Terminology of purposive behavior

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Date: Sun Sep 26, 1993 12:38 pm PST
Subject: Terminology of purposive behavior

[From Bill Powers (930926.1315 MDT)] Ken Hacker (930926)

Terms like intention, purpose, goal, desire, want, aim, objective, plan, design, end, motivation, ambition, and so on form a cluster around a central concept. Until control theory gave it one, this concept had no name: it was referred to only indirectly, in terms of the surrounding circumstances in which it was observed. This is why there are so many words that allude to it without naming it.

The central concept, which in control theory is named the reference signal or reference condition, concerned selection of an outcome of actions before the outcome has occurred. It is "that for the sake of which" all actions pertaining to it are performed. This concept has been missing from science for most of its history. Those who kept putting forward ideas relating to reference conditions were regularly taken to be talking about something supernatural or magical, something that belonged to a separate "mental" universe that had nothing to do with the physical one. It was assumed that no physical system could perform actions with a preselected outcome, because that would reverse cause and effect, giving a nonexistent future state of affairs a determining influence on present actions.

Before control theory, the only way to guess at an outcome of physical processes was to extrapolate from present conditions. This meant that outcomes were necessarily uncertain, being subject to unforeseeable events that could happen between the time of prediction and the time when the outcome was to be observed. The very concept of prediction implies leaving room for unknowable future perturbations, disturbances, and changes in conditions, with the expectation that they will in fact occur and will cause significant deviations of the outcome from the one predicted. Predictions therefore almost necessarily apply to multiple repetitions of a process, in which no one repetition is expected to produce something near the expected outcome. Only over a long series of predictions, over which the perturbations are assumed to average out to zero, can the average result be expected to approach the predicted result. The observed outcomes are expected, on a trial-by-trial basis, to be exactly as variable as all the possible variations of extraneous influences might be.

The concept of a reference condition, together with the control-system organization that gives it meaning, changes our expectations. An outcome that is controlled relative to a reference condition is very much more certain than one that is merely predicted from initial conditions. It is no longer necessary to add "ceteris paribus" to predictions, because under normal conditions quite large perturbations and changes in conditions have no important effects on the outcome of a control process. The reference condition supplies a fixed point around which actions are organized; whatever unpredictable variations may arise, the control organization automatically adjusts to keep the actions pointed toward the accomplishment of the reference condition right up to the time that the desired outcome occurs. Random perturbations no longer cause a random walk away from a predicted outcome. Instead, the action of the system changes as the perturbations come and go, in just the way necessary to maintain progress toward the preselected end.

The word we use to refer to reference conditions and the control process depends on ancillary considerations. If we are very confident that we can retain control and create the specified outcome, we say we intend for the outcome to occur. If we aren't quite sure that an overwhelming perturbation or some other major problem won't occur, we might say that the aim or goal is to reach the outcome. At the low end of confidence we describe the reference condition as a desire, a hope, or a wish. If we are explaining the actions by which we are progressing toward the goal, we commonly use the term "purpose": the purpose of moving my arms this way is to direct an orchestra, the purpose of pushing this machine over the grass is to mow my lawn. If we want to focus

on the reference condition rather than our current relationship to it, we might refer to a goal, an end, an objective, implying that it is not yet met. So we pick words that cover more than just the reference condition or the control actions, shedding light on surrounding conditions and our own attitudes toward the process.

I hope this helps you in sorting out the connotations of various terms that refer to reference conditions and control.

Best, Bill P.

Date: Mon Sep 27, 1993 8:43 am PST
Subject: Is all behavior purposive?

[From Bill Powers (930927.0900 MDT)] Ken Hacker (930926)

> The next question is whether there are any human behaviors or actions (two more good terminological weeds) which are not related to reference signals. If there are not, then it seems that all human behavior is related to some purpose at some level of organization.

Rick answered this, but I'll try, too, as this is a central problem in relating PCT to other approaches.

Let's say that "action" is to mean the immediate physical effect of an organism on its local environment. Actions produce effects on the rest of the environment, but are not the only contributors to those effects. For example, the action of turning a steering wheel has an effect on the car's direction, but so do crosswinds and other disturbances. The action of pushing on a lawnmower has an effect on the lawnmower's motion, but so does the internal friction of the wheels, the bumpiness of the ground, and so on. So we separate the actions of an organism from the effects that they have. The same actions may produce many different effects, depending on what other influences are acting at the same time.

Among all the effects to which actions contribute, some are perceived by the acting system, and the perceptions are compared with reference conditions. The error alters the action, with the result that we have a control loop: the perceived effect (as opposed to the unperceived ones) becomes a controlled effect; action now varies as needed to assure that only one particular state of that effect occurs even when other influences are present. There are still side-effects of the controlling actions, but because they are not being perceived and compared with reference levels, they are not repeatable or protected against disturbances. They just happen.

Now, the word "behavior." Here the problem is that traditional uses of this word do not actually refer to actions of an organism as defined above, but to controlled consequences of actions. We refer to the behavior of "picking up a pencil." But that phrase describes a consequence of coordinated motor outputs, not the outputs themselves. The actions that result in picking up a pencil depend on where the arm and hand are relative to the pencil, the orientation of the pencil, whether anything is on top of the pencil, and on and on. Every time you pick up a pencil your actions are probably different. What repeats is only the perceived consequence of your actions: the pencil getting picked up in the way you think of as getting picked up. So most of the time, "behavior" really means "controlled perception."

Your question as to whether any behaviors occur that are not related to reference conditions can now be seen, as Rick explained, in a new way. If you are asking whether any consequences of action are not under control, the answer is yes, of course. But such uncontrolled consequences would not tend to repeat or to be stable under changes in environmental conditions, whereas controlled consequences would be stable against disturbances. So to answer your question with respect to any given "behavior" would require knowing what you count as behavior -- if you include accidental side-effects, then no, not all "behavior" is related to a reference condition. But if you mean patterns of consequences of action that repeat over a variety of circumstances, the answer is yes: there is no other way for such consequences to repeat other

than by being under control, and being under control means that there must be a reference condition.

> For example, I may be standing at the lawn mower to mow grass, to look busy, or wondering what I am supposed to do with the machine. In the last case, one might conclude that my directionless-looking behavior has no purpose.

It's impossible to determine the purpose of an action without knowing its effects, and without seeing whether those effects resist disturbances. I would say that your standing at the lawnmower is probably a controlled consequence of muscle tension. Past experience tells me that when I see people standing, it's pretty certain that they will resist forces that tend to make them fall over. If I had any serious doubts about this, I could apply a small force to you and see if you fell over or adjusted your muscle outputs to resist the push.

As to WHY you are standing there -- that is, as to higher level goals that are accomplished by this standing in a particular place, there's no way to find out without doing some experiments or waiting for natural disturbances to occur. Actually, standing at the lawnmower doesn't accomplish the mowing of grass, so I can see right away that that is not the _immediate_ purpose of standing at the lawnmower. If you were to _push_ the lawnmower, then I could guess that the pushing is being used as a means of mowing grass.

It might be that your routine for mowing grass consists of getting out the lawnmower, standing in front of it for five minutes, and then starting to push it. Just seeing a snapshot of your position at one instant during this routine wouldn't reveal the routine to me, even though it's clear in your mind and even though your standing still is actually part of a familiar controlled sequence. The onlooker doesn't know what perception you're controlling. It's like seeing someone searching for some car-keys by looking under magazines, feeling in pants pockets, and lifting chair cushions. If you ask this person, "What are you doing?" that person might say, quite truthfully, "I'm getting a haircut." You're just seeing some of the lower-level details required to get oneself into town where the barbershop is. You're watching the person deal with disturbances on the way to accomplishing a more general goal.

> In fact, am I not still not comparing perceptual signals to reference signals and hence looking baffled because of the results of such comparisons?

Internally, you know what is going on. As an observer, I don't, until you start to do something. There are all sorts of things that might be going on in you as you stand there looking confused. Maybe you're trying to remember how to start the lawnmower. Maybe you're in conflict, really wanting very much to be doing something else, not getting all sweaty and tired, not using a precious half hour of your time just to mow a lawn. Maybe you're mowing the lawn in imagination, figuring out a perceptual pattern that will look nice when the lawn's all mowed. Maybe you're procrastinating by wondering about the philosophical implications of standing there (in which case, that is what you're doing). I'm in the wrong place to know about any of that. You don't have to ask what's "maybe" going on. You know. It's right in there where you are.

It's really pretty hard to say whether ALL behaviors are involved with reference conditions. All CONTROL behaviors are. I suspect that all behaviors are control behaviors, but as soon as I say that someone will come up with an obscure example of a behavior that doesn't seem to involve control of anything, like hiccups. All I can really say is that so far I haven't seen any important kind of behavior that can't best be understood as a process of control.

Best, Bill P.