Event and property centered explanations

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Date: Sun, 30 Oct 1994 10:03:04 -0600
Subject: Re: event and property centered explanations

[From Bill Powers (941030.0400 MDT)]

RE: Behavior.

Webster's Collegiate: n. 1. Mode of conducting oneself; deportment. 2. The way in which an organism, organ, or substance acts, esp. in response to a stimulus; as, the behavior of glands; activity or change in relation to environment; as, the _behavior_ of steel under stress.

I see _three_ major meanings of behavior here.

Behavior itself, the noun, is simply an observed activity which can only be described as a collection of variables changing through time. But the dictionary recognizes that context creates two meanings having to do with whether behavior is spontaneous or visibly caused.

One meaning is "evidence of inner processes" as in "Genghis Kahn behaved abominably toward his enemies." The actions performed by Kahn are assumed to be generated by processes inside Kahn, spontaneously; thus we attribute this kind of behavior to the behaving system alone.

The second is "evidence of external influences," as in "the behavior of a moving planet in a gravitational field" or "the behavior of a rat on an FR10 schedule." This kind of behavior is seen as a consequence of an external force or influence, without which there would be no behavior.

The distinction between the first and second meanings is in the attribution of behavior to a cause: either an internal cause or an external cause. In both cases, behavior is construed as some sort of change through time.

The third meaning of "behavior" is subtler, because the changes in variables through time is not the point; the point is in the _relationship_ between observed changes and observed influences. This is found in "the behavior of steel under stress." Under a tensile stress, a steel rod will elongate. The particular elongation observed, however, is not the central idea: the central idea is the coefficient of elongation, the ratio of change in length to applied force. If the applied force is one ton and the elongation is one millimeter, the behavior of the steel is said to be the same as when the force is two tons and the elongation is two millimeters.

This third meaning of behavior pertains to a _property_ of the thing that behaves. The elastic coefficient of a steel rod, whether linear or nonlinear, is a property belonging to the rod, which determines how length will depend on applied force. The applied force does not cause this property to exist in the same way it causes an elongation of the rod. Instead, the property is what determines how much elongation will occur for _any_ particular amount of applied force, including zero. The property does not predict that any particular elongation will occur; it is not a description of particular events, but of a consistent relationship that holds between variable events. The property exists not in the presumed cause nor in the time-course of the variables that are caused to change, but in what lies between, the structure of the object.

The transition from an event-centered view to a property-centered view can be seen in coming to understand how a lever works. At first, we see only that if we press down on this end, that end goes up. Then we notice that if we lift up on this end, that end goes down. If we move our end rapidly, the other end moves rapidly. If we create a brief movement that immediately returns to the initial condition, the other end does similarly, but the other way. And if we do nothing to this end, the other end does nothing.

This is all the knowledge we would need in order to control the other end of the lever. Of course given a second lever we would have to open the investigation again, because the behavior of the other end would probably be different. In the long run we would be able to anticipate how to control the other end of the _typical_ lever, with allowances for variability between levers. This is as far as we can go with the empirical approach based on observing behavior-as-event.

To make the transition to the property-centered approach, we would transfer attention from the activities at the ends of the lever and look at the lever itself. We would discover three kinds of levers, and we would find the geometrical and mechanical properties that depend on the placement of the fulcrum. We would discover the properties of the lever that account for the relationship between movements at one end and movements at the other end -- any movements at all. When we talk about the lever, we would no longer offer descriptions of what the other end does when you do various things to this end. We would just say d1/d2 = l1/l2. This doesn't describe any particular behavior, but it says that if you move one end by a distance d1, in whatever manner, you will find that the distance moved by the other end, d2, will continuously satisfy the equation for a lever with arms l1 and l2.

PCT is part of a scientific tradition that looks for properties, not specific causes of specific effects. This is one reason, and in retrospect perhaps the main reason, that psychologists have had great difficulty in understanding PCT.

The behavior of a control system is to make its inputs match a reference signal and its outputs be whatever they must be to achieve that result. So we can talk about properties of an organism without mentioning any particular action or any particular environment. But to many psychologists, this is not recognizable as a law of behavior. What they want to hear is something like "If the level of aspiration is increased, the level of effort will increase" or "an increment in reinforcement produces an increment in behavior." They want to know what will happen if something else happens. Of course from the PCT model we can deduce what will happen in any particular case, given suitable translations of terms, but we can also see that there are circumstances under which something different would happen. So we tend to talk in terms of properties of the model (once we have verified that it does work) and to ignore specific examples of behavior. When we look at data, we see it as illustrating a property of the model that would be seen in many other circumstances. But to the event-oriented psychologist, one set of observations may not seem to have anything to do with another set.

When we argue about cause and effect in behavior, we're asking whether the environment causes behavior or the organism causes behavior. This is looking for an event-oriented answer. A property-oriented answer is that neither is true. The governing factor is a property of the organism that determines _how_ the action of an organism will depend on events in the environment and vice versa. A change in the properties of the organism will result in a change in the relationship between the environment and the actions; the observed relationship is a consequence of the internal organization of the organism. When we characterize that internal organization as a hierarchy of control systems, we are describing, implicitly, an infinite variety of relationships between environmental events and action events -- but a single organizing principle.

Well, that's enough of a train of thought that started at 4:00 AM. The universe is permeated with the odor of turpentine.

Best, Bill P.