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Toward a Selectionist Future in Comparative Cognition

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We highlight the persistent problem of using hypothetical constructs as explanations of behavior. We discuss the abandonment of parsimony and the tautologies inherent to explanatory constructs in recent and ongoing topics in the field. Cognitive terms may be useful labels that aid communication, but progress stalls when they replace the environment as causes of behavior. We champion a functional selectionist perspective that unifies cognition and behavior, and we conclude that comparative cognitive psychologists are positioned to adopt such a stance.

Keywords: comparative cognition, hypothetical constructs, selectionism, habitual behavior, theory of mind

We are tasked here with looking to the future of comparative cognition. We suggest that researchers in comparative cognition move away from explaining behavior using in-principle unobservable concepts of mind and toward historical explanations that identify the interplay of the complex, but observable, contingencies characteristic of behavior. This brings our field in line with principles of natural science and will sharpen the boundaries of our subject matter. Although this suggestion may sound familiar to some readers, we elaborate on its implications for comparative cognitive scientists by applying it to recent and ongoing topics in the field.

On Selection in Behavior

Skinner's (1981) philosophy of science extended Darwinian theory to explain behavior at three distinct levels of selection: phylogenic, ontogenic, and what we here term *sociogenic* (see Stahlman & Catania, 2023). The phylogenic level roughly corresponds to familiar Darwinian (1859) natural selection, the ontogenic level corresponds to the differential reproduction of behavior as a function of its consequences (e.g., reinforcers), and the sociogenic level corresponds to the differential transmission of behavior across individuals. Skinner suggested that selection by consequences, thus conceived, may serve to frame a unified scientific account of the causes and function of behavior. Cognition, distinct from and antecedent to behavior, becomes unnecessary.

To be clear, neither Skinner nor we (e.g., Stahlman & Leising, 2018) deny that humans think. We consider thinking to be (covert) behavior. Unlike overt behavior, covert behavior has no direct effect on the environment and thus is only indirectly affected by selection by consequences. It is, however, part of what we seek to explain, and therefore it cannot be a satisfying explanation for its overt counterparts. This view, a part of radical behaviorist philosophy, remains on the fringes of psychological science and is certainly not popular within comparative cognition research.

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On Cognitive Concepts, and the Use and Abuse of Metaphor

Skinner's position is often dismissed as insufficient to apply to complex organismal behavior and thought. To many scientists, reliance on constructs of mind remains essential to *explain* the behavior of their subjects. Many researchers in comparative cognition persist in viewing behavior as a symptom of the "real" psychological events that interest them, those happening inside the organism (see Skinner, 1950). They explain behavior as the result of unseen associations, of memories, of expectancies, of mental images, of mind.

Some attempts to exclude selectionist, behavioral explanations point to a causal role for stimulus representations. The verbal label of "representation" is not vacuous. To invoke a "representation" is merely to affix a label on observations, and a scientist's behavior doing so, like all behaviors, is bound by contingencies. We can suggest that representations are patterns of neural activity, but the ultimate cause of that activity, as well as the corresponding behavior, remains outside the organism. At best, these terms may serve useful functions in easing communication; at worst, they threaten parsimony and direct the focus of research away from the relevant environmental relations. Consider, for example, the following case:

> When we began research on timing behavior of rats several years ago, the concept of internal clock was, for us, simply a metaphor. As our research progressed, however, we found ourselves searching for the properties of the internal clock. After we discovered some characteristics … our attitude toward it gradually began to change. The concept was no longer a metaphor; we began to believe that the clock actually exists. (Church, 1978, p. 284)

A metaphor is thus made corporeal. By positing the internal clock and seeking its properties in its supposed behavioral output, one asserts an ontology in which unobservable determiners exert their effects on the behavior of their possessors.

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We should find it suspicious that psychological representations are never observed independent of the behavior they are said to cause. All cognitive concepts are constructed from behavior, and so cognitive "explanations" of behavior are necessarily self-referential and smack of the nominalist fallacy (Blumberg & Wasserman, 1995). It is possible that positing such fallacious explanations—by naming particular collections of observations, and then reifying the concepts by asserting their causal power—may slow scientific progress (Wynne, 2005, 2007). This is true even of the term *learning*. The more species we examine, the more our general conceptions of learning, as a construct, are challenged (Abramson & Chicas-Mosier, 2016; Armus et al., 2006; for a review, see Loy et al., 2021). Empirical observations of such organisms are, however, commensurate with a functional account in which *learning* is a term that stands in for a sort of behavioral change. Wasserman (1981) suggested that scientific investigations should eschew investigation of hypothetical constructs but be allowed to invoke intervening variables (e.g., as in *learning*) as identifiers, not replacements, for important relationships in the environment:

> Tolman's original concept of the intervening variable was wholly reducible to the empirical relationships that it embraced; outside of these relationships, the intervening variable had no surplus meaning or independent status. … Tolman's mediational processes were purely theoretical in character; they were in his mind, but not necessarily in the rat's. (p. 249)

On the Cognition of Goal-Directed and Habitual Behavior

A specific case in which scientists regularly invoke cognitive mechanisms is in the so-called goal-directedness of behavior. A rat presses a lever *because* it has learned an *association* between pressing and obtaining sucrose. Such an animal *expects* sucrose. It is "*cognitively engaged* … with a *representation* of the *goal* in *memory* [emphasis added]" (Bouton, 2021, p. 349). If the sugar is then devalued by presenting it in conjunction with gastric illness, the rat may slow its pressing. Such a fact suggests to many that the behavior is controlled by a response–outcome (R–O) association. In some circumstances, however, the rat may not slow its lever-pressing after the sucrose had been devalued; this fact suggests to many that the behavior is no longer goal directed but is habitual, controlled by some kind of stimulus–response (S–R) association (e.g., Lingawi et al., 2016). *Association*, a useful term that

corresponds to environmental events occurring during conditioning, becomes reified as a structure inside the organism. We can acknowledge the inherent tautology of such associative explanations. An association is asserted by virtue of some observation of behavior; subsequently, when there is behavior to be explained, the associations are dutifully invoked. We never have evidence of an "association" independent of the rat's lever-pressing behavior.

This circularity can be avoided, however, if we appeal only to well-established effects of selective systems rather than cognitive constructs. The behavior of avoiding poison is highly prepared and easily fixed in an animal's repertoire. By virtue of a stable[1] and lengthy evolutionary history, animals quickly learn to avoid eating tainted food and quickly stop doing behaviors that produce it. An analogue exists such that stable operant contingencies produce a different kind of fixedness that competes with the prepared behavior of avoiding poison. When conditions are stable—when an operant reliably produces an outcome—ontogenic behavior becomes increasingly stable, to the point where it persists following outcome devaluation (Stahlman & Leising, 2024). This account depends only on the correspondence of effects across levels of selection (i.e., evolutionary and operant). The literature of goal-directedness and habitual behavior may thus be reinterpreted, and all linked causal constructs (e.g., R-O and S-R associations) may be summarily jettisoned.

On Complexity and Theory of Mind

Another case that has historically enjoyed popular support in our community is that regarding *theory of mind* (ToM; Premack & Woodruff, 1978). Do organisms "mind-read," and do they "build theories about unobservable content of [other] mind[s], predicated on a theory that other beings have minds in the first place?" (Krupenye & Call, 2019, p. 2). When researchers chase these causal constructs, they start on a path where the conditions under which behavior occurs are sidelined in favor of an ill-fated pursuit of cognitive architecture. The same fate awaits those who attempt to refute behavioral explanations by appeal to cognitive ones. In a review and a broader defense of ToM, Krupenye and Call (2019) write, "Skeptics suggested—and hold to this day—that no particular study has provided unequivocal evidence of animal ToM, since in most cases subjects had access to some behavioral information that they could use to predict others' actions" (p. 4).

Precisely. What is in question is whether we must leap to complex conceptual explanations for organismal behavior. If we can identify the "behavioral information" that indisputably exists and is functionally related to the behavior in question, then we need not appeal to ephemeral entities. The authors do not see things this way, however: "… for many, the convergence of findings across a great many paradigms … suggested that *a common mind-reading mechanism may provide a more parsimonious explanation* [emphasis added] than the diverse suite of behavior rules that would be necessary to explain successful performance across tasks" (Krupenye & Call, 2019, p. 4).

We might suggest that positing explanations that appeal to different and unobservable classes of phenomena is, in fact, far from parsimonious. We might suggest that doing so is reminiscent of supernatural explanations of natural events. To explain a plague, appeals to a vengeful god's bad mood appear to have a charming austerity compared with the intricacies of microbiology, germ theory, and epidemiology. But this simplicity is illusory. An explanation that demands the existence of vengeful gods demands that the world is, at bottom, more complex than one suggested by natural science. Cognitive scientists have gone afield from a naturalistic view of behavior by invoking nonphysical, dimensionless constructs to act in place of causal contingencies (Wixted & Gaitan, 2002).

The reader is welcome to consider other examples common to comparative cognition (e.g., mental imagery, episodic replay, information processing). There has been no real progress in understanding the nature of any of these so-called cognitive processes, though considerable progress has been made in identifying the conditions and stimuli that control behavior. Ultimately, a complete account of environmental conditions and their behavioral effects renders other explanations moot.

Conclusion

Many psychological scientists continue to give weight to disparate explanations of organismal behavior, many of which rely on nebulous conceptual entities. We may yet hope for the wholesale adoption of a scientific framework that sharpens the definition of our subject matter. Selection by consequences (Skinner, 1981)—in phylogeny, ontogeny, and sociogeny—may be a better organizing principle for the field of comparative cognition and for psychology generally (Catania, 2013; Stahlman & Leising, 2018). This may account for the origins of complexity and eliminate any need for explanatory hypothetical constructs of mind. To return to an earlier example, we should be less interested

1. In this case, *stable* is not a general term. It refers specifically to an ancestral history characterized by the probable fitness-related effects of being poisoned.

in discovering the properties of any internal clock and more interested in answering a different question: *Under what conditions does an organism behave like a clock?* Such a question allows us to retain the metaphor, but it neither posits unseen units nor reifies concepts.

We in comparative cognition are well positioned to pursue these changes and should embrace all its implications, "killjoy" (Shettleworth, 2010) or otherwise. We already accept many Darwinian principles in our research pursuits. Collectively, we have an advantage because we investigate behavior in many different species using varied methodologies, whereas other scientific communities are more limited in their subjects and methods. We should remember that any goal to uncover the cognitive machinery underlying behavior will bring little progress—independent of behavior, there's simply nothing there to be discovered. If our goal is instead to identify new relationships between behavior and its conditions, and to evaluate functional relations in phylogeny and ontogeny across species, we have much yet to do.

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