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"Wait! Just Let Me *Not* Think About That for a Minute": What Role Do Implicit Processes Play in Higher-Level Cognition?

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Abstract

The belief that in certain situations we are better off not thinking has anecdotal resonance and appeals to our tendency to follow a "law of least effort." But is it good advice? In this review, I examine recent work from two domains of higher-level cognition—perceptual category learning and decision making—in which similar claims have been made about the benefits of disengaging explicit thought to allow for the operation of superior implicit processes. A reevaluation of this literature suggests a less appealing but perhaps also less surprising conclusion: Complex tasks appear to require explicit thought, and there is little reason to think that *not* thinking is optimal in these situations. Far from offering a negative conclusion, this perspective emphasizes not only the powers of human cognition but also our ability to explain our behavior without recourse to the "black box" of the unconscious.

Keywords

category learning, decision making, explicit thinking, implicit processes, unconscious

There is a popular belief that in certain situations, we are better off not thinking. An often-provided reason for this belief is that by disengaging our deliberative, analytic thinking processes, we allow implicit processes to "take over" and make decisions in a more optimal manner. For example, in discussing techniques for learning complex category discriminations, Filoteo, Lauritzen, and Maddox (2010) claimed "it may be possible to enhance the training of radiologists by having them perform a secondary task while learning to read X-rays" (p. 422). In a similar vein, Dijksterhuis (2004) advised that when thinking about complex decisions such as where to live and work, we should not dwell on explicit thinking but "take [our] time and let the unconscious deal with it" (p. 596).

Despite these reassuring claims that when the going gets tough, implicit processes will see us through, the role that unconscious or implicit influences have on high-level cognition like decision making and category learning remains contentious (e.g., Newell, Dunn, & Kalish, 2011; Newell & Shanks, 2014). The reasons for this contention are manifold; here, I focus specifically on whether disengaging or preoccupying explicit thinking leads to improved performance in complex tasks. A close look at the evidence for this view suggests that the jury is still out and that there is little reason to think that *not* thinking is an optimal strategy for these tasks.

Category Learning

Category learning refers to the process whereby an agent learns to divide up the world into discrete entities—such as learning that some objects are square and some are round, or that some X-rays display tumors and others do not. In laboratory analogs of these tasks, participants are often given perceptual stimuli to categorize into experimenter-defined categories (see Fig. 1). In these experiments, the hypothesized involvement of implicit processes is often operationalized via the inclusion of concurrent or secondary cognitive-load tasks. As such, an implicit process in this context is defined as one that operates largely without deliberative rehearsal and explicit integration of information—that is, without relying on working memory (e.g., Ashby & Maddox, 2005). The logic behind these

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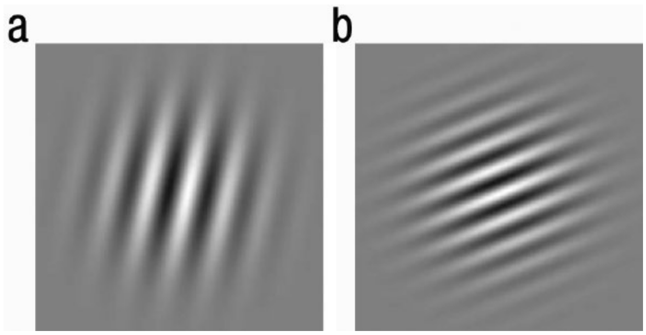

Fig. 1. Example stimuli from a perceptual categorization task. Stimulus (a) and stimulus (b) are representative stimuli that differ in the orientation of their grid lines and their spatial frequency. In a rule-based task, only one of these dimensions (e.g., orientation) is relevant to category membership, which makes acquisition via explicit processes straightforward. In an information-integration task, both dimensions are relevant, and the nature of the category boundary is claimed to make such tasks more amenable to learning via implicit rather than explicit processes.

experiments is that some kinds of category-learning tasks—rule-based (RB) tasks—require working memory, and some—information-integration (II) tasks—do not, and thus, one should see differential effects of imposing additional cognitive load on the learning of these different tasks.

Having time to think?

Filoteo et al. (2010) claimed support for the differential involvement of working memory when they demonstrated that participants who learned a complex II perceptual categorization task interpolated with a secondary working memory scanning task outperformed participants who learned only the categorization task. Filoteo et al. explained this result by arguing that when working memory resources are being used on the scanning task, control of performance on the category-learning task is more readily taken up by implicit processes. These implicit processes yield superior accuracy on the category-learning task because they predecisionally integrate information from the multiple dimensions present in the II category structure (see Fig. 1).

Newell, Moore, Wills, and Milton (2013) revisited this result and demonstrated in a new experiment that Filoteo et al.'s key finding appeared to be due to differences in the amount of time participants had to process feedback from the category task across the two conditions. Specifically, in the original study, those participants who learned only the categorization task had less feedback-processing time (only 2,500 ms) than did those given the interpolated scanning task (4,500 ms to process the task feedback). In the new experiment, Newell et al. compared conditions in which participants had either long (4,500 ms) or short (2,000 ms) processing times and crossed this factor with the position of the memory scanning task in the trial sequence. They found that irrespective of whether the memory scanning task was directly before or directly after the category task, participants with more time to process feedback had higher categorization accuracy. This result suggests that when one is learning a complex category structure, having time to think—and, presumably, to test hypotheses—is beneficial. This account requires no recourse to implicit processes, and it suggests that explicit processes that rely on working memory are beneficial even in complex category problems.

Reevaluating evidence for selective impairment

A similar conclusion was reached by Newell, Dunn, and Kalish (2010) in a reevaluation of Zeithamova and Maddox's (2006) claim that the addition of a concurrent working memory load impairs the learning of RB tasks but not II tasks. The logic underlying this claim is similar to that employed by Filoteo et al: II tasks are better suited to implicit processes, and these processes can operate unimpeded even when working memory resources are employed elsewhere. In contrast, RB tasks need working memory, and thus imposition of a concurrent load will impair performance.

When Newell et al. repeated Zeithamova and Maddox's experiment, they found no evidence for the selective impairment of RB category learning. Indeed, in two of their experiments, participants given the II task with the concurrent load were the poorest performers in terms of categorization accuracy. Moreover, an additional analysis of the Zeithamova and Maddox data, restricted to only those participants who achieved 65% accuracy on the category task and performed the concurrent working memory task adequately, revealed no differential effect of cognitive load in the RB and II tasks. (Note this focus on "learners," as opposed to non-learners, makes sense if the goal is to understand the effects of imposing cognitive load on participants who learn rather than on those who respond randomly.)

Newell et al. (2010) also highlighted some deeper concerns about the practice of relying on functional dissociations for determining the involvement of separable processes. Put simply, finding that Variable A (e.g., cognitive load) has a detrimental effect on Task X (e.g., an RB task) but no effect on Task Y (e.g., an II task) tells you precisely nothing about whether Task X and Task Y rely on distinct processes. Even if Task X is detrimentally affected while Task Y is simultaneously facilitated—a "double dissociation"—this still does not logically allow conclusions to be drawn regarding the number of independent processes producing the data (see Fig. 2 in

Newell & Dunn, 2008, for elaboration on this argument in the context of category learning).

Newell et al. (2010) advocated an alternative approach based on *state-trace analysis* (Bamber, 1979), which allows one to examine the dimensionality of data without relying on dissociation logic (see also Dunn, Newell, & Kalish, 2012; Newell & Dunn, 2008). The application of this approach to category learning tasks has, so far, led me and my colleagues to be skeptical of the claim that distinct implicit and explicit processes are required to explain category-learning performance (Newell et al., 2011)—but the debate continues (e.g., Ashby, 2014; Dunn, Kalish, & Newell, 2014).

A uniform role for working memory

Dissociation logic aside, a corollary arising from the argument that "not thinking" in II tasks is good for you is that higher working memory capacity should be beneficial for learning RB tasks but not II tasks. Lewandowsky, Yang, Newell, and Kalish (2012) tested this prediction by giving the same individuals a series of II and RB tasks that differed in complexity, alongside a comprehensive battery of tests of working memory capacity. The results were clear-cut: Structural equation modeling revealed a strong relationship between working memory capacity and category learning irrespective of the type of category task. Working memory capacity was also uniformly related to participants' ability to focus on the most task-appropriate strategy. Taken together, these results suggest that working memory underpins performance in both II and RB tasks. (For a similar discussion suggesting that working memory is important for all types of category learning, see the exchange between DeCaro, Carlson, Thomas, & Beilock, 2009; DeCaro, Thomas, & Beilock, 2008; and Tharp & Pickering, 2009.)

Summary

The simple story that emerges from these investigations of category learning is that there is no "free lunch"—disengaging explicit thought does not appear to help performance on complex tasks. On both varieties of the oft-studied perceptual category tasks, people benefit from having higher working memory capacity, from having time to think, and from being allowed to focus on a single rather than a dual task. Similar challenges to the role played by implicit processes in other popular category learning tasks have also been leveled, suggesting that the same conclusions extend to non-perceptual tasks (e.g., Lagnado, Newell, Kahan, & Shanks, 2006; Newell, Lagnado, & Shanks, 2007). Moreover, appeals to neuroscientific evidence, often made to bolster claims about the involvement of implicit processes, can be questioned on both methodological (e.g., Gureckis, James, & Nosofsky, 2011) and theoretical grounds (e.g., Newell, 2012; Newell et al., 2011).

Decision Making

One of the most eye-catching recent claims in the decision-making literature is that unconscious thought is better suited to complex decisions than conscious thought (Dijksterhuis, Bos, Nordgren, & van Baaren, 2006). This claim is remarkably similar to those made within the categorization literature—that one may realize performance improvements by disengaging explicit processing. What is the evidence?

Deliberating without attention?

In the standard experimental paradigm, participants are presented with information about three or four objects (e.g., apartments), each of which is characterized by 10 or more attributes (e.g., rental cost), and are asked to choose the best object. (In essence, this is a categorization task, albeit one in which participants have a priori knowledge of attribute/feature importance.) In most experiments, "best" is determined normatively by the experimenter's assigning different numbers of positive and negative attributes to each option. Attribute information about the four options is presented sequentially and typically in a random order. Following the presentation of the attributes, participants are assigned to one of three (or sometimes only two) conditions. In the unconscious-thought condition, participants are prevented from making a decision for a few minutes by engaging in some distracting activity (e.g., solving anagrams). This displacement of attention is what is claimed to allow the superior implicit processes (unconscious thought) to operate. In the conscious-thought condition, participants are asked to think carefully about their choice for a few minutes, and in the immediate condition (sometimes not included), participants are simply asked to make their decision as soon as the presentation phase has finished.

The key result is that participants who have been distracted in the unconscious-thought condition make better choices than do those in the either the conscious-thought or the immediate conditions. For example, Dijksterhuis et al. (2006) reported that 60% of participants chose the best car after being distracted, compared with only 25% following conscious deliberation.

As part of a comprehensive review of unconscious influences on decision making, Newell and Shanks (2014) examined the deliberation-without-attention literature in some detail and drew the following three conclusions. First, there are clear questions surrounding the replicability of the key result: Several studies have shown no advantage for decisions following distraction (e.g., Newell & Rakow, 2011; Newell, Wong, Cheung, & Rakow, 2009). Using Bayes factor analysis, Newell and Rakow (2011) demonstrated that there was in fact evidence *for the null hypothesis* of no difference between conscious- and unconscious-thought conditions in a sample of over 1,000 participants from Newell and Rakow's (2011) labs. Second, several of the studies that have shown an advantage following distraction did not include the relevant control conditions (e.g., there was no immediate condition), making it impossible to determine whether distraction was beneficial or deliberation was detrimental (e.g., McMahon, Sparrow, Chatman, & Riddle, 2011). Third, some studies that have found the effect have offered alternative explanations that do not involve the operation of implicit processes during distraction (e.g., Payne, Samper, Bettman, & Luce, 2008; Rey, Goldstein, & Perruchet, 2009). For example, Payne et al. (2008) demonstrated that allowing participants to think consciously for as long they liked (rather than for a forced amount of time) led them to make decisions that were superior to those made following distraction. Taken together, these results suggest that the case for improving decision making via the disengagement of explicit thinking has been overstated—a view echoed by some commentators (Hogarth, 2010; Thompson, 2014) and vehemently opposed by others (e.g., Dijksterhuis, van Knippenberg, Holland, & Veling, 2014).

Is more explicit thinking always better?

The lack of improvement following distraction is troubling for proponents of the "free-lunch" view, but finding that a period of deliberation does not lead to better choices appears equally inconsistent with an "explicit-thinking-is-better" view. However, such null effects are inconsistent only if one views the conditions under which deliberation is employed in the standard paradigm as optimal. Many would argue that they are not, because information is presented randomly and discretely and is unavailable for consultation during the deliberation period (Shanks, 2006). Thus, attempting to deliberate with such scattered and poorly encoded information may well not be very useful (see also Newell & Rakow, 2011, p. 723).

This issue also brings into focus an important distinction that is relevant to both domains of research reviewed here. The claim under scrutiny is not that disengaging explicit thinking can sometimes be beneficial—sometimes overthinking or providing post hoc justification for decisions can be detrimental (Wilson & Schooler, 1991). Nor is this an argument about whether decisions that we make quickly or intuitively are necessarily bad (Hogarth, 2001; Kahneman, 2011; Newell & Shanks, 2014). The key claim is that by disengaging, one allows superior implicit (and perhaps unconscious) thought processes to "take over" and make decisions more optimally in these tasks. This idea that there is some active, yet implicit, processing occurring outside of our awareness does not appear to be well supported by the literature (cf. Waroquier, Abadie, Klein, & Cleeremans, 2014).

Conclusion

Anecdotally, we have all experienced those times when we want to set a decision aside for a while because we cannot reach a conclusion. Many of us might also recall those times when, later, the answer then "pops" into our heads, seemingly from nowhere. It is important to remember, however, that the plural of anecdote is not anec*data*. While it might be tempting to generalize from these experiences and to sit back and hope that sophisticated implicit-processing machinery will save the day, it seems that at least when attempting to learn new categories or make, complex, multi-attribute decisions, engaging explicit thought is likely to be very helpful. Far from being a dispiriting or negative conclusion, this perspective emphasizes not only that human cognition can achieve many complex feats, but that also psychological science can explain many of these achievements without appealing to the black box of the unconscious.

Recommended Reading

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Hoffman, J. A., von Helversen, B., & Rieskamp, J. (2013). Deliberation's blindsight: How cognitive load can improve judgments. *Psychological Science*, *24*, 869–879. An empirical article demonstrating the importance of identifying the strategies people use in multi-attribute judgment for drawing conclusions about the impact of cognitive load.

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