Open Peer Commentary

The dual-system approach is a useful heuristic but does not accurately describe behavior

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Abstract

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We argue that the dual-system approach and, particularly, the *default-interventionist* framework favored by De Neys unnecessarily constrains process models, limiting their range of application. In turn, the accommodations De Neys makes for these constraints raise questions of parsimony and falsifiability. We conclude that the extent to which processes possess features of system 1 versus system 2 must be tested empirically.

De Neys has described an elegant dual-process model to overcome conceptual shortcomings among other models. At the same time, the model is constrained to fit a systems approach and a *default-interventionist* framework, which significantly limits its range of application. We question the necessity and value of these constraints and key components of the model designed to accommodate those constraints.

De Neys restricts his model to accounting for behavior that can be described in a default-interventionist framework, in which system 2 processes are engaged only when system 1 fails to offer an adequate response. However, not all dual-process models share the default-interventionist structure (e.g., Gilbert, 1999; Sherman, Klauer, & Allen, 2010). In fact, many models assume that system 2 is the default. For example, Jacoby's work on recognition memory specifies that familiarity (system 1) only drives responses when recollection (system 2) fails (Jacoby, 1991). In Payne's work on implicit stereotyping, people rely on automatically activated stereotypic associations (system 1) only when judges are unable to determine whether they are looking at a gun or a tool (system 2; Payne, 2001). Ferreira, Garcia-Marques, Sherman, and Sherman (2006) extended the same logic to standard judgment and decision-making errors (e.g., base-rate; conjunction; ratio-bias effect; and law of large number problems). Importantly, direct modeling comparisons in these domains show that system 2 default models better account for these judgments than a default-interventionist model. As well, none of the tasks in these examples inherently demands the prioritization of system 2 (a condition De Neys identifies as irrelevant to his discussion of dual systems).

It is the default interventionism requirement that necessitates a switching mechanism, which we find problematic in a number of ways. Most basically, we are skeptical that a serial model is more efficient than a parallel model. Certainly, it is an unusual claim among general theories of information processing. In any case, De Neys solves this problem by positing that there may be system 1 versions of system 2 processes that do operate in parallel to system 1. However, this accommodation further requires that conflicting responses and their detection must also reside in system 1. These claims are undermined by considerable behavioral and neuroscience evidence that conflict monitoring requires attention and effort, presumably indicating a system 2 process. As well, conflict monitoring is associated with activation in the dorsal anterior cingulate cortex (dACC), a brain region involved in higher-level function. The dACC is associated with attention to a problem and effort to address it with intentional action (e.g., Carter & van Veen, 2007).

Of course, De Neys can evade these problems by simply positing that any conflict detection that appears to involve system 2, in fact, involves a system 1 routinization of system 2 (and, presumably, is generated in a site different than dACC). But doing so raises concerns about parsimony and unfalsifiability. If there is always the possibility of unmeasured system 1 operations, then it is not clear how the model could possibly be falsified.

Adherence to the requirements of a dual-process or system approach also unnecessarily constrains the model and its assumptions. We certainly concur with De Neys that systems 1 and 2 cannot be expected to yield unique responses. However, process exclusivity – the notion that, at any given time, processes must belong solely to system 1 or 2 – also is problematic. For example, driving may become quite efficient (system 1 feature) but continue to require intention (system 2 feature). The ability to inhibit racial bias is compromised by old age and alcohol (suggesting system 2), yet frequently operates effectively on implicit measures of bias (suggesting system 1; Calanchini & Sherman, 2013). Thus, the same process may possess features of either system and those features (e.g., intention; awareness; controllability; efficiency) rarely all coincide (Gawronski, Sherman, & Trope, 2014).

More broadly, these issues highlight the problematic dual-process tendency to conflate *operating principles* and *operating conditions*. Whereas operating principles refer to the qualitative nature of a process (i.e., what the process does –detect; suppress), operating conditions refer to the conditions under which the process operates (e.g., with or without intention or cognitive resources). In dual-process models, it is common to assume that certain processes (e.g., response inhibition) must possess certain features (e.g., resource-dependence). Such assumptions are often necessary to maintain the claim of two distinct process types or systems. However, whether a process possesses features ascribed to system 1 and/or 2 is an empirical question that should be tested directly (Sherman, Krieglmeyer, & Calanchini, 2014).

In our own research, we have adopted this approach via the use of multinomial modeling techniques (Sherman et al., 2010). We found De Neys' model especially interesting in that, in many ways, it aligns with a model we have applied extensively

(Sherman et al., 2008). Briefly, the Quad model proposes that, when an automatized response (implicit bias) conflicts with an intended response (respond favorably), a third process acts as arbiter to decide the winner. Obviously, this bears similarity to De Neys' portrayal of conflict detection and resolution, which we found highly valuable. However, we make no assumptions about the system 1 versus 2 features of these processes. Rather, we measure the processes independently and directly examine how they respond to interventions. For example, we know that both the intended response and conflict arbiter processes are relatively inefficient because they are undermined by short response deadlines. We believe this is the way forward for describing and testing process models.

If dual processes or systems cannot be distinguished by exclusive outcomes, processes, or features of processes, one must ask what is the point, particularly if they necessitate the sorts of work arounds De Neys must build to make it all work. It is more productive to simply identify the processes involved in some operation and the conditions under which they operate with no constraint of fitting into distinct process types or systems. The dual-process approach is effective as a heuristic for thinking about human behavior, but rarely describes that behavior accurately.

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Conflict of interest

The authors declare none.

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