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Commentary

The Jury of Intuition: Conflict Detection and Intuitive Processing☆

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Recent findings on error or conflict detection during thinking suggest that individuals often intuitively detect conflicts between heuristics and traditional normative standards. This work has generated results that are especially pertinent to the perspectives discussed in this special issue, potentially bridging certain divides. For example, interpreting these findings casts intuition in an entirely new light: perhaps intuitions are also quasi-logical in an important sense. This renders the naturalistic and heuristics and biases accounts presented in the issue more compatible than they seem otherwise. We summarize the most relevant implications of the conflict detection findings and show how they relate to the dual process account of intuition and decision making more broadly. Furthermore, we suggest that this new view of intuitive processes has important implications in organizational settings, especially as it relates to improving performance in typically biased contexts.

Keywords: Intuition, Conflict detection, Reasoning

The recent special edition of *JARMAC* presented a number of compelling accounts of how researchers can model and aid intuition, uniting both theoretical and applied perspectives. The diversity of topics covered in the edition, which ranged from computational models of intuitive judgment to the use of intuition within legal processes, is a testament to the variety and breadth of the topic. Using various media and implicating many, sometimes competing metaphors, Hoffrage and Marewski (2015) illustrate in their introductory article that the role, nature, and origin of intuition are all highly contested. Although intuition has been conceived of as guiding the intellect and inspiring artists and poets, it is also at points envisioned as an obscure repository of unrefined and inaccurate urges, the source of many reasoning errors. As Hoffrage and Marewski further illustrate, in everyday life, when professionals are forced to explicitly account for their decisions, they often do so by making reference to their intuitions, but they are often hesitant, even ashamed, to admit this aloud.

The main claim of the present commentary is that the ambiguity that attaches to interpreting and trusting intuition,

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an ambiguity present throughout a number of the articles in the edition, can be accounted for by conclusions derived from recent research in conflict detection during reasoning (e.g., De Neys, 2012; Pennycook, Fugelsang, & Koehler, 2015). Namely, we will propose that this research suggests that intuitions track associative bundles of fast heuristics—like stereotypes—but they also reflect quasi-logical features of our environment (see also Dhami, Belton, & Goodman-Delahunty, 2015). It is, in fact, the battle between these two opposing types of intuitions that often seems to best characterize a number of cognitive conflicts. But before further characterizing this proposal and relating it to Klein's (2015) insightful suggestions, it is worthwhile to review some evidence.

Decades of decision making research has contrasted the operation of fast, fairly effortless processes (System 1) with slower, more deliberative modes of reasoning (System 2) (Sun, 2015). Although System 1 processes, including intuition, often work quite well and are efficient means of reacting to complex environments (Gigerenzer, 2008), they sometimes conflict with logical and mathematical principles (Evans, 2003, 2010; Kahneman, 2013; Stanovich & West, 2000). Conflicts of this sort have been discovered across many domains, but until relatively recently they were considered to occur imperceptibly. However, contemporary empirical analysis of reasoners in contexts of conflict illustrates that many—indeed, most—reasoners seem to be sensitive to conflicts between intuitions and logicomathematical principles even when they end up erring (e.g., De Neys, 2012, 2014).

The evidence for such conflict detection sensitivities spans many reasoning domains and is derived from both behavioral and physiological measures. The basic rationale in these studies is to contrast people's processing of classic reasoning problems in which heuristic intuitions and logicomathematical principles cue conflicting responses with control no-conflict problems in which such conflict is not present. Behavioral results indicate that compared to no-conflict items, when individuals are presented with conflict problems they tend to respond more slowly (e.g., Bonner & Newell, 2010; De Neys & Glumicic, 2008; Pennycook, Fugelsang, & Kochler, 2012; Stupple & Ball, 2008; Villejoubert, 2009) and they indicate that they are less confident than when they are answering no-conflict problems (De Neys & Feremans, 2013; De Neys, Cromheeke, & Osman, 2011; De Neys, Rossi, & Houdé, 2013; Gangemi, Bourgeois-Gironde, & Mancini, 2015; Johnson, Tubau, & De Neys, 2016; Thompson & Johnson, 2014). They also tend to make eye movements to the critical logicomathematical information in the problems while evaluating their conclusions, as demonstrated in eye and gaze tracking experiments (Ball, Phillips, Wade, & Quayle, 2006; De Neys & Glumicic, 2008; Morsanyi & Handley, 2012). Additionally, there is neuropsychological evidence for conflict detection from fMRI (De Neys, Vartanian, & Goel, 2008; Simon, Lubin, Houdé, & De Neys, 2015), EEG (De Neys, Novitskiy, Ramautar, & Wagemans, 2010) and skin conductance recordings (De Neys, Moyens, & Vansteenwegen, 2010).

The primary implication of this research is that individuals seem to have fast, intuitive access to certain logical principles. Even when stereotypes or other intuitive processes ultimately overwhelm these principles, leading reasoners to err, they nonetheless show evidence of at least cursory access to them. On the general dual process schematic introduced before, it is fairly uncontroversial to suppose that intuitions are System 1 processes; however, as Klein illustrates, the status of the former is hotly contested within this structure. For example, to the Heuristics and Biases community (H&B), intuition is often primarily envisaged as the source of reasoning errors. Conversely, members of the naturalistic decision making (NDM) community emphasize that intuition is a manifestation of experience that culminates in rich mental models that work quite well, and the fast and frugal heuristics (FFH) community often considers intuitions primarily as optimally adapted heuristics that generate decision making strategies that rival slower System 2 processes. As Klein suggests, the distinction between the last two is often a matter of degree and perspective. Although NDM and FFH are, in many respects, compatible, the former often emphasizes specific intuitive tools that develop through expertise, while the latter often focuses on all-purpose heuristics.

One of Klein's main proposals is that the H&B community reduce its emphasis on errors in intuitive processes and adopt the NDM perspective that encourages research into the sorts of insights and expertise that naturalists have found to bolster optimal intuitive decision making. We believe that research in conflict detection offers a relatively straightforward complimentary proposal: by underscoring that even reasoners who make errors often have a subtle intuitive sense of the shakiness of their reasoning, it posits a functional mechanism that links erring to the sorts of insights and expertise the NDM community emphasizes. In other words, research in conflict detection suggests that the H&B and NDM perspectives are often natural compliments of one another. To further illustrate how conflict detection research clarifies the NDM perspective, consider an additional example drawn from Klein's article.

Without too much injustice, one could characterize the sorts of real-world exercises the NDM community employs as bolstering intuitive access individuals often already have to relevant logicomathematical or other principles, while further equipping them with inhibitory tools for situations of conflict. For example, one of the exercises Klein touts involves tactical decision games, which are exercises designed to teach strategic doctrine to members of the military. Although soldiers could simply be required to commit to memory a list of strategic propositions, Klein and his team discovered that playing mock games deepens emotional and semantic ties to the doctrine, thereby reinforcing it better than simple memorization. In such games, soldiers are allowed to make strategic mistakes in front of facilitators who then introduce "variations that would bring home the consequences of mistakes such as failing to post sentinels" (Klein, 2015). Although soldiers generally know that securing their perimeter is important, given a number of constraints and conflicts (the need to quickly establish a command post, to set up communications, etc.), they might incorrectly prioritize other considerations and neglect to post sentinels. Research in conflict detection might help to explain how learning in tactical decision games occurs by suggesting that exercises of this sort reinforce access to intuitive principles—like the need

to post sentinels—while equipping individuals with additional inhibitory control to overcome competing intuitions.

In summary, increasing research suggests that intuitions often track the potentially problematic nature of automatic responses, even when they fail to overturn these. We have suggested that this research is an important contribution to the conversation about aiding and modeling intuition. In particular, we believe that it can help to explain some of the ambiguity that attaches to discussions of intuition and offers a potential complimentary explanation of some of the successes of the NDM community.

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