top-down mechanisms influencing processes such as motion perception. We think the role of attention is extremely critical for the debate on conscious and unconscious thought, and that it requires further elaboration. We suggest rethinking the core assumptions of UTT, the very definition of unconscious thought and the nature of processing during distraction.

A critical assumption of UTT is that the powerful unconscious is not constrained by limited capacity attentional processes (Dijksterhuis & Nordgren 2006). We have questioned the unlimited capacity and optimal weighing assumptions of UTT using simulations that were performed on data sets employed in the UTT paradigms (Srinivasan & Mukherjee 2010). The simulations clearly showed that a small subset of information is sufficient to produce performance that is seen in UTT tasks. Experimental results (Ashby et al. 2011) confirm our concern with the fundamental assumptions of UTT (the capacity and weighting principles). The use of a generic "sub-sampling" heuristic can enable people to "select" a small set of dominant attributes during distracted thought (hypothesized to elicit "unconscious thought") and can partly explain other related findings based on consideration sets even during conscious thought (Mukherjee & Srinivasan 2013). This is consistent with suggestions made by N&S to explain earlier findings on decision making (Wilson & Nisbett 1978). Even intuitive or affective processing (Usher et al. 2011; Kahneman 2011) could be utilizing a subset of attribute information along with quickly recovered cues from memory that would result in decently good solutions because many choice scenarios require attending only to a subset of the information. For example, in Usher et al.'s (2011) data set consisting of 12 attributes and four alternatives, choice based on the two best attributes creates a tie between the best and second best option, and selecting 7 out of the possible 12 attributes results in the selection of the best alternative. These results indicate that attention plays an important role in selecting specific attributes based on prior experience to make satisfying decisions.

A critical problem in many decision making studies is the lack of proper treatment of attentional processes, possibly linked to graded differences in consciousness. For example, attention is used to operationalize "unconscious thought," which we believe conflates attention and consciousness and treats attention as a dichotomous variable (Mukherjee & Srinivasan 2013; Srinivasan & Mukherjee 2010), thereby limiting the construct of attention. Attention can vary as a resource (more versus less) and perceptual scope (focused versus distributed) that involves differences in selection resulting in differences in perception, memory, and awareness (Baijal & Srinivasan 2009; Srinivasan et al. 2013).

Given that people are performing a distractor task during "unconscious thought," the nature of the distractor task – and more specifically the attentional mechanisms employed during distraction – can potentially influence processing either during or after distraction. The changes in (perceptual or conceptual) scope of attention under different situations enable us to sample and process information differently leading to differences in processes involved in memory and decision making. Using the UTT paradigm, we manipulated the distraction task using global or local processing (associated with changes in scope) at low and high levels of cognitive or working memory load (Srinivasan et al. 2013). We found that global processing during distraction resulted in stronger preference for the chosen item irrespective of cognitive load. In addition, we found better incidental memory for attributes with global compared to local processing during distraction only when the distractor was an easy low load task.

Therefore we propose that the putative "unconscious thought" is constrained by differences in the attentional processes employed during distraction (Mukherjee & Srinivasan 2013; Srinivasan et al. 2013) and to differences in selection (e.g., information sampling; Srinivasan & Mukherjee 2010). Theorizing about the causal effects of conscious versus unconscious processes is critically dependent on a proper treatment of attention (like the global workspace theory discussed in the target article). Conflating both attention and consciousness would add more confusion to this critical debate on the role of consciousness in decision making.

More generally, attention could influence judgment and decision making at multiple points such as cues and their utilization – points C and D in the lens model. Selective attention mechanisms (e.g., subsampling) can affect the number of cues selected for processing depending on the weights of the cues and past experience of their validity. Sometimes not attending to part of the information or relying on small samples can prove useful (Gigerenzer & Gaissmaier 2011). The differences in selection (changes in scope of attention) could also affect utilization of the cues and would be consistent with results showing that changes in scope of attention can affect preference strengths and memory (Srinivasan et al. 2013).

The information that we attend to gets privileged access in working memory (McElree 2006) and the access can be related to graded levels of consciousness as attention and working memory interact (Baars & Franklin 2003). A clear understanding about the role of different attentional processes is crucial for debates on the role of consciousness in decision making including the current analysis about causally effective unconscious processes. Much of the published literature in UTT and other areas of decision making (see Mukherjee & Srinivasan 2013) need to be reevaluated through the lens of attentional mechanisms and their role in conscious or unconscious thought.

Performance and awareness in the Iowa Gambling Task

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Abstract: Newell & Shanks (N&S) conclude that healthy participants learn to differentiate between the good and bad decks of the Iowa Gambling Task, and that healthy participants even have conscious knowledge about the task's payoff structure. Improved methods of analysis and new behavioral findings suggest that this conclusion is premature.

Newell & Shanks (N&S) convincingly argue that past research has severely overstated the importance of conscious processes in decision making. We agree with N&S on many counts, but here we focus on what is perhaps our sole source of dissention. N&S conclude that healthy participants who perform the Iowa Gambling Task (IGT) learn to differentiate between the good and bad decks, and that this behavioral differentiation is even reflected in conscious knowledge about the payoff structure. We believe this conclusion may be premature: Several pitfalls in IGT data analysis methods frustrate a fair interpretation of IGT data, and several behavioral findings go against the authors' conclusion.

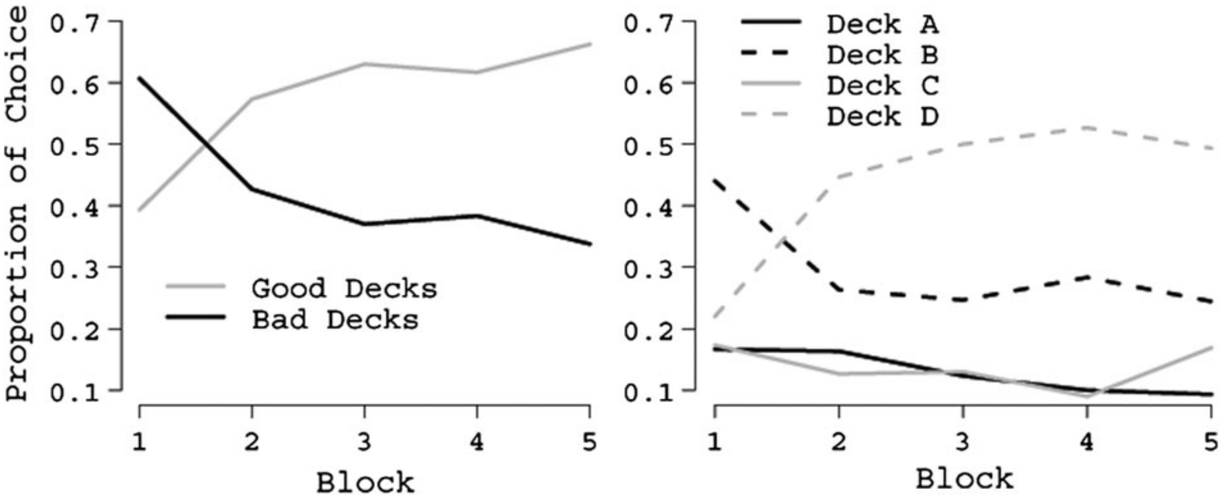

Figure 1 (Steingroever & Wagenmakers). Choice behavior of healthy participants in Fridberg et al. (2010), once for the good and bad decks (left panel) and once for each deck separately (right panel). Each block contains 20 trials, except the last block (15 trials).

The first pitfall is that the traditional way of analyzing IGT data is incomplete and potentially misleading because it collapses choice behavior over the two good decks and over the two bad decks. This procedure hides the impact of the frequency of losses (bad deck B and good deck D yield rare losses, whereas bad deck A and good deck C yield frequent losses) and potentially obscures diagnostic information. For example, consider the data of Fridberg et al.'s (2010) healthy participants. Fridberg et al. plot the mean proportion of choices from the good and bad decks as a function of trial number, replotted here in the left panel of Figure 1. This panel suggests that participants learn to prefer the good decks. However, Fridberg et al. also plot the mean proportion of choices from each deck separately, replotted here in the right panel of Figure 1. This panel shows that, across all trials, participants prefer the decks with infrequent losses (B & D).

A similar problem is evident in work that assesses conscious knowledge about the IGT either with subjective experience ratings (C+D) – (A+B) (Bowman et al. 2005; Cella et al. 2007), or by determining whether participants have conscious knowledge that would encourage them to choose *one* of the two best decks (Maia & McClelland 2004). However, participants who consider "*one* of the best decks as the best deck" do not necessarily understand that there are two best decks and that both bad decks should be avoided. To investigate whether participants understand that there are two good decks, participants should identify the best and second-best deck on each trial.

The final pitfall concerns the way in which IGT studies typically assess the learning process, namely by applying an analysis of variance to assess whether participants' preference for the good decks (i.e., (C+D) – (A+B)) increases over blocks of trials (main effect of block). A significant effect of block is typically taken as evidence that participants learned to discriminate between the good and bad decks. However, when the main effect of block is significant, this does not imply it is also substantial. For example, consider the data of Bowman et al. (2005), who tested three groups of healthy participants that differed in whether they obtained a manual or computerized IGT combined with or without a 6-second delay. The only significant effect was a main effect of block. However, even in the last block (i.e., the final 20 trials), the three groups showed at most a weak preference for the good decks, as (C+D) – (A+B) ranged from about 3 to about 6.5. A value of 3 corresponds to an average of 11.5 out of 20 choices from the good decks, and a value of 6.5 corresponds to an average of 13.25 out of 20 choices from the good decks. Similar unconvincing results were evident from subjective ratings of how positive each deck was experienced. These findings suggest that neither participants' behavioral preference for the good decks nor their conscious preference for the good decks is substantial. Cella et al. (2007) reported similar findings.

Next to the above mentioned pitfalls, several behavioral findings contradict the conclusion from N&S. First, a detailed reanalysis of eight data sets showed that healthy participants learn to prefer the good decks in only one data set (see Steingroever et al. 2013, and references therein). In the remaining seven data sets, participants either only learn to avoid bad deck A (frequent losses) or prefer the decks with infrequent losses (decks B & D). Such a preference for the decks with infrequent losses – the frequency-of-losses effect – has been reported by many studies. The empirical evidence for the frequency-of-losses effect contradicts the assumption that healthy participants learn to prefer the good decks.

Second, Steingroever et al. (2013) showed that participants have a tendency to switch frequently throughout the entire task. This is counterintuitive because one expects a strong decrease in the mean number of switches once participants learned to prefer the good decks. The frequent switches suggest that participants do not learn to systematically differentiate between the good and bad decks, a suggestion that is illustrated by deck selection profiles of 394 participants (Steingroever et al. 2013; see https://dl.dropbox.com/u/12798592/DeckSelectionProfiles.zip for the deck selection profiles); each participant has a highly idiosyncratic choice pattern, and for most participants it is impossible to identify a point where they realized that the good decks should be preferred.

In sum, detailed analyses of IGT data have shown that even healthy participants are unable to discriminate the good decks from the bad decks, a finding that suggests a lack of both conscious and unconscious knowledge in this task.

The problem of the null in the verification of unconscious cognition

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Abstract: Newell & Shanks (N&S) argue that when awareness measures are more reliable and valid, greater evidence of awareness of supposedly