

PHIL250
Midterm Key

Methodological/logical [a/]symmetry

From Popper's falsificationist thesis. **(2.5 pts)** Falsifying a theory is *methodologically asymmetrical* as it takes just one empirical counterinstance to falsify it, but it may be either practically unfeasible or in principle impossible to confirm it, as it requires an exhaustive method over all empirically possible confirming instances. **(2.5 pts)** The procedure is nevertheless *logically symmetrical* since it's based on the distribution of negation (over a universally quantified conditional $\neg(\forall x: Px \rightarrow Qx) \equiv \exists x: \neg Qx \wedge Px$) as well as Modus Tollens, a rule of inference which is an extension of a contrapositive, which is itself logically equivalent to its base conditional, i.e.: $\neg Q \rightarrow \neg P \equiv P \rightarrow Q$.

Falsificationism

Karl Popper's revision of the hypothetico-deductive approach in the philosophy of science, which is based on the notion of falsification as opposed to confirmation. Karl Popper introduced it as a **(1 pt)** criterion of demarcation: **(4 pt)** A necessary condition for a theory to be scientific is for any of the laws it generates must be falsifiable. That is to say, though according to Popper such laws must be stated in universal conditional form, they must be specific enough to be in principle empirically testable, in such a manner that they can be refuted.

Posterior/Prior Probability

(2.5 pts) Probabilities are *prior* insofar as they're accepted as given before a hypothesis is tested in the light of new evidence. **(2.5 pts)** *Posterior* probabilities on the other hand are the probabilities derived from the introduction of new evidence. For example, $P(H \mid C \ \& \ B)$, i.e. the probability of a hypothesis being true given certain background assumptions and conditions of experimental design (which don't depend on H) is an example of a prior probability, whereas $P(H \mid E^n \ \& \ C^n \ \& \ B)$, i.e. the probability of H given n tests is an example of a posterior probability.

Ontology

(1-2pts) In general terms, the branch of metaphysics dealing with the *way* entities *exist*. **(4 - 3pts)** In the philosophy of science, this is usually restricted to the characterization of a theory's 'furniture.' That is to say, what kinds of entities are introduced by a scientific theory or conceptual scheme.

Methodology

In the philosophy of science, **(1)** this is the theory of scientific *method*, in all senses. **(4)** This notion encompasses everything from a theory of "how scientists should behave," (Laudan), experimental method, to the other extreme involve the interrelation of scientific theories and rationality of theory choice, evidence, viz. general frameworks (research programmes, research traditions, paradigms.)

Apriori/Aposteriori

Epistemological concepts: **(2.5)** A statement is *apriori* if its truth-conditions are independent of experience, though some experience is obviously necessary to grasp the meaning of the statement's terms/referents, as well as the syntax of the statement. **(2.5)** A statement is *aposteriori* if its truth conditions depend on experience.

Scientific Realism

(4) The metaphysical position in the philosophy of science which argues that the aim and essential nature of science necessarily involves truth, in the sense of presenting claims about the nature of the world which can be objectively assessed as true or false. **(1)** Realists usually argue that the essential *reliability* of any theory indicates that its entities (whether observable or unobservable) refer to metaphysically real entities in the world.

Paradigm. Aside from giving a concise definition (1-2 sentences) list what is encompassed by this concept, as described explicitly by Kuhn¹.)

(2.5) Thomas Kuhn's notion of a fundamental framework or coherent disciplinary which instantiate particular scientific theories and practices. **(2.5)** According to Kuhn, paradigms are "acceptable models or patterns," examples which include law, theory, application, and instrumentation together—provide model from which spring particular coherent traditions of scientific research

Anomaly/crises (Aside from defining both in a simple sentence or two, state in 1-2 sentences their relation)

As opposed to a 'puzzle' which is constituted by a paradigm and therefore testing the ingenuity of the scientist-as-puzzle-solver, **(1pt)** an anomaly presents itself as *problem* to a paradigm, insofar as testing its integrity. **(1pt)** Anomalies usually present themselves as 'evidence' or empirical instances which cannot be constituted by any aspect of a paradigm. **(3pts)** Over time, anomalies tend to accrue, eventually precipitating a crisis for a particular paradigm. During this period of crisis, 'revolutions' occur in which no particular paradigm may be have hegemony in a particular scientific field. Previous anomalies become *exemplars* in a new paradigm.

Normal science/puzzle solving (Aside from defining both in a simple sentence or two, state in 1-2 sentences their relation)

According to Kuhn, this is the 'status quo' in the historical development of a scientific field: normal science is the rule, revolutionary science the exception. **(2-3 pts)** Normal science is characterized by periods of relative stability for a particular paradigm: its inevitable anomalies haven't precipitated a crisis. **(3-2 pts)** For a science in its maturity, its paradigms create a disciplinary matrix fundamentally characterized by an activity of puzzle-solving. The paradigm supplies both the ontology of its puzzles, as well as its standards for their solution. In this respect, the ingenuity of the researcher working in the particular paradigm is subject to test, should s/he encounter difficulty solving the puzzle, not the paradigm itself.

Empirical adequacy (Both the "informal sense" and van Fraasen's notion)

¹ Hint: See quote from SSR in Lecture XIII notes.

Empirical adequacy, a term coined by Bas van Fraassen, has found its way in ordinary usage like Kuhn's notion of 'paradigm.' (2.5) In its everyday sense, the notion is associated with (Aristotle's) "saving the phenomena," i.e. the theory fits the empirical constraints of the phenomena it purports to describe/predict. (2.5) According to Bas Van Fraassen, however, "a theory is empirically adequate exactly if what it says about observable things and events in the world, is true...such a theory has at least one model that all actual phenomena fit inside...*all* the phenomena; these are not exhausted by those actually observed, nor even by those observed at some time, whether past, present, or future." In other words, if everything the theory says about observables (whether actually observed or not) is true. This is a considerably stronger statement than the informal notion.

Retrorecognition²

(4 pts) Gingrich and Lightman's claim that anomalies are only fully recognized or appreciated as such retrospectively *from the standpoint of a particular paradigm*. For example, prior to plate tectonics in geology, the congruence of fits of the South American and the African continents was dismissed as a curiosity, not fully appreciated as anomalous in the pre-tectonics paradigm that stipulated that continents can only move in an upward/downward direction. (1pt) This notion presents tensions for the Kuhnian, insofar as implying a different mechanism of conceptual change. (G & L view paradigms as even more opaque to novelty than Kuhn did.)

Models/Conceptual change (Aside from defining both in a simple sentence or two, state in 1-2 sentences their relation³)

According to those in the cognitive philosophy of science tradition (Giere, Nersessian, etc.) excessive attention has been paid to science as a linguistic and logical structure at the expense of the *cognitive* processes (many of them sub-linguistic) that scientists engage in, in their *modeling* activity. (2 pts) Models, in other words, are viewed in the *cognitive scientific* sense, as being tacit cognitive structures adopted in everyday as well as in specialized reasoning. Nersessian describes such *analogical* modeling processes in particular as providing an essential insight into the problem of conceptual change; (2pts) i.e. the problem confronting pre-cognitive philosophers of science concerning how to account for the evolution and change of scientific knowledge (Kuhn's incommensurability thesis being a particularly notorious rendition.) (1 pts) Nersessian argues for a gradualist/continual evolution of conceptual change, underwritten by successive mappings/transformations in modeling activity between analogical source/target domains.

STUDY QUESTIONS:

1.) (20/15) Explain briefly what is meant by the "Problem of Demarcation." (2) Describe (without explaining in depth) the various criteria proposed by Popper (5) , Lakatos (3), Kuhn (3), and Thagard (7). Make sure you specify: a) who argued that their criteria function only as necessary conditions, b) who argued that their criteria were both necessary and sufficient, c) who didn't venture that far (i.e. believed the demarcation line is vague at best). (15) Then, in a paragraph or two, argue why you think one the above four provide the most effective 'solution' or argue why all them fall short—i.e. , argue why you think the problem is unsolvable.

² See Lecture XIV and/or the Lightman & Gingrich article

³ According to Nersessian.

2.) **(20/15)** Explain briefly what Longino meant by ‘cognitive’ **(3)** versus ‘contextual’ **(3)** values, and what relation they have (if any) with Kuhn’s notions as discussed in his essay on Values and Theory-Choice. Make sure you give (at least) a brief mention of what Kuhn meant by ‘background.’ **(2)** List Kuhn’s five criteria (without explaining them in depth) **(4)** and Longino’s criteria of ‘transformative criticism’ (without explaining them in depth) **(4)**. Make sure you state in a sentence or two whether (or not) Kuhn or Longino believe objectivity in theory-choice is a process that is irrational or logically regimented **(2)**. **(15)** Then, in a paragraph or two, argue either: a) Kuhn against Longino: I.e. who do think provides a more effective account of objectivity/theory choice and why? or b) Neither K nor L: I.e. argue that both attempts fall seriously short either because (on one extreme) objectivity is untenable or (another extreme) there are reliable procedures in place to secure such notions (i.e. inductive logic).⁴

3.) **(18/17)** Explain briefly what is meant by the problem of conceptual change **(3)** and how Popper **(4)**, Kuhn **(5)**, and Laudan **(6)** sought to deal with it. For the latter, simply give a brief description without explaining in depth their ‘takes’ or programmes. Feel free to use any convenient analogy concerning how the ‘ontology’ of their variously fundamental explanatory notions fit together. **(17)** Then, in a paragraph or two, argue either: a) Why one of the above three has the most effective approach and why, or b) Why all of them fall short in significant ways. Feel free to mention (without explaining in much detail) whether or not you feel Giere/Nersessian have a better ‘take’ and why (or why not, i.e. that you believe the problem of conceptual change is insurmountable).

4.) **(18/17)** Explain briefly what is meant by scientific realism versus scientific anti-realism. **(5)**. Just give a few brief sentences here, without listing all of their garden varieties. Then, in the case of realism, state briefly (without explaining in depth) what Boyd’s **(4)** essential take is (i.e. what underwrites Boyd’s “Lex Orandi Est Lex Credenti) and Ian Hacking’s **(4)** essential take. In the case of anti-realism, describe without explaining in depth what Bas Van Fraassen’s (BVF’s) position is **(5)**. **(17)**. Then, in a paragraph or two: a) Either argue for anti-Realism (wherein you may or may not agree with BVF⁵ or for realism (where you’re welcome to defer to Boyd or Hacking and point out briefly why you think their arguments prove the most effective. b) Argue against the realism/anti-realism in which you defend Fine’s NOA stance and mention why you think Musgrove’s criticisms against Fine are unjustified.

⁴ If you choose this option, you need not explain in any depth what inductive logic is. Just give 1-2 sentences giving the gist of its aims.

⁵ If you disagree with BVF, make sure you at least mention in passing Musgrove’s criticism against BVF