

Chapter 13

Quantitative measurement of volition

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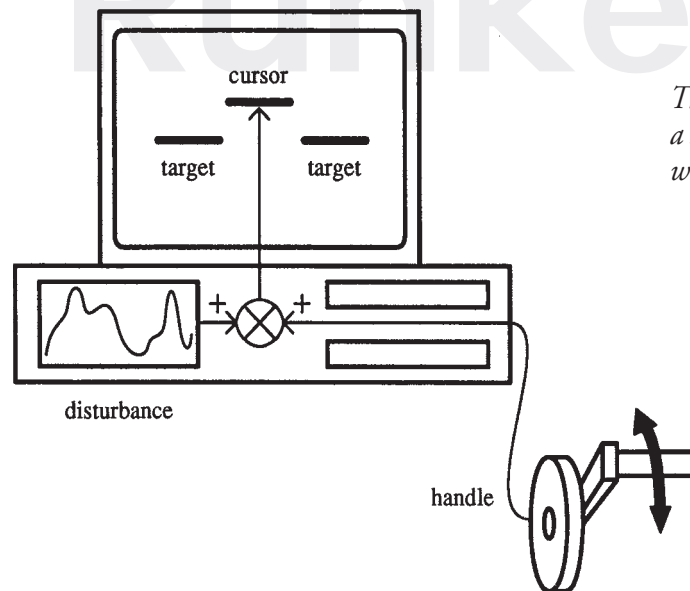
QUANTITATIVE MEASUREMENT OF VOLITION: A PILOT STUDY

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In cybernetic control theory, overt intentional behavior is operationally defined as a controlled input or perceptual variable being maintained in a publicly-observable reference condition. In a control-system model the observable reference condition corresponds to a reference signal inside the behaving organism. The reference signal is the physical embodiment of the intention that is directing the volitional action. The volitional actions of others are not always obvious. Their discovery requires finding a variable that the person's actions are maintaining in some identifiable state despite disturbances that act directly on the variable. From the behavior of the controlled variable it is possible to infer the behavior of the internal reference signal and thus get a picture of the directing intention (Marken 1982, 1983). This inference is model-dependent, but as we will see in this study, it can be made with more internal consistency than might seem reasonable.

EXPERIMENTAL PROCEDURE

This analysis will be done in the context of a "compensatory tracking" task modified to include an interval of spontaneous behavior. The basic compensatory tracking task requires the participant to use a control handle to keep a vertically-movable cursor stationary on a display screen, centered between two fixed target marks. The cursor is continuously disturbed from inside the computer that runs the experiment, the disturbance varying randomly but smoothly in amplitude. About one third of the way through each run, a tone sounds to indicate the start of a period of spontaneous voluntary behavior, and two thirds of the way through, sounds again to end it. Runs last for 60 s, with a 2 s run-in period to allow control to be established before data recording begins. The screen is updated and a sample of handle position is taken 30 times per second, for a total of 1800 data points. The disturbance is generated and handle positions are measured with a precision of one part in 2000 relative to the maximum deviation from center, but cursor position is scaled down to fit on a screen with 200 lines of resolution.



This is Compensatory Tracking, a step in the DEMO1 program which is available on the CD.

Figure 1. Experimental setup. Handle movements are added to a disturbance generated inside the computer to position the cursor. Two stationary target bars are placed in the center of the screen. The cursor can move up and down between them.

DISCUSSION AND CONCLUSIONS

About the present results we can say at least this: when a person deliberately makes the cursor move in some clearly-conceived way, the model will allow us to deduce a reference signal behavior that the person will agree represents the intended movement of the cursor more closely than the actual cursor movement represents it (when we smooth out the highest-frequency variations in reference signal). We still have to rely on the person to tell us that the cursor movements really were intentional, and that the deduced pattern is close to the intended pattern. While that is legitimate information, it would be better to obtain it some other way. The only way to do so is to expand the model to include more kinds of behavior and more levels of behavior—to find other ways of observing what we assume is the same phenomenon.

The ideal way to test this model might be through recording neural signals in appropriate parts of the central nervous system of the participant. In the present state of technology, however, doing this by non-intrusive and safe means is beyond us.

We are in much the same position as astronomers were before space travel became possible. When a telescope is pointed toward the tiny dot of a planet in the sky, we can see or photograph an image that shows a disk with markings on it. By referring to optical theory, and by analogy with observing objects on Earth that we can inspect by other means, we can infer that there really is something out there corresponding to the image. This inference, however, is unverifiable, because the same image could be generated in many ways other than by a planetary body located millions of miles away and illuminated by the Sun. All we can be reasonably sure of is that a collection of wavefronts of light enters the telescope and is subjected to consistent transformations caused by the optical elements: any phenomenon capable of creating the same wave-fronts at the open end of the telescope would produce the same appearance in the eyepiece or on film. A computer-generated hologram, for example, could reproduce the image exactly.

We have now sent spacecraft to Mars, for example, and their cameras confirm, generally, the fuzzy outlines we see from Earth. Or do they? Are we not in the same position as before when we look at the images generated by the cameras? All we can really say is that the assumption of a real body, given the laws of optics and extrapolation from phenomena on Earth, is consistent both with the spacecraft pictures

and the Earth-based telescopic pictures. It would seem that we will not get final confirmation until a human being orbits Mars or lands on its surface.

Even then, the problem will not be solved, the inference will not become a fact beyond all doubting. All we could say is that the wavefronts of light reaching the pupils of the astronaut's eyes, transformed by the optical properties of the lens and interpreted by the computations in a human retina, create a perceived result consistent with the idea that a real body exists, and also consistent with the spacecraft pictures and the Earth-based pictures. With each step we take toward certainty, certainty itself recedes.

In short, we are faced with the same problem that greets all sciences that rely on models of reality for their understanding of nature—physics, chemistry, astronomy, geology, neurology, psychology, and so on. We assume models that seem to serve as instruments for observing formerly invisible objects. Then we try to find alternate ways of observing the same thing, which always turn out to be alternate models or alternate ways of applying the same model. When inconsistencies arise, we modify the models to remove them, or even invent new models when the old ones can't be made to work any more without changing their fundamental nature. The nearest we get to certainty that the models are true pictures of reality is a subjective conviction that what we see makes sense, looks simple, repeats itself, changes as it ought to when circumstances change.

We seem to be seeing reference signals here through an instrument called control theory. There are, no doubt, alternate explanations for what we see here. There always will be. The best we can do is expand our experiments and look for alternate views of the same phenomenon, either to increase our conviction that we are seeing something real, or to force us to change the model.

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