Science, Psychology, & Reality
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“The physiological element affects all physical definitions if all our observations be associated with our sense-perceptions; in short, the whole range of physics, its definitions as well as its entire structure, bears an anthropomorphous character.” Planck (p.3)

It is sometimes stated that psychology is not a science. What is the meaning of this statement? Science is a method for uncovering what is real. As the fields of psychology, neuroscience, genetics, and machine learning are all faced with an inability to replicate many of their experimental results, numerous scientists are grappling with the question: what phenomena do we actually know are real? Given this question, it might be useful to consider how we define anything to be “real” in the scientific sense.

First, although science depends on observation, scientific constructs need not be observed directly. Consider how a radio wave is never directly observed by our senses, we simply observe that our equipment behaves in a certain way that confirms its reality. This is also true for even the most basic scientific constructs. No one has ever observed gravity—we only observe the motion of objects. Given that we observe solid objects of a certain size all move in a certain way, it is convenient to assume the law of gravitation. Second, note that experimental replication played only a trivial role in the leap of scientific progress made by Newton. Before Newton mathematically formalized his laws, plenty of people were well aware that what is tossed in the air will fall back to the ground. It replicates every time. Yet here, neither the knowledge of the fact nor the fact's tendency to repeat itself are considered scientific in and of themselves. Nonetheless, the repeated perception, or observation, of the motion of objects was necessary to instigate the scientific leap. In this sense, there must always be some *perceivable* phenomenon in order for us to verify the reality of a construct, even if a highly contrived apparatus, such as the Large Hadron Collider, is necessary to bring the effects of the construct into the awareness of our perceptions.

Importantly, a single person's perception is not enough for science. There is a social component to all of science as we know it, which is usually not explicitly identified as social. Not only can I perceive the sun, but you can also perceive the sun, and everyone we know can perceive the sun and its effects, so we say that the sun is real. The scientific evidence is immediately present to our capacities of observation, it does not require any contrived measurement strategy beyond the organic technology of the eye and visual system. If a person were to claim they observed two suns in the sky, we would call that a hallucination. But in our current understanding, we now know that there must be some real physiological basis to this hypothetical hallucination--something must be happening in that person's brain to cause them to have such a peculiar observation such as two suns. What is often not always admitted, is that

there is also a process in our own brains that is affording our perception of the sole sun. Every observation of the sun emerges within the darkness of our skull. In this sense, the perception of two suns would be an individual's hallucination, whereas the perception of a single sun is, in a sense, the collective hallucination. This "collective hallucination" is called reality, and it is the basis of all science. We cannot see beyond our own minds, so we use the minds of others to correct our own misperceptions, using our own established definition of what is real: we say that what is real is that which is the same for everyone. Note that there is no way of proving this is the right definition of reality, its correctness is merely self-evident and convenient.

This is not at all saying that our reality is meaningless or that there is no truth to science. Rather, it is an attempt to explicitly lay on the table what the basis of our scientific work is, highlighting the abstract, almost arbitrary, nature of its roots. Many people would say that physical mass is probably the most concrete thing in reality that there is. But what is mass? Mass is a numerical value that allows the equations of physics to be conveniently arranged in a way such that they do not contradict each other (Poincare, 1905). Mass is energy divided by the speed of light squared (Einstein, 1905). Why is mass not energy divided by the speed of light cubed? The equations simply do not work out that way. There is nothing concrete about it and there is no explanation for it. In science, truth is equivalent to convenience, not explanation. This convenience is often called elegance, and chiseling this elegance out of the crudeness and sparsity of our collective observations is the work of a scientist.

For the field of psychology in particular, it might be tempting to blame the difficulty on the fact that the phenomena of interest, the inner workings of the psyche, are invisible and unseen--in other words, unobservable, and therefore somehow beyond the reach of science. But we have already recognized that gravity is unobservable. Even light itself is invisible, that is why space is black. So the unseen is not only well within the domain of science, it is ironically the crux of it. Any scientific construct itself need not be observed, rather, it must be inferred by its capacity to elegantly organize observations. Psychological science should be concerned with how to organize their observations in a way that references numerical physical concepts such as force, energy, space, and time. This could be done with a mathematical framework (Mattek, 2019), which could lead to the establishment of units of measurements for psychology. But this is not all:

"The whole development of theoretical physics, up to the present, is the unification of its systems which has been obtained by a certain elimination of the anthropomorphous elements, particularly the specific sense-perceptions. Seeing, however, that the sensations are acknowledged to be the starting point of all physical research, this deliberate departure from the fundamental premises must appear astonishing, if not paradoxical." Planck (p. 6)

The objective measurements of science are no longer made with our sensory systems. There was a certain departure that had to be made. The body was the original detector of heat,

but ultimately, precise measurement required some apparatus outside the body (e.g., a thermometer) that could reflect the quantity of heat. In psychology, we are still at a stage where the primary measurement apparatus is our sensation. When an emotion arises, we detect it in our own body, using the capacity of our nervous system. When a psychiatrist observes their patient with depression, they are using their own eyes and ears as a mechanism for detecting the disease. When a person expresses empathy, we can see and identify it with our senses. How much noise must be in these measurements? It is impossible to estimate. How much progress could be made if we were to construct an apparatus outside of ourselves to measure such things based on clearly formalized theoretical work? This should be highly important for the field of psychology, and we can look to see how this feat was accomplished in other domains:

“To this end, I would direct your attention to that point from which the first step was taken towards the actual realization of the unified system of physics, up to then only postulated by philosophers--I mean the Principle of the Conservation of Energy. Now, as I observed before, it will be clear, almost self-evident, that before its general enunciation by Mayer, Joule, and Helmholtz, the principle of energy originally had an anthropomorphous nature. It began with the knowledge that no one can do useful work out of nothing; and this knowledge was born of the observations gathered in the search of a solution for a practical problem—the discovery of perpetual motion...We no longer think of making [the law of conservation of energy] dependent upon the refinements of methods which we possess to get experimental proof on the question of perpetual motion. In [its] generalization, *which cannot be rigidly proved*, but which forces itself upon our attention, lies the above-mentioned emancipation from the anthropomorphous elements.” Planck (p.6), italics added

In all branches of science, leaps in progress are often achieved through self-evident generalization, which may not be able to be “rigidly proved”, but nonetheless can draw connections between diverse phenomena in a way that affords simplicity. The motion of planets around the sun is not different than the motion of objects that fall to the earth--this was a generalization made by Newton. Light is not different than electricity--this was a generalization made by Maxwell. Energy is not different than mass--this was a generalization made by Einstein. These generalizations were all made using mathematical proof, not by conducting or replicating any particular experiment.

Now we must ask ourselves, what is it about the force of our own attention that we think it is so different than physical force? After all, we can observe the effects of our attention everywhere. Like gravity affecting the motion of objects, attention affects the motion of our bodies, most simply, our eye movements. The earth follows the sun, tied to it by gravity, and your cell phone follows you to your car, to your work, etc., tied to you by your attention. Our behavior is perpetual motion, and mathematically, it is continuous and differentiable. The integration of psychology and physics will come by looking more deeply into what is directly observable, and finding the elegant mathematical structures that guide our human dance.

References

- Einstein, A. (1905). Does the inertia of a body depend on its energy constant? *Annalen der Physik*, 18:639.
- Mattek, A. M. (2019). "Expanding psychological theory using system analogies." *Statistical Modeling, Causal Inference, and Social Science*. 22 July 2019.
<https://statmodeling.stat.columbia.edu/2019/07/22/alison-mattek-on-physics-and-psychology-philosophy-models-explanations-and-formalization/>
- Planck, M. (1925). *A Survey of Physical Theory*. Translated by R. Jones and D. H. Williams. Republished in 1993. Dover Publications: Mineola, NY.
- Poincaré, H. (1905). *Science and Hypothesis*. London: The Walter-Scott Publishing Co., Ltd.
<https://www.gutenberg.org/files/37157/37157-pdf.pdf>