

## (Sir) Karl Popper (1902-1994)

- Considered to be the most influential and greatest philosophers of science of the 20<sup>th</sup> century. (Stephen Thornton, 2006<sup>1</sup>)
- Prominent social and political philosopher as well.
- Held a “critical-rationalist” position and defended it in a time in which “post-critical” thought was flourishing (ca. 1930-1950) and what he considered were “pessimistic and skeptical” elements of the equally prominent **logical-positivistic, logical-empiricist** schools of thought, themselves highly influenced by methods of linguistic analysis.

“Philosophers are as free as others to use any method in searching for truth. **There is no method peculiar to philosophy...I equate the rational attitude and the critical attitude...** whenever we propose a solution to a problem, **we ought to try as hard as we can to overthrow our solution, rather than defend it...** Yet criticisms will be fruitful only if we state our problem as clearly as we can and put our solution in a sufficiently definite form—a form in which it can be critically discussed.”

-*The Logic of Scientific Discovery (L. Sci. D.)*, (1959), xix

- **Central Epistemological Question (for Popper). How does one account for the growth of knowledge?**

“The central problem of epistemology **has always been and still is the growth of knowledge. And the growth of knowledge can be studied best by studying the growth of scientific knowledge.**” (*L. Sci. D.*), xx

“[M]ost problems connected with the growth of or knowledge **must necessarily transcend any study which is confined to common-sense as opposed to scientific knowledge...philosophers should not be specialists.** For myself, I am interested in science and in philosophy only because I want to learn something about the **riddle of the world in which we live**, and the **riddle of man’s knowledge of that world.**<sup>2</sup> And

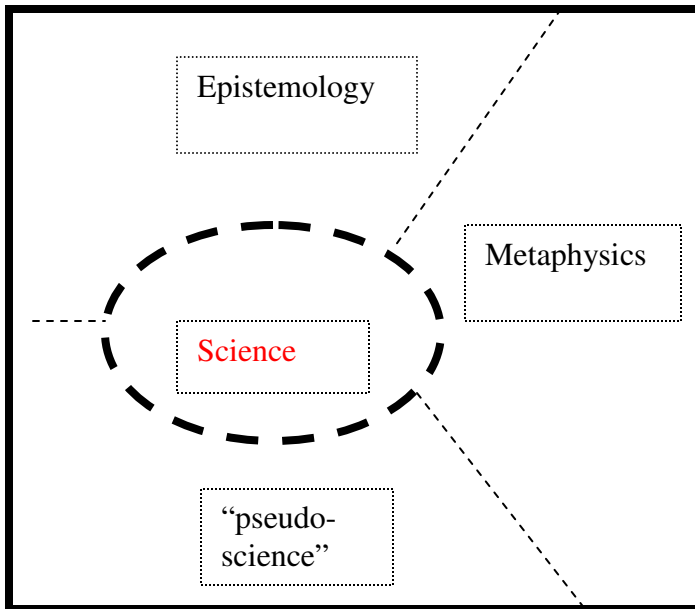
<sup>1</sup> “Karl Popper,” *Stanford Encyclopedia of Philosophy*, (on-line) <http://plato.stanford.edu/entries/popper>

<sup>2</sup> Note how he is signaling to the reader here already his preference for the “grand” questions in “traditional” philosophy, both metaphysical (highlighted by the blue phrase) and epistemological (highlighted by the red phrase). Keep in mind that he was writing this during a time when highly specialized methods of

**I believe that only a revival of interest in these riddles can save the sciences and philosophy from narrow specialization and from an obscurantist faith in the expert's special skill...a faith that so well fits our 'post-rationalist' and 'post-critical' age, proudly dedicated to the destruction of the traditions of rational philosophy, and of rational thought itself."**

(*L. Sci. D.*), xxiv-xxvi.

- **The Demarcation Problem**



- **Note:** The dashed boundary signifies the search for **necessary conditions**<sup>3</sup> (i.e.: “If it’s science, then...”), which is *not* the same endeavor as searching for **necessary and sufficient** conditions. The latter endeavor, when applied to such a concept as broad as science, is hopeless and unnecessary for Popper’s project. (A list of necessary and sufficient conditions would establish a logical equivalence between science and such a list, i.e. provide a *definition* of science. However, the list of sufficiency conditions might be open-ended!)

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language and logical analysis were predominant in philosophy, methods which sought to repudiate or undercut most of the “traditional” questions asked in “traditional” philosophy. Note how he sets himself against such trends in the selections you read. He’s sympathetic to rationalist philosophy and classical metaphysical and epistemological questions, without championing a particular metaphysical viewpoint.

<sup>3</sup> Recall Sept. 4 lecture

- **Popper’s Answer: Falsificationism!**

“*[T]he criterion of the scientific status of a theory is its falsifiability, or refutability, or testability.*”

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### A Toy Example

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Consider the following law  $L$  below that’s part of some general theory  $T$ :

**$L$  : All ravens are black.**

**“The theories of natural science, and especially what we call natural laws, have the logical form of strictly universal statements.”**

(*L. Sci. D.*), §15, p.48

- **Recall from September 4 lecture this can be expressed in FOPL as**

$$\forall x:(Rx \rightarrow Bx) \qquad R: \text{Raven predicate}$$

$$\qquad \qquad \qquad B: \text{black predicate.}$$

However, any (material) conditional in FOPL can be re-written in the following form<sup>4</sup>:

$$\forall x:(Rx \rightarrow Bx) \leftrightarrow \forall x( Bx \vee \neg Rx)$$

Suppose we negate the above conditional:

$$\neg \forall x:(Rx \rightarrow Bx) \qquad \leftrightarrow \qquad \neg \forall x( Bx \vee \neg Rx)$$

Then<sup>5</sup>:  $\neg \forall x( Bx \vee \neg Rx) \leftrightarrow \exists x(\neg Bx \wedge \neg \neg Rx) \leftrightarrow \exists x(\neg Bx \wedge Rx) \vdash$

$$(\neg Ba \wedge Ra)$$

- **Hence, through ordinary FOPL, the negation of the above ‘theory’ is a falsifying incidence, i.e. a case  $a$  which is Raven, and isn’t black.**

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<sup>4</sup> Proof suppressed here. It’s easily demonstrated, however, through the use of truth-tables. Or more rigorously, one can establish the above logical equivalence using some of the 14 rules of inference in FOPL.

<sup>5</sup> Using DeMorgan, Double-negation, and  $\exists$ -elimination

According to Modus Tollens argument form:

$$\begin{array}{l} T \rightarrow \forall x:(Rx \rightarrow Bx) \\ (\neg Ba \wedge Ra) \\ \hline \end{array}$$

$$\therefore \neg T$$

Or a disconfirming incidence (a non-black raven) has *falsified* the theory *T* !

- **Falsificationism is based (of course) on a logical “symmetry”, but it is methodologically asymmetrical!**

“My proposal is based upon an *asymmetry* between verifiability and falsifiability; an asymmetry which results from the logical form of universal statements.”

(*L. Sci. D*), §6, p. 19.

“If we accept as true one singular statement which...assert[s] the existence of a thing (or...event) ruled out by the law, **then the law is refuted.**”

[S]trictly universal statements are not verifiable...**we cannot search the whole world in order to make sure that nothing exists that the law forbids.**

Nevertheless...strictly universal [statements] are in principle empirically decidable...*in one way only.* **Whether it is found that something [a counter-instance] exists here or there, a strictly...universal one [is] falsified.**

The asymmetry here described,...[namely] the one-sided falsifiability of the universal statements of empirical science...[is] no asymmetry of any purely *logical* relationship. On the contrary, the logical relationships show symmetry. Universal and existential statements are constructed symmetrically. It is only the line drawn by our criterion of demarcation which produces an asymmetry.”

(*L. Sci. D*), §15, pp. 48-50.

- **Against Induction: Science is a Hypothetico-Deductive Procedure**

“Every application of science is based upon an **inference from scientific hypotheses (which are universal) to singular cases, i.e. upon a deduction of singular predictions.**”

(*L. Sci. D*), §14, p. 43.

“(3) Every ‘good’ scientific theory is a prohibition: it forbids certain things to happen. The more a theory forbids, the better it is...[conversely](4)

[i]rrrefutability is not a virtue of a theory, but a vice. (5) Every genuine *test* of a theory is an attempt to falsify it, or to refute it. Testability is falsifiability...some theories are more testable than others; they take, as it were, greater risks.”

*Conjectures & Refutations* CC1998, p.7

- Conversely, (recall Popper’s complaint about Marxist history, psychoanalysis, etc.) if *T* generates “laws” that are **tautologies** (always true), then their negations (logically expressing possible disconfirming incidences) are **contradictions**. In other words, they cannot exist! But if there are no disconfirming cases, then the Modus Tollens procedure is blocked, and therefore *T* is *unfalsifiable*!

“Thus the [tautological] statement, ‘It will rain or not rain tomorrow’ will not be regarded as empirical, **simply because it cannot be refuted.**”

(*L. Sci. D*), §6, p. 19.

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- Moreover, “[w]hilst **tautologies...and other non-falsifiable statements assert, as it were *too little*...self-contradictory statements assert *too much*. From a self-contradictory statement, any statement whatsoever can be validly deduced.**”

*L. Sci. Disc* §23, p. 71.

- “We can put this briefly by saying: a theory is falsifiable if the class of its potential falsifiers is not empty.”

*L. Sci. Disc* §21, p. 66.

- “On the other hand...statements contradict[ing] a basic theory provid[e] grounds for its falsification only if they corroborate a falsifying hypothesis at the same time.”

*L. Sci. Disc* §22, p. 67.

- **Questions/Concerns**

1. The attractive appeal of Popper's falsificationism lies in its simplicity. However, does it present an over simplified picture of science? Is every 'genuine test' an attempt to falsify a theory? Are laws really expressible in such simple universal conditional forms in FOPL?
2. Popper repudiates all methods of degrees of inductive support. So what *positive criterion* distinguishes a 'better' theory? (If two different theories  $T$ ,  $T^*$  both generate the same classes of potentially disconfirmable events?)