Open Peer Commentary

Distinguishing regulatory variables and ecological affordances: Prioritizing goals versus implementing action

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Abstract

We fully share Ko and Neuberg's premises and conclusions. We only suggest that the framework could be further clarified by distinguishing two kinds of inputs: regulatory variables (cues that calibrate motivational salience) and affordances (local action possibilities that matter only once a motivation is already engaged).

Ko and Neuberg argue that adaptive behavior arises from how individuals manage ecological inputs. Using life stages as illustrations, they show how shifting goals and trade-offs shape responses to ecological conditions such as kin density, sex ratios, or threats. We fully share their premises and conclusions.

In this commentary, we propose to distinguish two kinds of ecological inputs. More specifically, many of the variables Ko and Neuberg call "ecological affordances" (such as sex ratio, kin density, or threat) would be better described, according to us, as *regulatory variables*: cues that modulate the salience of motivational systems, thereby influencing which motivations are prioritized. Affordances, in contrast, are local possibilities for action that matter only once a high-order motivation is already engaged and salient. This distinction may look trivial (just a matter of terminology) or unnecessary (perhaps, many scholars already implicitly recognize it). But we believe it is both important and often overlooked. The words themselves are not the issue; what matters is the conceptual separation between *inputs that regulate motivation* and *inputs that guide action*. Making this clear, we argue, strengthens the framework proposed by Ko and Neuberg and clarifies the architecture of adaptive behavior.

Natural selection engineered mechanisms that map ancestrally recurrent cues onto adaptive motivations. Internal variables such as age, sex, or hunger state, and external variables such as kin density, predation risk, or resource predictability are all inputs that *regulate* the strength and priority of motivational systems (Tooby et al., 2008). For instance, food uncertainty "magnifies food seeking motivation" (Anselme & Güntürkün, 2019): birds and mammals facing unpredictable resources consume and hoard more food and accumulate fat stores. Experiments with humans show that merely feeling low in social rank elevates appetite and caloric intake (Cheon & Hong, 2017). These variables became cognitively important because they reliably predicted future resource shortfalls in ancestral environments (Tooby & Cosmides, 1990), and they continue to shape motivational regulation in humans living today. Importantly, these cues do not indicate what to do locally; in this example, they alter how hungry one feels.

Natural selection also engineered mechanisms that, once a motivation takes precedence, decompose goals hierarchically to guide behavior. As Del Giudice (2023) emphasizes, motivational systems generate structured goal hierarchies that map abstract ends onto concrete means (see also Dubourg, Chambon, & Baumard., 2025; Tomasello, 2024). These mechanisms ensure that, once a drive is engaged, the mind searches the environment for affordances that can realize it. In the case of hunger, the superordinate goal of securing nutrition, once salient, may be broken down into subgoals of acquiring calories through locally available resources. A bakery affords caloric intake, a tree affords fruit picking, a supermarket affords packaged goods, and a

smartphone affords ordering delivery. Which affordances are detected depends on the ecological context. Affordances, in short, do not regulate how hungry one feels; they organize the opportunities through which an already salient motivation can be expressed.

Exploration provides another example. Sensation seeking and the broader trait of openness to experience, follow an inverted-U trajectory across the life span, rising from childhood, peaking in late adolescence, and declining thereafter (Steinberg et al., 2018; Costa, McCrae, & Löckenhoff., 2019). Age is thus an internal regulatory variable that calibrates exploratory motivation. External regulatory variables also modulate exploration. For instance, resource affluence enhances curiosity: people in resource-rich environments are more curious (Dubourg & Baumard, 2024) because in such contexts, in our evolutionary past, the opportunity costs of exploration were lower and the potential benefits higher (Boon-Falleur, Baumard, & André., 2024). None of these inputs are action possibilities; they adjust how strongly one wants to explore. Once the exploratory system is active, individuals turn to affordances. A forest path, a landscape from a high vantage point, or an open-world video game can satisfy exploration. Many such affordances are evolutionarily novel. This framework explains why adolescents are drawn to imaginary worlds and travel: their regulatory variables enhance exploration and cultural innovations (e.g., transport, video games) supply new means to satisfy it (Dubourg & Baumard, 2022).

This distinction between regulatory variables and ecological affordances matters for at least three reasons. First, because the two kinds of input play fundamentally different roles in explaining organisms' motivated behaviors. Regulatory variables alter motivational states, while affordances only guide behavior once a motivation is already salient. Importantly, affordances do not alter the strength of motivations. Take a hamburger in the street: for a hungry passer-by, it is a compelling opportunity; for someone just satiated, it has no effect at all. The difference lies not in the environment but in the state of the organism. Hunger activation and affordance exploitation are thus distinct stages of adaptive behavior.

Another way this distinction matters is that affordances can be culturally novel, whereas regulatory variables are not. People readily exploit new affordances (e.g., ordering food by smartphone or eating at a fast-food chain) because these learnt options serve ancient goals once hunger is engaged. By contrast, we argue that the parameters that regulate motivation are evolutionarily derived and restricted to cues that reliably predicted outcomes in ancestral environments. Our motivational systems are, therefore, calibrated by long-standing variables such as kin density, sex ratios, or resource unpredictability, not by cultural inventions. Novel practices can create new affordances for satisfying goals, but the ultimate motivational priorities remain regulated by evolutionarily relevant, long-standing variables.

A final reason why this distinction matters is that it helps explain the functioning of cultural evolution. Cultural evolution can be seen as the cumulative process by which individuals reshape their environments to better satisfy preexisting goals (Baumard & André, 2025). By building new institutions, inventing technologies, or establishing norms, people multiply affordances that serve their motivations. Over time, these changes may also transform the ecological parameters that regulate motivation itself, for instance, by altering the predictability of resources, the density of kin, or the level of threat. Cultural evolution thus operates through a feedback loop: humans engineer affordances to fulfill ultimate goals, and in doing so, they sometimes modify the regulatory variables that set the salience and priority of those goals.

Ko and Neuberg emphasize that goal priorities interact with kin density, sex ratio, and threat levels. We suggest reframing these factors as regulatory variables. Our refinement is consistent with the authors' predictions but adds a conceptual precision that could be useful in future research.

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