

CAN STATISTICAL ANALYSIS PROVE THE NEED FOR COGNITION IN PSYCHOLOGICAL THEORY?¹

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ABSTRACT: In a 2017 article in *Behavior and Philosophy*, Elliott Sober suggests that the statistical phenomenon of “screening off” requires the postulation of inner entities that mediate between antecedent and consequent variables in behavioral research. This is a prime example of researchers believing that the disagreements about the role of internal states in psychological explanations can be resolved with a statistical analysis. Sober’s suggestion is based on a fundamental misunderstanding of what behavioral psychologists do. This article is intended to stimulate conversation among behaviorists concerning Sober’s arguments in favor of mentalistic postulations.

Five years ago, the eminent philosopher of biology, Elliott Sober, wrote in this journal that “inner states” *are* relevant to the functional analysis of behavior, contrary to the claims of Skinner (1953). “Inner states,” Sober asserted, “can *help* explain behavior” (Sober 2017, p. 23). We could understand this assertion in at least one benign way. An animal’s behavior may change if it is drugged, brain-lesioned, or trained, and those changes are due in part to events within the animal’s skin. We fully understand that animals have literal insides that play a significant role in overt action.

However, we can also understand Sober’s assertion in other ways, some fully contradictory to the behaviorist project. We could, for example, understand him to mean that we must speculate about neurophysiology to perform a functional analysis, or

¹The target of this commentary on Sober’s article is *not* Sober, himself, but our fellow readers of *Behavior and Philosophy* who let the article’s challenge to behaviorism stand without rebuttal for 5 years. Please address all correspondence to both authors, Charles.psychology@gmail.com and nthompson@clarku.edu

understand him to be insisting that considerations of *mental entities* are essential to make inferences about control, prediction, and explanation of behavior.

Sober appears to be making one, if not both, of those contradictory assertions. When we understand his *Behavior and Philosophy* publication in this latter way, we wonder why no reader of this behaviorist journal has responded to the article in the 5 years since it was published.

Are Sober's internal states physiological?

“Screening off” is the key concept that brings Sober to his recommendation that we behaviorists consider internal processes. “Screening off” is a statistical phenomenon observed in networks that relate probabilities of events. Imagine that you are investigating three events, A, B, and C. You find that A predicts both B and C (i.e., $A \rightarrow B$ and $A \rightarrow C$), and that B predicts C (i.e., $B \rightarrow C$). In that case, B “screens off” A from C when knowledge of both A and B do not predict C better than knowledge of B alone. Screening-off is of particular interest to Sober, because of its role in causal modeling. In that context, when everything researchers can predict about C is subsumed in their knowledge of B, they prune any direct connection from A to C in their model and conclude that A *causes* B *causes* C ($A \rightarrow B \rightarrow C$). In that context, the statistical predictive power from A to B and from B to C is asserted to represent causal process, and it follows that the lack of *additional* predictive power from A to C would be taken to indicate that A causes C only via its effect on B.

Sober offers screening off as a method to determine when behavioral data warrant the inference of an “inner state.” He uses the model of two “black boxes,” each with a button on one side (a single input) and two lights on the other side (two outputs). The relations between the button and the lights are probabilistic. He offers a hypothetical data set for each of the two boxes, and in both data sets the probability of an individual light coming on when the button is pressed is 0.5. The data sets differ because, for box 1, the probability of both lights being on at the same time is 0.25 (as would be expected if the events were statistically independent). In the second box, however, the probability of both lights being on at the same time is 0.45 (significantly higher than would be expected if the events were independent).

From these data, Sober says, we may conclude something about the wiring of the two boxes. He writes that the data set displaying conditional independence implies the button is connected directly to each light by a single wire (a “V” model); however, the data set displaying conditional correlation implies the button is connected to an unseen junction point within the black box, with that *internal* junction point connected to each light (a “Y” model) (Sober, 2015, 2017). But nothing about the data supports a simple V or Y model without the additional assumption that the effects were produced in the most economical

manner.² This assumption might be relevant to a wiring diagram or a computer program for which the artifact's creators are paid to be *parsimonious*. However, no such obligation applies to brains, which are often a tangle of kluges and historical accidents. In short, while some may certainly have an aesthetic preference for making our *models* of brains as parsimonious as they can be, no such obligation applies to the brains they are models of. In fact, the number of wiring hairballs that could produce results indistinguishable from the results Sober provides is infinite (Charles, Wilson, & Golonka, 2014). And if a brain is analogous to a hairball, then we should be highly suspicious of any model of the brain's wiring that is dramatically more parsimonious than the hairball that the brain is.

Now, Sober might protest at this point, that, apt as our hairball metaphor might be, those hairballs would divide into two functional groupings, one that produced conditional independence and the other conditional correlation. But that is just to say that the two boxes do what they do, and the data already told us that. The data that show statistical independence must be produced by one of the **many** configurations that can produce independence, and the data that show dependence must be generated by one of the **many** configurations that produce dependence. However, these facts hardly justify believing that insides are in a particular, exactly, and maximally parsimonious, configuration. And further, if we give the two kinds of configurations names, they should be the "independent" and "dependent" group, not the "V" or "Y" group, because the latter labels smuggle in the unjustified assumption that the causal wiring is extremely basic.

If not physiological, then what?

So far, we have assumed that by "inner states" Sober meant physiological states.³ Elsewhere in the article, he describes the phenomena of interest in at least four additional ways: -- as mental states, as psychological states, as internal states, and as intervening variables. Further, only a few years earlier, in his 2015 book, *Ockham's Razors: A User's Manual*, he wrote:

"For experimental psychologists, ... [the] task is to figure out what the psychological mechanisms are that mediate the connection between stimulus and response. These internal mechanisms are intervening variables. You don't observe

2 We will leave aside the question of how complex the insides of the button and the insides of the junction box must be to produce these probabilistic results.

3 To ensure we were correct in our reading of his text, we wrote Sober for clarification. He kindly replied as follows: "When I say mental states are "inner," I mean that they occur spatially inside the skull. In this respect they are like the blood pressure of arteries in the skull. They are inferable from what we see outside the skull (e.g., from the readings of measurement instruments attached to the skull, or inserted into it) or by watching behaviors. There is nothing dualistic about this sense of inner, as you mention. Hypotheses about inner states needn't be accepted on faith. They can be evaluated by looking at observational evidence." Email, dated, August, 2020.

internal processes directly: rather, you need to infer what they are like from what you do observe.” (p 207-208)

These ways of speaking suggest that Sober is talking about more than mere wiring. Could he be suggesting that screening off justifies inferences about an ephemeral level of organization, whose structures emerge from physiology, and which may be inferred from behavior? What would be the value of inferring such a level?

Sober frames his paper largely around an alleged flaw in Skinner’s thinking, and he spends the first part of the paper deconstructing a particular quote from *Science and Human Behavior* (1953). However, Skinner could easily have replied that behavior analysts don’t need to posit *any* level of analysis between the physiological and behavioral to get their work done, and that those interested in the theoretical approaches to behaviorism can do just fine without them. Further, Skinner would likely assert that, in the history of psychology, the avoidance of such speculations advanced scientific psychology, not hindered it. As evidence, he would point to the decades of successes that behavior analysts have in the laboratory study of animal behavior and in designing interventions for human clinical and educational settings

What Sober provided in his black-box data in his article, as well as numerous other examples in his book, is what psychologists will recognize as a deviation from statistical independence; in a more complex experiment we would call it a statistical interaction. Indeed, one potential explanation for the presence of the statistical interaction in a behavioral experiment, is that there exists a single unaccounted-for *mental* variable that – if we could identify it and measure it directly – would statistically screen off the inputs we currently have from the outputs we currently have. We do not deny that is an inference that many non-behavioral psychologists might choose to make. However, it is not accidental that behaviorists have chosen a different path. Imagine two operant chambers, each with one light (one input) and two levers (two outputs), just like Sober's black boxes. Imagine that we train the rats using various schedules of reinforcement, such that our operant chambers perform like the black boxes: After the light comes on, each lever has a 0.5 chance of being pressed, but in one box the probability of both being pressed is 0.25, while in the second box it is 0.45. Are we to conclude that the rat in box 1 is doing something mental, but the rat in box 2 is not? Are we to infer that the rat in one chamber is somehow V-like, while the rat in the other chamber is somehow Y-like? Certainly not. Attempts to make such inferences would simply be out of place, and contrary to the goals of the endeavor – which is to understand how past events, combined with stimuli in the present environment, influence behavior. Attempting to focus on the role of imagined, non-physiological, internal states distract from discovering functional relationships that exist out there, in the organism's relationship with the world.

Conclusions

The discovery of the psychological mechanisms “that mediate the connection between stimulus and response” is not how we behavioral psychologists understand our task. However, if not as internal psychological states or as literal physiological states, where do we “place” psychological phenomena? One solution, which Sober puts aside on the article’s first page, is philosophical behaviorism, an approach echoed in various non-representational psychologies, such as ecological psychology (Costall, 2017), radical embodied cognitive science (Chemero, 2011), descriptive mentalism (Charles, 2011), and the natural design perspective (Thompson, 1997, 2018). According to philosophical behaviorism, mental and psychological phenomena exist but are in no sense inner -- they are *of* the organism not *in* it. They consist in standing patterns of relation between organisms and their environments over space and over time, not structures or processes within it. Their obscurity lies not because they are hidden inside the skin but because they have no instantaneous localizable referent. You cannot take a snapshot of a psychological or mental state, not because you are blocked by the skin, but because psychological states are diffused in time and place. To a philosophical behaviorist, the whole black box metaphor, with its imputation of mental or psychological states confined in an enclosure, is misdirection; it is a category error. If you want to understand human behavior, look around and up, not down and in!

Behaviorism is a form of pragmatism, or it is nothing. As pragmatists, we take seriously the pragmatic maxim, which says, in effect, that any concept that cannot be defined in terms of systematic experiment and observation is no concept at all. We do not see how postulations concerning an internal mental life are helpful. If they don’t point to facts about physiology, and they don’t point to facts about behavior, where do they point? The mind? Where is that?

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