Science as Falsification
Karl Popper

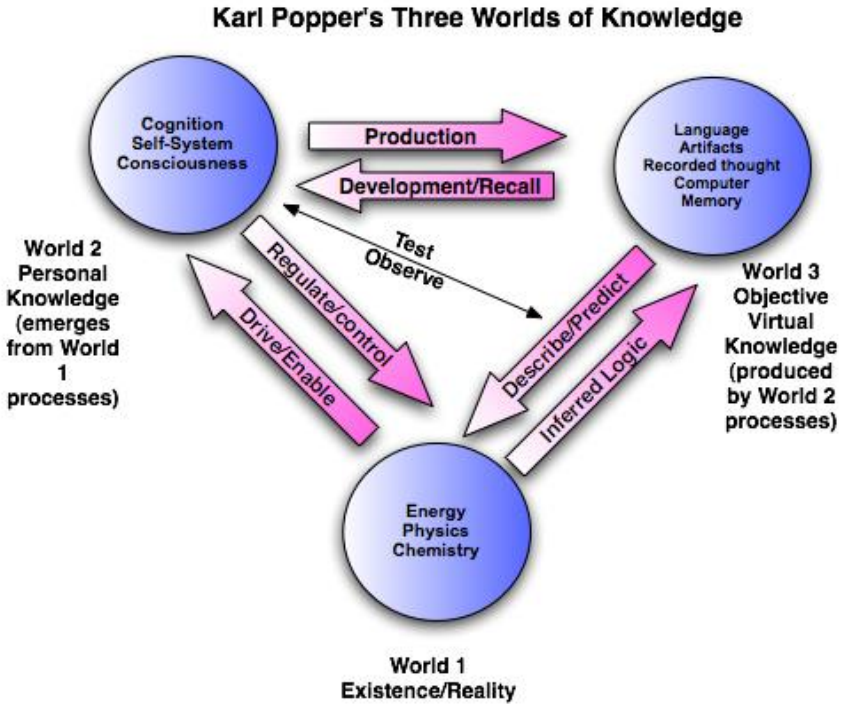
Karl Popper was a professor and philosopher of science born in Vienna in 1902. Although Popper left school at the age of 16, he attended lectures as a guest student at the University of Vienna before joining the University after a brief stint as a construction worker and cabinetmaker's apprentice. In 1919, the young Popper became attracted to Marxism and joined the Association of Socialist School Students and Social Democratic Workers' Party of Austria. However, later that year he became disillusioned with Marxism, claiming that it was "pseudo-scientific" (a turn which greatly influenced his later work). In 1925, Popper graduated from the university as an elementary teacher and worked at an after-school club for underprivileged children, but continued to study philosophy and psychology, earning a doctorate in psychology in 1928. In 1934 he published and introduced his theory of falsifiability for which he is most famous. He continued to defend this theory as a professor at the University of New Zealand, the London School of Economics, and the University of London and then into retirement after 1969 until his death in 1994.

Science as Falsification is an excerpt from Popper's 1963 publication *Conjectures and Refutations,* a collection of his lectures and writings on the philosophy of science. In this work, Popper claims that, in order for something to be considered science, it must be falsifiable. This does not mean that it is made false, but that, if it is false, it can be shown through observation and experiment to be false. On the other hand, there are theories that cannot be proven to be false ("falsifiable"), and therefore, cannot be considered legitimate scientific theories, but rather "pseudo-science." One example he provides of a legitimate, falsifiable scientific theory is Einstein's theory of relativity, because it provides a specific and risky prediction that can prove the theory to be false. Examples Popper provides of pseudo-scientific theories are Marx's theory of history, Freud's psychoanalysis, and Alfred Adler's individual psychology, which he claims have more in common with primitive myths than science because they seek constant verification of their theories without falsifiability.

Note that in Latin, prove means to test or demonstrate. With science, you conduct *tests* and, if successful, the tests fail to disprove your hypothesis. The aim is not to prove, but to *fail to disprove*. There is a distinction between scientific *laws* and *theories,* and according to Popper, the two, since they are in two different realms of thought, can live and work together. There are three worlds of knowledge: 1) the physical universe that consists of actual truth and reality that we try to represent through chemistry, physics, etc. We exist in this world but do not always perceive or represent it correctly (since we are limited by our perceptions, which brings us to…2) the world of our subjective

perceptions and consciousness. This is world is affected by our personal experiences and thoughts, which can differ from objective reality. And finally we have 3) the products of our mind that exist in artifacts such as books, *theories*, models, etc. They are objective in their existence but subjective in their creation. You can see by the following model how these co-exist (fact and belief); however, they are distinct and, in order to cross from belief to knowledge, there must be tests and observations.

**Theories are included in World 3, because they explain facts (the objective reality of World 1), but only through passing through World 2 first!



Although pseudo-science does not meet the criteria of *failing to disprove* via tests, this does not demean the belief. It is just not science. It is belief, not knowledge. According to Popper's theory, religion/faith would be included as a pseudo-science, because it is a belief that cannot be tested or disproved. Again, this does not demean the belief; it is just not science.

Discussion Questions:

1. Look at the following examples. Which are falsifiable and which are not? Can we prove them wrong (either in practice or theory)?
    a. No human lives forever.
    b. All humans live forever.
    c. It will be raining here in one billion years.
    d. The sun will rise tomorrow.

2. If a theory is not falsifiable, is it a legitimate theory? Does it still have some value even if it is not "scientific"? Is it on the same level as other non-scientific claims, such as "Peter Pan can fly"?
3. What experience do you have with the "explanatory power" of pseudo-scientific theories? For example, consider the way horoscopes are worded to fit just about any person or situation. Now consider Marx and his "Alienation of Labor." Think of an example when the laborer is not alienated. Now try to come up with Marx's response- how would he show that your example actually supports his theory? Is it "easy to obtain confirmations, or verifications, for nearly every theory- if we look for confirmations?"
4. Is it better to focus on finding evidence against your beliefs rather than verification, as Popper claims? Why? *This is why counterarguments are crucial to critical thinking!! Whether you agree or not, try to disprove as well as prove.
5. Consider other theories and your own beliefs. What would be an example of something that, if observed, would contradict the hypothesis? If you cannot answer this question, the theory is not scientific according to Popper. Do you agree? Are they falsifiable or not? If not, are they still justifiable beliefs?
6. If religion is considered a pseudo-science (because it cannot be tested or disproved), can it still be a justifiable belief? Furthermore, if science and pseudo-science exist in different realms, can faith and science co-exist and even work together?

Some examples of categories for discussion: Economics, Ethics, Historicism, Mathematics, Evolution, Creationism, Theism

Connections to Other Readings:

Plato (Allegory of the Cave), Bohm, Plato (Apology), Winter, Mill, Friedman, Emerson, Myers, Loury, Swimme, Marx, Menkiti, Ridley, Sovacool & Brown, Quinn, Bodian, Lewis, Tillich, Religious Diversity, Camus, Moore

Examples of connections include:

- Beliefs must be questioned in order to come closer to truth and understanding (ie, remove blocks, test your beliefs, communicate with others): Plato, Bohm, Mill
- What can be considered a legitimate theory or belief? Do you have to test it for it to be a justifiable belief?: Winter, Emerson
- Consider the following authors' theses and determine if they are falsifiable and therefore legitimate theories. What could be observed to contradict them? Do any of these authors rely on "explanatory power?": Friedman, Myers, Loury, Swimme, Marx, Menkiti, Ridley, Sovacool & Brown, Quinn, Bodian, Lewis, Tillich, Religious Diversity, Camus, Moore
- What are myths? Compare what Popper says to other authors who discuss myths.: Quinn, Sovacool & Brown, Camus

Online Resources

http://plato.stanford.edu/entries/popper/

http://www.princeton.edu/~achaney/tmve/wiki100k/docs/Falsifiability.html