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Combining the Strengths of Naturalistic and Laboratory Decision-Making Research to Create Integrative Theories of Choice

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Naturalistic decision-making research contrasts with traditional laboratory research along a number of dimensions. It is typically more observational, more focused on expert performance, and more attentive to the context in which decisions are made than laboratory studies. This approach helps to shore up some of the weaknesses of laboratory research by providing incentive to develop integrative theories of choice and examining strong methods of problem solving in a choice domain. This paper contrasts the strengths and weaknesses of laboratory and naturalistic approaches to decision making. Then, it explores strategies for using both of these approaches as well as mathematical and computational modeling to find the optimal tradeoff between internal and external validity for research projects.

General Audience Summary

Two prominent strands of research on how people make decisions are laboratory studies (which focus on experiments often involving undergraduates or novice decision makers) and naturalistic decision-making studies (which typically explore the strategies experts use in complex settings). These strands are pursued by different researchers and the two areas of work do not sufficiently influence each other. This paper contrasts these two approaches to research and suggests the strengths of each are complementary. By combining approaches, researchers may be able to develop better and more integrative research on how people make choices.

Keywords: Decision making, Naturalistic decision making, External validity, Internal validity

Laboratory research in decision making is a major success story for cognitive science. It has yielded a trove of research that has led to two Nobel prizes (for Daniel Kahneman and Richard Thaler), has forced the field of economics to rethink fundamental assumptions about human rationality, and has become a central part of the way people in business are taught about choice.

Despite significant advances in what we know about decision-making behaviors, there are few comprehensive models that help us to understand how decision makers will approach choice situations in natural settings. Instead, the field does an excellent job of characterizing the strategies people use in constrained situations such as evaluating a particular set of options (called a *consideration set*), developing preferences for those items, and ultimately selecting one.

In parallel with this laboratory research is an extensive literature on natural decision making that explores expert decision makers in realistic contexts (e.g., Gaeth & Shanteau, 1984; Klein, 2008). This work has done an effective job of describing the kinds of decisions that real people (typically experts) make in actual contexts. This work has led to the development of integrative proposals about choice that provide generalizations of existing observations.

These research strands are complementary. Laboratory studies provide the control that is typically needed to infer the causal

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factors underlying decision-making tasks, but they often lack external validity. Naturalistic decision-making studies provide rich data sets, but often lack the controls necessary to isolate causal variables.

In this paper, I explore the factors that make it difficult to develop integrative theories of decision making based on laboratory research. Then, I explore the ways that studies of naturalistic decision making provide opportunities for thinking more expansively about decision contexts. Next, I examine the benefits of developing an integrative framework for laboratory studies. Finally, I suggest that research in decision making seek the optimal tradeoff between internal and external validity (Markman, Beer, Grimm, Rein, & Maddox, 2009).

Laboratory Research and Integrative Frameworks

One element of laboratory research that is rarely discussed explicitly is that empirical contributions typically require a focus on narrow aspects of mental processes. For example, individual papers in the classic research tradition on heuristics and biases focused on isolating particular strategies people used to make choices and judgments such as anchoring and adjustment or the availability heuristic (Gigerenzer, 2000; Kahneman & Tversky, 2000; Tversky & Kahneman, 1974).

Early work on a particular heuristic is devoted to identifying its characteristics. For example, initial studies of anchoring and adjustment found that people would make judgments by starting with a salient value from the environment or their memory and then adjust the value in a direction they felt would make the final judgment more accurate (Tversky & Kahneman, 1974). Subsequent work refined the heuristics. Studies of anchoring and adjustment explored factors that would lead people to use a particular value as the anchor (Chapman & Johnson, 1999). Other studies posited factors that would lead people to adjust anchors insufficiently, which is why judgments made from anchors are systematically biased away from the true value and toward the anchor (Epley & Gilovich, 2006).

Other research refined our understanding of the effectiveness of these strategies. Initial research on the availability heuristic assumed that it gave reasonably accurate judgments, but the work tended to focus on cases in which using easily available information led to faulty judgments (Tversky & Kahneman, 1983). In a classic example, people often judge that there are more words ending in *–ing* than words ending in *-_n_*, even though the former is a proper subset of the latter. This error occurs because the letters *–ing* are a better cue to retrieve words from memory than just the penultimate letter of a word *-_n_*.

More recent work on these heuristics has focused on the many situations in which these strategies actually lead to accurate judgments. When people have limited memory about the items being judged, then using the ease with which information comes to mind to assess the frequency or popularity of those items is actually an accurate strategy to use (Gigerenzer, 2008; Gigerenzer & Goldstein, 1996).

There is good reason to pursue research in this way. The power of experimental designs is their ability to strengthen causal inferences about the factors under study. In addition, experimental research allows researchers to isolate particular factors and to study their interactions carefully. For example, by focusing just on the adjustment process of the anchoring and adjustment heuristic, Epley and Gilovich (2006) were able to examine the role of factors like time pressure and working memory in the accuracy of adjustments. Experimental designs also allow for replications of phenomena within an individual across time as well as across individuals that strengthen our belief that a particular strategy is used generally and was not idiosyncratic to a particular individual or context.

Empirical research in this tradition drives (and is driven by) two kinds of theory building. Marr (1982) pointed out that descriptions of cognitive processes can be couched at one of three levels: computational, algorithmic, and implementational. Computational models specify the function that a cognitive process is intended to carry out. Algorithmic models explore the processes and knowledge structures used to carry out these functions. Implementational models focus on how these processes are actually instantiated in the brain (or in software in AI models). Decision-making research typically focuses on the computational and algorithmic levels of description, though there is a growing area of research that explores the underlying neuroscience related to decision making (e.g., Glimcher & Fehr, 2013).

Computational models of decision making provide a high-level description of how decisions are made or ought to be made. Variants of expected utility theory drawn from economics, for example, provide a normative framework for thinking about choices (von Neumann & Morgenstern, 1944). These models assume that people evaluate options for their overall utility and then select the item with the highest utility. Utility is calculated by taking the goodness (or utility) of each feature of an option and weighting it by its importance and then adding up all of these weighted utilities into an overall score. Following this strategy guarantees that people will always make the best choice based on their underlying preferences.

Even after studies demonstrated that people's choices do not obey the predictions of utility models, theorists still developed overarching computational frameworks for describing people's decisions. A key exemplar of this approach is prospect theory (Kahneman & Tversky, 1979). This framework adjusted the functions for evaluating the weighting and value of features of choice items away from the normative approach of expected utility theory in ways that were more consistent with empirical data. For example, prospect theory assumed that features were evaluated with respect to whether they led to gains or losses relative to the current situation (which was used as a reference point) rather than evaluating features based on a universal scale of utility. This change allowed prospect theory to account for observations that people find losses of a particular amount more painful than they find gains of that same amount pleasurable.

These computational-level models of choice were valuable for the field to the extent that they generated new predictions that could be tested in studies. However, a lot of detail about the process people go through to make choices is missing from these models, and so researchers began to think about more

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