Blind Research

Are the Hard Sciences Immune From Experimenter Effects?

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IN SCIENTIFIC RESEARCH, AS IN EVERYDAY life, our beliefs and biases often influence how we observe and interpret the world. In experimental psychology and clinical research, this problem is widely recognized, which is why experiments in these subjects are often carried out under blind or double-blind conditions. There is solid experimental evidence that experimenters' attitudes and expectations can influence the outcome of experiments.

In single-blind experiments, an investigator does not know which samples or treatments are which. But when human subjects are involved, as in medicine and experimental psychology, double-blind procedures can be used to guard against the expectancy of both subjects and investigators. In a double-blind clinical trial, for example, some patients are given tablets of a drug and others are given similar-looking placebo tablets, pharmacologically inert. Neither clinicians nor patients know who gets what.

In such experiments, the largest placebo effects usually occur in trials in which both patients and physicians believe a powerful new treatment is being tested. The inert tablets tend to work like the treatment being studied, and can even induce its characteristic side-effects. Likewise, experimenter expectancy effects are well known in experimental psychology, and also show up in experiments on animal behavior.

It is fascinating to learn that blind assessment first began in the late eighteenth century, in which the first blind experiments were carried out to evaluate mesmerism. They were literally conducted with blindfolds, and took place in France at the house of Benjamin Franklin, the American minister plenipotentiary, who was head of a commission of inquiry appointed by King Louis XVI. (The report is translated and reprinted in its entirety in SKEPTIC, Vol. 4, No. 3.)

The use of blind assessment was adopted in the mid-nineteenth century by homeopaths, and by the end of that century was taken up by psychologists and psychical researchers. But it was not until the 1930s that blind techniques combined with no-treatment control groups started to be used in clinical trials, and only after World War II did blind assessment in randomized controlled trials became a standard technique.

In medicine and psychology, blind experimentation began as a deterrent against the unconventional, but its general importance is now recognized for orthodox research. It has been internalized within the mainstream. Although researchers in medicine and psychology have been aware of the effects of experimenters' expectations for decades, how widely has this awareness spread throughout the scientific community? Can the expectations of experimenters affect their results in other branches of science? No one seems to know. Most people simply assume that scientists in orthodox fields of inquiry are immune from the problem.

My colleagues and I have attempted to quantify attention to possible experimenter effects in different branches of science by means of two surveys. The first survey was of experimental papers recently published in leading scientific journals, including *Nature* and the *Proceedings of the National Academy of Sciences*.

In the physical sciences, we found no blind experiments in any of the 237 papers we reviewed. In the biological sciences, there were 7 blind experiments out of 914 (<1%); in psychology and animal behavior, 7 out of 143 (5%); and in the medical sciences, 55 out of 227 (24%). By far the highest proportion (but the smallest sample) was in parapsychology, 23 out of 27 (85%).

In the medical journals, out of the 55 reports involving blind methods, only 25% (11 of the total surveyed) involved double-blind trials. Thirty employed single-blind methods, with one or more of the investigators carrying out blind evaluations or analyses. The majority of the papers involved no blind methods. (The journals surveyed were the *American Journal of Medicine, Annals of Internal Medicine, British Journal of Clinical Pharmacology, British Medical Journal* and *New England Journal of Medicine*.)

The second survey was of science departments at 11 high-status British Universities (including Oxford, Cambridge, London and Edinburgh). We found that blind procedures are rare in most branches of the physical and biological sciences. They are not used or taught in 22 out of 23 physics and chemistry departments, or in 14 out of 16 biochemistry and molecular biology departments. By contrast, blind methodologies are practiced and taught in 4 out of 8 genetics departments, and in 6 out of 8 physiology departments. Even so, in most of these departments they are used occasionally rather than routinely, and are mentioned only briefly in lectures.

Only in exceptional cases are blind techniques used routinely. Our survey revealed three examples, all of which involved commercial contracts. The university scientists were contractually required to analyze or evaluate coded samples without knowing their identity.

When academic scientists were interviewed for this survey, some did not know what was meant by the phrase "blind methodology." Most were aware of blind techniques, but thought that they were necessary only in clinical research or psychology. They believed that their principal purpose was to avoid biases introduced by human subjects, rather than by experimenters. The commonest view expressed by physical and biological scientists was that blind methods are unnecessary in their own field because "nature itself is blind," as one professor put it. Some admitted the theoretical possibility of bias by experimenters, but thought it of no importance in practice. One chemist added, "Science is difficult enough as it is without making it even harder by not knowing what you are working on."

The assumption by most "hard" scientists that blind techniques are unnecessary in their own field is so fundamental that it deserves to be tested empirically. Can the expectations of experimenters introduce a bias, conscious or unconscious, into the way they carry out their procedures, make observations or select data?

I suggest the following investigation. Take a typical experiment involving a test sample and a control, for example the comparison of an inhibited enzyme with an uninhibited control in a biochemical experiment. Then carry out the experiment both under open and blind conditions, with the samples labeled A and B. In student practical classes, for instance, half the class would do the experiment blind, while the other half would, as usual, know which sample is which.

If there are no significant differences between the results under open and blind conditions, this would be evidence that blind techniques are unnecessary. On the other hand, if there are significant differences between results under blind and open conditions, this would reveal the existence of experimenter effects. Further research would then be needed to find out how the experimenters were influencing the data.

The more independent investigations, the better. This is an inquiry in which the critical skills of skeptics could play an important role. The use of blind methodologies, pioneered by skeptics, has been internalized within medicine, psychology and parapsychology, resulting in improved rigor and a sophisticated awareness of the effects of experimenter bias. The so-called hard sciences have largely escaped skeptical scrutiny. There seems no good reason why they should continue to be granted this immunity.

Perhaps it will turn out, after all, that "hard" scientists need not bother with blind techniques. They may indeed be exceptions to the principle that beliefs, desires and expectations can influence how we observe and interpret things. On the other hand, hard scientists may be like everybody else, including researchers in psychology and medicine.

I would be grateful to hear from any readers who might be able to help with experimental investigations on this subject. ▼