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Putting Naturalistic Decision Making into the Adaptive Toolbox

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Naturalistic decision making (NDM) falls clearly within the realm of bounded rationality—the art of making decisions with limited time, knowledge, and other resources. Herbert Simon, known as the father of bounded rationality, once illustrated its logic with the image of a pair of scissors whose blades are cognitive heuristics and the structure of environments. The study of bounded rationality is accordingly the analysis of the heuristics people use, the analysis of the structures of environments in which people make decisions, and the match between the two. We have called the degree to which this match exists the "ecological rationality" of a heuristic, that is, the degree to which it can exploit the structure of information in its environment (Gigerenzer et al., 1999). There are strong parallels between our research program on ecological rationality and that of NDM, such as the focus in both on simple decision-making heuristics that are task-specific rather than general-purpose and computationally fast and frugal rather than optimizing. Work in NDM has already expanded our understanding of these components of the "adaptive toolbox" of human decision mechanisms (Todd et al., 2000). In this comment, we highlight how the ecological rationality perspective can help strengthen NDM research in turn.

Natural Decision Making Can Be Formally Modeled

Perhaps the most important feature of NDM is that it deals with real-world tasks rather than with the stock-in-trade of classical decision experiments, such as choice between hypothetical gambles. Together with its focus on expertise and on group decision making, these aspects of NDM research have opened up promising areas of investigation. However, these emphases seem to lead NDM researchers to feel that they cannot build precise models of the decision-making processes involved in real-world situations. Lipshitz et al. (this issue) state that "to be valid, NDM models have to describe what information decision makers actually seek, how they interpret it, and which decision rules they actually use. This is another reason why NDM models tend not to be formal, and especially not abstract." We agree with the first sentence, and disagree wholeheartedly with the second, which sets up a misleading opposition. NDM researchers need not choose between formal modeling and descriptively valid and task-specific (rather than abstract) processes. By focusing on the rules that people use to search for information, stop their search, and make decisions based on the information found, precise models can be built of the mechanisms that underlie much of human decision making, as we have done in studying fast and frugal heuristics in the adaptive toolbox (Gigerenzer et al., 1999). While NDM researchers also point to the importance of considering psychological processes that generate decisions (rather than focusing on the final outcomes themselves), they do not take this objective far enough—overcoming the false opposition between formal modeling and real-world decisions can lead to more of the rigor and depth they desire for their theories.

Rules For Search and Stopping

Here is an example of the kinds of questions that formal modeling could lead to. For situation-action matching decision rules, we agree that the search for options is an important and often-overlooked aspect of choice, usually leading to options being considered sequentially. In common with the NDM approach, we think that such sequential search can often be performed in a fast and frugal way through Simon's notion of satisficing—setting an aspiration level through prior experience and using that aspiration level to stop search once a sufficiently good option has been encountered. In this way, options need never be compared, nor complex optimal-stopping calculations performed. But this overall framework must be filled in with more specific models of the search and stopping processes involved.

To begin with, how is the aspiration level set in the first place? This occurs during the learning process through which a decision maker gains the necessary domain-specific expertise, but we should be able to say more specifically how past experiences alter the aspiration level that a given expert uses. Second, how are the various options compared to the aspiration level? This is where NDM's situation-action matching rules come into play, but the precise method by which the matching occurs, and the nature of the cues over which that matching is done, remains to be spelled out for various specific domains. This matching process should also be fast and frugal to fit into the overall approach of making good decisions under time pressure—for instance, cues (which typically also need to be searched for) need only be sought until some sufficient level of confidence in a match (or certainty of mismatch) has been achieved. Finally, how are the options themselves found? The NDM perspective indicates that they are generated by the decision maker in a way that yields highly feasible options first—but can more be specified about the process that does this, rather than relying on vague ideas that sound like "availability"? Some possibilities that we have already explored in the context of searching for cues include checking them in order of their past record of success, or past use, or randomly (Gigerenzer et al., 1999).

Benefits of Formal Modeling

Thus, in contrast to what Lipshitz et al. propose, the alternatives for studying NDM are not context-free formal modeling versus context-bound informal modeling, as research on context-specific formal models of the contents of the adaptive toolbox has shown (Gigerenzer & Selten, 2001). The greater precision that comes from formal modeling will allow detection and repair of current inconsistencies in NDM, fixing those spots where its bounded rationality is overcome by traditional ideals of complete information integration. For instance, the STEP model's use of extensive information processing, in which "… stories are revised to incorporate all available information into the most complete and plausible account possible," could be replaced by a more realistic fast and frugal process. New clear and precise predictions will also become possible, rather than reliance on fuzzy constructs such as "mental models" and "typicality judgments;" in particular, greater precision can engender surprising predictions of the sort that can give the strongest support to NDM theories. And formal models will allow the creation of computer simulations not only of natural decision situations in which to test human behavior (as is already done by NDM researchers), but also of the decision mechanisms themselves, so that the details of the operation of these mechanisms and their mesh with the environment can be worked out. By bolstering the theoretical foundations of NDM in these ways, it will become clear exactly how the components of NDM fit into the adaptive toolbox of ecological rationality.

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