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Reply to Comments

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Abstract

Evidence of prospective processes is increasingly common in psychological research, which suggests the fruitfulness of a theoretical framework for mind and brain built around future orientation. No metaphysics of determinism or indeterminism is presupposed by this framework, nor do considerations of scientific method require determinism—successful scientific theories in the natural sciences all involve probabilistic elements. We speculate that expressive behavior and moral decision making use prospective processes parallel to those used in nonmoral decisions.

Keywords

prospection, affect, free will, moral intuitions

Embracing Prospection

In their commentary, Fukukura, Helzer, and Ferguson (2013, this issue) agree that prospection is an important construct in psychology, but they strongly disagree that it has been neglected. They write that psychology has “exploded with exciting research that champions prospection as a guiding force for behavior” (p. 146). One example is reinforcement learning models in computational neuroscience. These models posit that learners have access to a rich suite of future-directed representations, including a state space that serves as a “model of the world,” a set of candidate actions available from each state, and a set of expectations about what states will ensue on the condition that each action is performed (Schultz, Dayan, & Montague, 1997; Sutton & Barto, 1998). A second example is research that understands temporal lobe memory systems—including most prominently the hippocampus—as playing a dual role in both recalling past episodes, and recombining information in order to construct simulated future scenarios.

These phenomena are the very ones that we discussed at length in our article (e.g., Seligman et al., 2013, this issue). So we very much agree that theorists are increasingly explaining cognitive and practical abilities in terms of sophisticated prospective mechanisms. In addition to drawing overdue attention to this work, we hoped to accomplish two further goals.

First, we sought to place the current wave of prospection-related findings against a historical backdrop, which we believe helps explain why systematic research into prospective cognition and guidance was so slow in coming to scientific psychology. Major movements in psychology—associationism, behaviorism, Freudianism—tended to view the past as shaping

or driving present behavior, rather than as an informational resource drawn upon by the organism in order to evaluate and choose among possible actions. The historical legacies of these traditions, as well as the intellectual habits of thought that sustained them, are still on the current psychological scene, as when Fukukura et al. write that they are “hard pressed to see how it could be that prospection is not, itself, driven by the past” (p. 147) or that “the fundamental components of prospective cognition may happen reflexively” (p. 148). Our first goal was to highlight the important theoretical differences between the emerging future-oriented perspective versus previous “driven by the past” or “reflexive” perspectives.

Our second aim was to argue that that prospection might be a unifying principle or a centerpiece across many domains of psychological inquiry. Prospection-related ideas, we argued, are crucial for understanding optimal foraging in animals, reinforcement learning, perception, memory, emotion, motivation, decision making, psychotherapy, motor processing, skilled action, social intelligence, and imagination. This commonality of prospective processes has not yet been widely registered. Indeed, as Fukukura, et al. themselves note, the term *prospection* is as yet rarely used even by the theorists who are proposing prospection-related ideas. Thus, we proposed on evolutionary, theoretical, and empirical grounds that prospection could serve as a basic organizing framework for psychology and brain science.

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In our article, we contrast this framework with prospect theory as developed extensively by Amos Tversky, Daniel Kahneman, Paul Slovic, and others (Kahneman, 2011; Kahneman & Tversky, 1979; Slovic, Finucane, Peters, & MacGregor, 2007). Both Fukukura et al. and Dunning and Fechenhauer (2013, this issue) cite this work as evidence that prospection is already a mainstream tendency, but our view differs from prospect theory, and the larger heuristics and biases framework with which it is associated (Kahneman & Tversky, 1979, 2000; Slovic & Tversky, 1974). The difference between the two frameworks is illustrated in their respective takes on the process they call the *affect heuristic*, in which “People make judgments and decisions by consulting their emotions. Do I like it? Do I hate it? How strongly do I feel about it?” (Kahneman, 2011, p. 139; Slovic et al., 2007). In the heuristics and biases framework, such affective responses are viewed as quick, heuristic-based automatic reactions that exhibit “little understanding of logic and statistics” (Kahneman, 2011, p. 25). It is a short step to the conclusion that, when affect enters decision making, people do not rationally elect from a range of options but rather are driven along by whatever feelings happen to occur.

The prospection framework sees human agents as ubiquitously engaged in the business of constructing and evaluating alternative possibilities. An important recurring theme in our discussion was that affective signals, though too often caricatured as simple, crude, and misleading feelings that push a person in a particular direction, are better seen as the products of sophisticated, experience-based computations that guide a person across an evaluative landscape—and for the most part guide accurately and well. In particular, we reviewed lines of evidence drawn from research in animal behavior, neurophysiology, and human cognitive neuroscience that affect and reward systems separately encode sophisticated information dimensions, such as risk, absolute and relative value, expected value, and discrepancies between expectation and actual outcomes, which permit subsequent recalibration (Christopoulos, Tobler, Bossaerts, Dolan, & Schultz, 2009; Preuschoff, Bossaerts, & Quartz, 2006; Tobler, O’Doherty, Dolan, & Schultz, 2007). Eons of evolution appear to have created affect and reward systems that can, under a range of circumstances, approximate optimal decision making according to canonical formal models (Quartz, 2009; Schultz, 2002).

The heuristics and biases framework sees consulting one’s affective responses as an alternative to a rational search for information. Kahneman writes, “The affect heuristic is an instance of a substitution, in which the answer to an easy question (How do I feel about it?) is substituted for the answer to a much harder question (What do I think about it?)” (Kahneman, 2011, p. 139). In the prospection framework, however, the two are typically not alternatives at all—how I feel about an option may be a summation of precisely the sort of information that rational thought about that option would need to take into account. Of course, statistical learning systems, such as the affect and reward system, have real limitations and can make mistakes due to biased or incomplete evidence, as reams of

research attests. Higher order thought can be a much-needed corrective. Our point, however, is not to pit these two processes against each other. The locus of our rationality is in their joint operation, wherein each make distinctive contributions.

Prospection, Determinism, and Free Will

We proposed that free will involves at least two kinds of causal processes that may or may not involve probabilistic subprocesses (Grabenhorst & Rolls, 2011). First are the constructive processes that simulate candidate actions available for choice. We highlighted dimensions along which these constructive processes varied including complexity, time horizon, and accuracy. Second are the selective processes that weigh candidate options by attaching evaluative information to prospects—actions are then elected in light of these evaluations. Prospection science, we argued, fills in the details of how these processes might be realized in human brains or how they can be disrupted, as in compulsive motivation or drug-craving. It thus can help to illuminate not just the experience, but the actual operation and limits of free will. Fukukura et al. take strong issue with our approach to free will. They regard determinism as essential to the scientific enterprise, and they claim our views are antideterministic.

According to Fukukura et al., determinism is “endorsed (necessarily) by experimentalists in any field” (p. 147) and “insofar as psychology is a scientific enterprise, it rests upon a deterministic understanding of human thought and behavior” (p. 148). We disagree. In our view, determinism should be seen as an empirical thesis about the kinds of physical laws that govern the universe. In a deterministic universe, the past plus physical laws jointly entail the future. That is, given a specified way things are at any particular time, the way things go thereafter is fixed.

By contrast, quantum theory, the well-confirmed physical theory that applies to the subatomic constituents of matter, is, at least on the standard interpretation, fundamentally stochastic, yielding for many interactions only a probability distribution over outcomes (Halliday, Resnick, & Krane, 2001). And above the level of quantum phenomena, a vast array of thermodynamic, chemical, biological, and psychological phenomena are understood in terms of statistical, not deterministic, generalizations and laws. We are skeptical that anyone can articulate deterministic principles to explain economic or political events, and recent works in political science have forcefully argued that causal principles in those fields are not deterministic (Acemoglu & Robinson, 2012; Fukuyama, 2011). Thus, we see no ground for insisting that science must be deterministic, either in its fundamental principles or in method.

We recognize that even if probabilistic interactions reign at the sub-atomic level, it is an open and hotly-debated question whether probabilistic causation operates at higher macroscopic levels, and in particular at the level of neurons, circuits, systems, and brains (Bishop, 2002; Eccles, 1995; Hameroff, 1998; Penrose, 1990). Our account of free will was explicitly agnostic on this question—neither requiring indeterminism

nor contradicting determinism. Whether probabilistic causation plays an important explanatory role in the prospective constructive and selective processes that underwrite free will is an empirical question that is ultimately best settled by actual empirical investigation.

Prospective Cognition and Expressive Actions

Prospection is inherently future directed. A creature mentally represents and evaluates potential states of affairs not yet realized and selects the best action on this basis. Dunning and Fetchenhauer helpfully draw attention to an important class of actions that would seem to fall outside the scope of prospection-based accounts. They contrast instrumental actions—those done as a means to advance some future end—with expressive actions that have immediate goals. Expressive actions are “ends in themselves” in that executing the action itself fulfills the goals of the action. They cite voting in national elections and acts of interpersonal trust, among others, as examples of expressive actions that are present centered, and are thus “orphaned” both by traditional accounts that emphasize the role of the past in molding action and our prospection-based approach that emphasizes the future.

But are expressive actions lost sight of in prospection-based accounts? To say that voting in an election or extending trust to another person has expressive meaning for the agent is to say that she has acted guided by her evaluative representation of these acts as possessing a certain value in and of themselves. If she had no such forward representation of what values voting or trusting embody and communicate, the acts would be gratuitous rather than expressive. As Dunning and Fetchenhauer recognize in a footnote, “people have expectations about the outcomes of merely completing an action ... just like they have expectations about more distal and potentially uncertain outcomes” (p. 144), so that expressive action is not really a counterexample to the role of prospective evaluation in action guidance. Expressive action, however, does provide two important reminders. First, talk of acting in light of a representation of the future should take into account the “quick-arriving future” as well as the distant future (Dunning & Fetchenhauer, p. 144). Second, *value* as it figures in evaluative representations is not always instrumental value or self-interest. True, the individual might gain “civic pride” from voting, which is a positive experience. But he would not experience this feeling if he did not already value civic participation for its own sake.

Our account was focused on the best-studied aspects of prospective evaluation and guidance. These are typically experiments and observations involving self-interest or biological needs—reliable sources of motivation and feedback in humans and animals alike. But a full account of prospection should include moral decision making, behavior, and experience—as Dunning and Fetchenhauer put it, behavior “demonstrating respect for the other individual, or fulfilling some norm or dictate” (Dunning & Fetchenhauer, p. 143).

Because our account thus far has been silent about how one’s moral concerns enter into prospection, perhaps we might respond to Dunning and Fetchenhauer’s challenge by speculating a bit on this question.

In our account of nonmoral prospection, agents are conceived of as entertaining alternative possibilities and being guided in part by affect in evaluating these possibilities in order to select options in light of their relative value. We suspect that a similar model can be applied to moral decision making. As agents consider possible actions, fast evaluative reactions, called *moral intuitions*, play a key role. Our account differs from other approaches emphasizing intuition (e.g., Haidt, 2001) in terms of the nature and origin of these affective responses, and thus what sorts of evaluative information they typically embody.

Sometimes the acts under consideration in a moral situation do not have intrinsic moral significance, so that the information most relevant to their evaluation will be instrumental (e.g., the minimization of harm in an emergency situation). In such cases, people’s “intuitive” moral responses can be expected to recruit general-purpose implicit prospective capacities to represent the magnitudes of value and risk at stake and to guide moral choice accordingly—and this is what Amatai Shenhav and Josh Greene have found (2010). At other times, an act under consideration will have considerable expressive significance but little or no instrumental effect, as in the case of voting in a presidential election in a state where the outcome is a foregone conclusion, or making one’s own tiny contribution—despite a very restricted income—to a major relief effort. Here, the affective evaluation of options can be expected to reflect more distinctively moral emotions—such as prospective guilt or self-respect—acquired through a lifetime growing up within a society and reflecting both empathic feelings and the requisites of mutual trust and sociability. Expressive action therefore coheres with our prospection framework and represents an interesting extension of the framework into the normative domain.

We have argued that prospection is a fundamental organizing principle of mind. It affords a way of understanding many intuitive, affect-laden processes in morality and in human thought generally that does not discount such responses as “emotional”, but rather sees them as part of our ability to respond rationally to the world and one another (Railton, in press).

Declaration of Conflicting Interests

The authors declared that they had no conflicts of interest with respect to their authorship or the publication of this article.

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