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METHODOLOGICAL BEHAVIORISM, CAUSAL CHAINS, AND CAUSAL FORKS

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Abstract: B.F. Skinner argued that in a causal chain from an environmental cause, E, to an inner state, I, and then to a behavior, B, the prediction, explanation, and control of B can be achieved better by focusing on the environmental cause, E, than by focusing on the inner state, I. In particular, he claims that the observable relationship of E to B is not affected by whether the inner state, I, exists. The present paper evaluates Skinner's claims and then shifts from a causal chain to a different causal arrangement, wherein two environmental states, E1 and E2, each causally contribute to a behavior, B. In this case, postulating an inner state, I, that is caused by both E1 and E2, and which causes I, affects one's predictions concerning the relationship between environment and behavior.

Key Words: behaviorism, causal chains, screening-off, B.F. Skinner.

My point of departure is a passage from B.F. Skinner's *Science and Human Behavior*:

> (1) The objection to inner states is not that they do not exist, but that they are not relevant in a functional analysis. (2) We cannot account for the behavior of any system while staying wholly inside it; eventually we must turn to forces operating upon the organism from without. (3) Unless there is a weak spot in our causal chain so that the second link is not lawfully determined by the first, or the third by the second, then the first and third links must be lawfully related.
> (4) If we must always go back beyond the second link for prediction and control, we may avoid many tiresome and exhausting digressions by examining the third link as a function of the first. (5) Valid information about the second link may throw light upon this relationship but can in no way alter it (Skinner 1953, p. 35).

I have numbered Skinner's sentences because I want to comment on each.

Proposition (1) characterizes "methodological behaviorism." Unlike logical behaviorism, there is no claim that mentalistic vocabulary can be

translated into purely behavioral and physical terms. And unlike the thesis that Skinner (1974, p.16) calls "radical behaviorism," there is no commitment here to the thesis that introspection is an awareness that an organism has of the physical state of its own body.

Proposition (2) is correct if we are talking about a *complete* explanation of behavior, but it is false if we are talking just about explaining behavior. Inner states can *help* explain behavior.

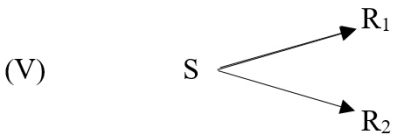
Proposition (3) is true, and it can be generalized. In a causal chain from a stimulus S to an internal state I to a response R, the relationship of lawful determination is transitive, but the same can be true if the relationship is probabilistic. For example, if a stimulus S raises the probability of inner state I, and I raises the probability of response R, then S raises the probability R, provided that I screens-off S from I. Screening-off means that

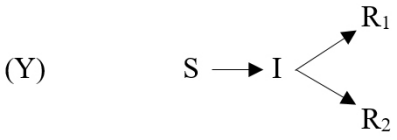
$$\Pr(R \text{ at } t_3 \mid I \text{ at } t_2) = \Pr(R \text{ at } t_3 \mid I \text{ at } t_2 \,\&\, S \text{ at } t_1).$$

Causal chains often exhibit screening-off. For example, suppose I dial your phone number at t_1, your phone rings at t_2, and you answer your phone at t_3. The second event screens-off the first from the third. Or, at least that was true in the days before caller ID.

Proposition (4) does not entail the thesis that knowledge of inner state I is *always* useless for prediction and control of behavior if you know that S causes I and that I causes R. That is fortunate, since the thesis is wrong. Given the causal chain from S to I to R, you may seek out *other* causes of I, and this new knowledge may enhance your ability to predict or control R. This point holds regardless of whether I is a psychological state. It is illustrated by Dennett's (1981) retelling of Skinner's example in which a robber points a gun at you and says "your money or your life." Suppose this causes you to believe that you will be harmed if you do not comply and to desire that you not be harmed. This belief/desire pair then leads you to hand over your wallet. If I know that you are capable to having this belief and desire, I may be able to discover other stimuli that will cause that pair of inner states (e.g., handing you a written note that contains a certain inscription), thereby enhancing my ability to predict and control your behavior. Notice the "if" in the previous sentence. There is no claim here that your beliefs and desires are knowable.

Proposition (5) is true as a claim about causal chains in which there is screening-off. If you know that S causes R, discovering that there exists a screening-off intervening variable I does not alter the probabilistic relationship of S and R. However, matters change when there are two or more responses. For example, consider two models of how S, R_1, and R_2 are related to each other:





I call these models V and Y to reflect the shapes of the arrow diagrams. Each postulates a causal fork, not a single causal chain. If you revise the V model by introducing the intervening variable I (and thus obtain the Y model), does this change the probabilistic relationship of S to R_1 and R_2? According to the standard interpretation of causal graphs in the Bayes net literature (Spirtes, Glymour, & Sheines 2001; Woodward 2003; Pearl 2009), the answer is *yes*. The V model says that R_1 and R_2 are independent of each other, conditional on S:

$$Pr(R_1 \& R_2 \mid S) = Pr(R_1 \mid S)Pr(R_2 \mid S)$$

The Y Model denies this equality. This is because the Y model, under its usual interpretation, says that I screens-off S from each of the R_i, that all the relevant probabilities are strictly between 0 and 1, and that the state of I makes a difference in the probabilities of the R_i. This entails that the R_i's must be correlated, conditional on S. S, R_1, and R_2 are all observable, and the two models disagree about how they are related. Contrary to what Skinner says, the presence of an intervening variable in this situation *does* alter the relationship of stimulus and response.

In my book *Ockham's Razors* (Sober 2015), I illustrate this point about the V and Y models by discussing the literal black box shown in the accompanying figure. There is a button on the left side of the box and two lights on the right. When you push the button, each of the lights either goes on or does not. Repeated button pushes yield a data set describing how often each

light goes on when the button is pushed, and how often they go on together when the button is pushed. Suppose that the frequency for each light is 50% while the frequency for them being on together is 45%. Notice that this joint frequency is greater than the product of the two single-light frequencies. The V model says that there is a wire running from the button to light 1 and a completely separate wire running from the button to light 2; the V model also says that the two lights are independent of each other, conditional on the button's being pushed. The Y model says that a single wire runs from the button to an interior junction box I, and two wires run out from that junction box ─ one to light 1, the other to light 2; the Y model additionally says that the two lights are correlated, conditional on the button's being pushed. The data set I described favors model Y over model V.

In *Ockham's Razors*, I apply this idea about testing for the existence of an intervening variable to two hypotheses about chimpanzee behavior. Both are committed to the assumption that chimpanzees have mental states. According to the behavior-reading hypothesis, chimpanzees form beliefs about the physical objects in their environment and about the behaviors of other chimpanzees, but not about the mental states of other chimpanzees (Povinelli & Vonk 2004).

According to the mind-reading hypothesis, chimpanzees form beliefs about all three (Tomasello & Call 2006). I describe a hypothetical experiment and construct two causal models (one of which implements the behavior-reading hypothesis while the other implements the mind-reading hypothesis) that disagree about what we will observe. The disagreement concerns whether a stimulus will screen-off responses from each other. Testing V and Y models against each other can be done for psychological as well as for non-psychological problems. Introducing an intervening variable between stimulus and response can make an empirically detectable difference in the predictions the model makes about how stimulus and response are related. This isn't true when you are talking about causal chains, and it was causal chains that Skinner talked about in the passage I quoted. Matters change when a single stimulus causally influences multiple responses. The difference between chains and forks makes all the difference.

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Author's Notes

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