PAUL KARL FEYERABEND

(13 January 1924–11 February 1994)

A Viennese émigré, Paul Feyerabend taught philosophy of science wherever his restless nature brought him—especially Berkeley, California; London, Auckland, Berlin, and Zürich. His views on methodology and the politics of science established him as one of the most controversial, eccentric, and outrageous figures in contemporary philosophy. Allegedly an irrational thinker, Feyerabend was in fact a skeptical master and iconoclast about the sciences and their philosophy. He denounced the gap between abstract normative philosophical accounts of science and actual, complex, and context-dependent scientific practice. He argued against the hegemony of any intellectual or ideological vision to promote the advantages of tolerance and pluralism in science as well as in society. His anarchistic theory of knowledge and the willingness to question the supremacy of Western scientific rationality vis-à-vis other "forms of life" made him famous beyond the boundaries of the philosophy of science.

A Philosophical Life Spent "Killing Time" and Scientific Idols

Paul Karl Feyerabend was born in Vienna in 1924. As a young man he was attracted to physics, mathematics, and astronomy (a passionate observer through the telescope he built with his father), as well as to drama, cinema, singing, and opera. Four years after the anschluss of Austria by the Third Reich in 1938, he was drafted into the Nazi work service and later entered the German army.

Posted to battle on the Russian front, he was awarded the Iron Cross. The end of the war saw him recovering from a bullet wound in his spine, which was to leave him crippled. He was granted state funding to study singing and stage management, and also cultivated Italian, harmony, piano, and diction. He then decided to study history and sociology in Vienna, but soon changed to theoretical physics and generally adhered to a positivistic scientism, which regarded science as an empirical activity and the basis of all knowledge.

During the following years Feyerabend received his Ph.D. in Philosophy with a dissertation on "basic statements" supervised by Viktor Kraft, and crossed Karl Popper's path for the first time (see Popper, Karl Raimund). He also met Bertholt Brecht, turning down an offer to work as his production assistant ("one of the greatest mistakes of my life," he would later say, adding, however, that as with Marxism and the army, he would probably not have enjoyed the gregarious group mentality prevalent in Brecht's circle).

In 1952, Feyerabend left for Cambridge, England, hoping to study under Wittgenstein; when the latter died, Feyerabend turned to the London School of Economics, where he was supervised by Popper, and genuinely embraced falsificationism. His adherence to it, however, was fairly unorthodox, combining realism and the view that all (observational) terms are theoretical with the principle of tenacity (the idea that it is rational to keep working on a theory despite empirical anomalies) and theoretical pluralism. A year later, he declined the offer of a job as Popper's assistant and left for Vienna.

In 1955, the University of Bristol, England, granted him his first academic post as lecturer in philosophy of science. During the following years Feyerabend confirmed his decision to cut all ties with what he later called the "Popperian Church," a group of scholars who preached but did not practice the critical attitude that plays a central role in Popper's philosophy. From 1958 to 1990 (the year he tendered his official resignation), Feyerabend was lecturer and then professor at the University of California–Berkeley, spending much time both in the United States (Yale University and Minnesota) and abroad (London, Berlin, Auckland, Brighton, Kassel), wherever his restlessness and growing fame took him. During the 1980s, Feyerabend accepted a chair at the Zürich Polytechnic ("ten wonderful years of half-Berkeley, half-Switzerland"). Struck by a brain tumor, he died on February 11, 1994, in Grenolier, Switzerland.

Explanation, Reduction, and Empiricism (Feyerabend 1962) marks both Feyerabend's departure

from a foundationalist conception of experience and his endorsement of some of Wittgenstein's later views. Feyerabend argues against the logical empiricist accounts of explanation, theoretical reduction, and meaning invariance (see Explanation; Logical Empiricism; Reductionism). He also derives the methodological implications of his "contextual theory of meaning" and "incommensurability thesis" based on detailed historical examples. During his frequent visits to the London School of Economics, Feyerabend met Imre Lakatos, who encouraged him to collect the impertinent ideas expounded in his lectures about the nonexistence of scientific method. Lakatos was supposed to reply and defend rationality, but their joint project—provisionally titled *For and Against Method*—was never completed. Lakatos unexpectedly died in 1974, and Feyerabend's part of the project, *Against Method*, was ultimately published as a collection of essays (Feyerabend 1975). The publication of the long correspondence between Feyerabend and Lakatos (Feyerabend and Lakatos 1999) partially filled this gap and fully acknowledged the dialectical exchange of ideas between the two friends that helped sharpen Feyerabend's attack on the rationalist position.

While *Against Method* denounces the dichotomous and enigmatic relation between philosophical theories and scientific practice and advocates the freedom of science from the interference of philosophy, *Science in a Free Society* (Feyerabend 1978) argues for the freedom of all "forms of life" from the interference of science. In this book, Feyerabend complains about the "illiteracy" with which his previous book was received, but also elaborates on the political consequences of his epistemological anarchism, argues for the separation of science and state and for the equal right to survival and access to power of all traditions (including those in conflict with accepted "scientific truths"). Feyerabend's corrosive skepticism is here directed toward the uncontrolled and uncritical, yet all-powerful, authority of "scientific expertise." Feyerabend claims that in order to defend society against science, the latter has to be placed under the supervision of democratic councils of laymen—with the aim of assessing and counterbalancing experts' judgments and decisions.

Feyerabend's attempt to dethrone science from its privileged position within Western culture is also carried on in his later writings collected in *Farewell to Reason* (Feyerabend 1987), a *sui generis* apology for cultural relativism. Reviving John Stuart Mill's argument on the means of cultivating human flourishing, Feyerabend argues that the freedom of a society increases as the restrictions imposed on its traditions are removed. Moreover, societies that contain many traditions side by side and stimulate cultural diversity have a better chance to enhance both the quality of the traditions and the maturity of their citizens. The citizens, in turn, should be prepared to use the standards of the traditions to which they belong to judge and supervise the institutions. In Feyerabend's view, this constitutes the best antidote to cultural and political totalitarianism.

The Refutation of Classical and Logical Empiricism, or How to Be a Good Empiricist

Feyerabend's first iconoclastic enterprise is directed against philosophical empiricism: the view that what is to be believed is what experiences establish, and no more. In fact, Feyerabend's line of attack is broad and applies to any foundationalist epistemology (see Epistemology). A naïve appeal to experience assumes that the meaning of observational terms is unequivocally determined by the procedures of observation such as looking, listening, and the like, and that scientific theories can be grounded in independently meaningful facts thus established. To Feyerabend, this view is at variance with actual scientific practice. Moreover, empiricism in the form theorized by logical empiricist philosophers cannot contribute to the growth of knowledge; on the contrary, it is bound to lead to "a dogmatic petrifaction" of theories and "the establishment of a rigid metaphysics" (Feyerabend 1999a, 82).

Feyerabend's argument moves from the consideration that theories are all-pervading conceptualizations of the world and determine the vocabulary that is used in building up "facts." This is in particular the case with the observation-language reputed to ground scientific theories (see Observation; Theories). Feyerabend's first main thesis is that "the interpretation of an observation-language is determined by the theories we use to explain what we observe, and it changes as soon as those theories change" (1981, 31).

In principle, according to Feyerabend, all observational terms are fully theoretical, and there is no semantic difference between theoretical terms and observational terms. Thus, observational terms are neither certain nor stable but share the hypothetical and changing nature of theoretical terms. The consequences for the relation between theory and experience are radical. Crucially, if meanings of observational terms depend on the universal principles of the theory in which they are used, terms that depend on different universal principles will not share the same meaning. Feyerabend then, anticipating some of Kuhn's ideas, argues that theory

testing cannot be a matter of confrontation of theory and (theory-laden) empirical data; rather it is a matter of competition between theories that are in part mutually exclusive, or *incommensurable* (see Incommensurability; Kuhn,Thomas).

Theories are incommensurable when the universal principles used to determine the concepts within one theory "suspend" the universal principles of the other, and thus all its facts and concepts. Classical Newtonian mechanics, for example, is said to be incommensurable with relativistic mechanics on the basis that the latter rejects a universal principle of the former "that shapes, masses, periods are changed only by physical interactions" (Feyerabend 1975, 269–271). Consider, in particular, the concept of 'length.' In classical mechanics, length is a relation that is independent of signal velocity, gravitational fields, and the motion of the observers; whereas in relativistic mechanics the value of length depends on these very concepts. The switch from classical mechanics to relativity entails a change of meaning of spatio-temporal concepts (see Classical Mechanics; Space-Time). Classical length and relativistic length are incommensurable notions, and classical mechanics is not explained by, or "reducible to," Einstein's relativity theory (Feyerabend 1981, 76–81). In general, according to Feyerabend, any attempt to derive the universal principles of an old theory from those of a new one necessarily leads to a change of the meanings in the old theory's terms. And this is why the "theoretical reduction" fostered by the orthodox account of explanation is not viable. Feyerabend's second main thesis is thus that there is not any reduction of a theory to another in actual science, but rather a replacement of one theory and its "ontology" with another (1999a, 86–87).

The question now is raised of "how to be a good empiricist." For Feyerabend a good empiricist is a *critical metaphysician:*

> His first step will be the formulation of fairly general assumptions which are not yet directly connected with observations; this means that his first step will be the invention of a new metaphysics. This metaphysics must then be elaborated in sufficient detail in order to be able to compete [with] the theory to be investigated as regards generality, details of prediction, precision of formulation. . . . Elimination of all metaphysics, far from increasing the empirical content of the remaining theories, is liable to turn these theories into dogmas. (1999a, 102)

However, it should be noticed that contrary to what many critics have claimed, Feyerabend's incommensurability thesis should not be interpreted as maintaining that competing theories cannot be compared. What his thesis entails is that theories cannot be compared in the ways in which many philosophical accounts of scientific explanation and reduction have thought that such comparisons should occur. To reject these accounts is to raise problems about certain philosophical theories of science; it is not to raise any difficulties for scientific practice itself (1981, xi).

Against (Too Much) Method

Against Method aims at demystifying another philosophical idol: the existence of a strictly binding system of rules for (good) scientific practice. Feyerabend highlights the huge gap between the "real thing" (science) and the various images of science. His therapy for philosophers' schizophrenic detachment from scientific reality is methodological anarchism. The therapy is the result of historical analyses. In particular, careful historical investigation supports the thesis that

> [t]here is not a single rule, however plausible, and however firmly grounded in epistemology, that is not violated some time or another. . . . Such violations are not accidental events. On the contrary we see they are necessary for progress. . . . The Copernican Revolution, the rise of modern atomism, the gradual emergence of [the] wave theory of life, occurred because some thinkers either *decided* not to be bound by certain "obvious" methodological rules, or because they *unwittingly broke* them. (1993, 14)

If this is the case, then any attempt to reform science by bringing it closer to the abstract image philosophers have of *the* scientific method is bound to damage science. On the contrary, "the only principle that does not inhibit progress is: *anything goes*"(1993, 5). Anything goes (perhaps paradoxically) is also the only general principle to which the coherent rationalist can be committed if looking for a rule valid in all given historical situations. But at the same time—at least in Feyerabend's intention—it is not introduced to replace one set of general rules by another set, but rather "to convince the reader that all methodologies, even the most obvious ones, have their own limits" (1993, 23). Consider for example the application of a clear, well-defined, and well-regarded rule like the consistency condition. According to it, the new hypotheses should agree with the accepted theories. But for Feyerabend it is not a reasonable condition at all. In fact, instead of being of help in obtaining better theories, it is just a factor for preservation of the old ones. Hypotheses contradicting well-confirmed

theories should proliferate and not be restricted, because they help provide (theory-laden) evidence that cannot be obtained in any other way. Consider also the rule that a theory that contradicts experience should be excluded from science. This rule, Feyerabend claims, is violated at every run:

> [T]heories are refuted in every moment of their existence ... *ad hoc* hypotheses patch up gaps in the proofs and cracks in the connection of facts. And internal contradictions are almost never avoided. We do not have proud cathedrals standing before us, instead we have dilapidated ruins, architectural monstrosities whose precarious existence is laboriously prolonged through ugly patch-work by their constructors. This is scientific reality. (1981, 156)

Scientific reality is always too rich in content, too varied, too many-sided, too lively and subtle to be captured by the simple-minded rules of even the best philosophers or historians. Scientists are not rule-followers but opportunists. In the construction of their conceptual world, they cannot be restricted by the adherence to any epistemological system; rather they rely "now on one trick now on the other" (1993, 1). Galileo Galilei's cunning defense of the heliocentric cosmology is paradigmatic in this respect. According to Feyerabend, not only did Galileo develop a research program in striking contrast to the Aristotelian standards and the accepted observation of the time, he was also prepared to defend it by substituting a "natural" interpretation of motion (motion can be expressed only in terms of observable changes) with an "unnatural" and highly theoretical concept, which introduced into the phenomenon of motion some components (such as circular inertia) that cannot be observed. In this way Galileo was able to "defuse a mine" placed under the Copernican system by explaining away the objection regarding the motion of the Earth. This move was possible because people see a phenomenon and interpret it in what they regard as a natural way according with their beliefs. So it is the *interpretation* of the phenomenon and *not* the phenomenon itself that is in contradiction with a given belief. Galileo then resolved the contradiction between empirical observation and the Copernican view by providing a new and highly abstract observational language and thus a newly constructed empirical basis. This, in turn, was a new theory of interpretation (containing the idea of the relativity of motion and the law of circular inertia) fitting the Copernican system (Feyerabend 1993, 55–85).

Galileo also changed the "sensory core" of observational statements that seemed to contradict Copernicus. He claimed to have removed them with the help of a 'superior and better sense' for astronomical matters, the telescope. However, Feyerabend points out, Galileo had no theoretical reasons to support the conclusion that the telescopic phenomena are more veridical than observations by the unaided eye. Once again, behind the clashes of the senses, there was a clash of theoretical assumptions, explicit or not. Galileo chose the research program that promised him the most exciting discoveries and adopted propaganda strategies in which reason was not enough to defend it against the widely accepted methodological canons:

> We see that Galileo's view of the origin of Copernicanism differs markedly from the more familiar historical accounts. He neither points to new facts which offer inductive support [for] the idea of a moving earth, nor does he mention any observations that would refute the geocentric point of view but be accounted for by Copernicanism. On the contrary, he emphasizes that not only Ptolemy, but Copernicus as well, is refuted by the facts, and he praises Aristarchus and Copernicus for not having given up in the face of such tremendous difficulties. He praises them for having proceeded *counterinductively*. (Feyerabend 1993, 80–81)

That is, Galileo wins the battle against the Ptolemiac system by subverting the most carefully established observational results and challenging the most plausible theoretical principles.

The Value of Theoretical Pluralism

Counterinduction can be beneficial to the advancement of science. Even Feyerabend's anarchism, then, provides some positive prescriptions. In particular, counterinductive hypotheses are valuable because they provide a means of criticizing accepted theories in a manner that goes beyond the comparison of the theories with the "facts." He says that

> the only way of arriving at a useful judgment of what is supposed to be the truth, or the correct procedure, is to become acquainted with the widest possible range of alternatives.... The reasons were explained by John Stuart Mill in his immortal essay *On Liberty*. It is not possible to improve upon his arguments. (Feyerabend 1978, 86)

One of the arguments Feyerabend is referring to is that silencing the expression of an opinion robs the human race by reducing the opportunity to ascertain truth. The role of tolerant controversy in grounding knowledge is so important that, according to Mill, "if opponents of all important truth do not exist, it is indispensable to imagine

them, and supply them with the strongest arguments which the most skilful devil's advocate can conjure up" (Mill [1859] 1977, 229).

Accordingly, science should be organized to generate the continuous generation of alternatives, to strengthen anomalies, and to stimulate controversies. The legacy of Mill's liberal standpoint is what Feyerabend calls the principle of proliferation: "Invent, and elaborate theories which are inconsistent with the accepted point of view, even if the latter should happen to be highly confirmed and generally accepted" (Feyerabend 1981, 105). Of course, knowledge generated by such a principle is of a peculiar sort: It is not a series of self-consistent theories that converges toward an ideal view; it is not a gradual approach to the truth. Rather,

> It is an ever increased ocean of mutually incompatible alternatives. Each single theory, each fairly-tale, each myth is part of the collection forcing others into greater articulation and all of them contributing, via this process of competition, to the development of our consciousness. (1993, 21)

As a consequence, "experts and laymen, professionals and dilettanti, truth-freaks and liars—they all are invited to participate in the contest and to make their contribution to the enrichment of our culture" (Feyerabend 1993, 21). Democratic participation in scientific matters warrants the advocacy of minority opinions and thus sustains the conditions for scientific development and human flourishing. This last consideration leads to the question of "science versus democracy," which in his later years Feyerabend (1993, 3) regarded as most important: "My main motive is humanitarian, not intellectual . . . . I want to support people, not 'advance knowledge.'" In particular, provided that there is no abstract canon ensuring success in any given field of enquiry, and that scientific achievements can be judged only *after* the event, Feyerabend claims that scientists are no better off than anybody else in these matters. The public, therefore, not only can take part in scientific decisions, but *should* do so:

> [F]irst, because it is a concerned party; secondly, because such participation is the best education the public can get—a full democratisation of science is not in conflict with science. It is in conflict with a philosophy, often called "Rationalism" that uses a frozen image of science to terrorize people with its practice. (1993, xii)

So the humanitarian motive behind Feyerabend's debunking of science is clear: Scientists should adapt their procedures and goals to the values of the people they are supposed to advise. Feyerabend is not against science so understood—"Such a science is one of the most wonderful inventions of the human mind"—he is "against ideologies that use the name of science for cultural murder" (1993, 4).

Relativism and Beyond

Two more consequences emerge from the thesis that the sciences have no common structure, but local and distinct features. First, "the success of 'science' cannot be used as an argument for treating as yet unresolved problems in a standardized way" (Feyerabend 1993, 2); second, "'non-scientific' procedures cannot be pushed outside by arguments" (ibid). The political implication of this epistemological stand is *democratic relativism*, the view that all traditions have equal rights. Democratic relativism, in turn, denies the right of traditions to impose their "form of life" on others, and therefore recommends the protection of traditions from interference from outside, including the interferences of the tradition of Western scientific rationalism. A new question then arises: How is a citizen to judge the suggestions issuing from the institutions that surround him? It is assumed that the citizen will judge "rationally," that is, in accordance with some scientific standards. However, there are no unambiguous scientific standards. Feyerabend's answer is that in a "free society," a citizen will use the standards of the tradition to which the citizen belongs: "Hopi standards if he is Hopi; fundamentalist Protestant standards if he is Fundamentalist; ancient Jewish standards if he belongs to a group trying to revive ancient Jewish traditions" (Feyerabend 1999a, 220). To those who claim the superiority of Western achievements over other traditions, Feyerabend simply objects that such a claim needs to be backed up by comparative studies:

> The sciences, it is said, are uniformly better than all alternatives—but where is the evidence to support this claim? Where, for example, are the control groups which show the uniform (and not only the occasional) superiority of Western scientific medicine over the medicine of the *Nei Ching*? Or over Hopi medicine? Such control groups need patients that have been treated in the Hopi manner, or in the Chinese manner using Hopi experts and experts in traditional Chinese medicine. (1999a, 221)

In his later years, however, Feyerabend acknowledged that relativism can run into trouble: It reflects on traditions "from afar" in an abstract and unrealistic way. Traditions are not closed units, they are not frozen systems of thought:

> Traditions not only have no well-defined boundaries, but contain ambiguities and methods of change which enable their members to think and act as if no boundaries existed: *potentially every tradition is all traditions.* Relativizing existence to a single "conceptual system" that is then closed off from the rest and presented in unambiguous details mutilates real traditions and creates a chimera. (quoted in Munévar 2000, 76)

The same, of course, applies to the tradition of scientific rationality. If scientific rationality were characterised as a well-defined, unambiguous, and "closed" system of rules, then relativism would be correct. On the contrary, scientific theories are not unified semantic domains with rigid borders; they change, they borrow from others, and they adapt to new situations. And so is the case for scientific procedures and value judgments; they are continually adapted to circumstances in an open-ended historical process. After all, Feyerabend clarifies, incommensurability is a difficulty for philosophers, not for scientists—the latter being "experts in the art of arguing across lines which philosophers regard as insuperable boundaries of the discourse" (Feyerabend 1987, 272).

Posthumous Works and the Legacy of Paulus Empiricus

At the time of his death, Feyerabend was working on *The Conquest of Abundance* (1999b), developing the theme of how different traditions, or forms of life, can learn from each other and can grow out of each other. The target here (as elsewhere) is the hegemony of any intellectual or ideological single vision—in particular the entire tradition of rationalism and its heirs. The subtitle ("A Tale of Abstraction Versus the Richness of Being") hints at the poverty of the "reality" produced by the method of abstraction typical of Western thought, compared with the abundance, richness, and boundless variety of the world around us. In a "Letter to the Reader" (quoted in Hacking 2000), Feyerabend also makes clear how to approach this text and possibly all his work, which he regarded as specially constructed plays to be performed in the theatre of ideas:

> I want you to sense chaos where first you noticed an orderly arrangement of well-behaved things and processes.... This, my dear reader, is the warning I want you to remember from time to time and especially when the story seems to become so definite that it almost turns into a clearly thought-out and precisely structured point of view. (Hacking 2000, 28)

Feyerabend's (1996) fascinating autobiography shows that he often changed his mind on a variety of subjects, but it also proves that he was neither the worst enemy of science, as depicted by some of his commentators, nor the irrationalist philosopher criticized by most of the profession. He was a skeptic about the foundations of knowledge and a cunning rhetorician who knew how to use effectively all the ancient skeptical tropes. (Feyerabend used to entertain Lakatos by signing his letters and postcards as *Paulus Empiricus.*) Skepticism to him was not only a powerful rhetorical device but also highly regarded for its normative implications for the practice and the role of science in a "free society." Feyerabend's iconoclastic enterprise is against neither reason nor science. It is against the idea that there is some unique set of rules (whatever it is) that ought to be followed in order to produce good science (whatever that is). Feyerabend's favorite slogan, *anything goes,* "is a jocular summary of the predicament of the rationalists" (Feyerabend 1978, 188)—thus "anything goes" from the point of view of the rationalist who believes that only *the* scientific method is admissible. On the contrary, there are lots of ways of moving forward, including the different local and contextual methods of various sciences or traditions. (If anything goes, reason sometimes goes as well; thus Feyerabend is not guilty of any inconsistency by employing rational arguments to attack the rationalist positions he opposes.) In this respect, Feyerabend can be seen not as rejecting rationality *tout court*, but rather as urging a conception of rationality wider than that embodied in some existing version of scientific rationalism (Preston 1997, 203). Feyerabend's arguments are generally to be intended as a *reductio* against certain forms of rationalism, rather than positive arguments in favor of irrationalism (Munévar 2000, 63–64). Far from a self-defeating skepticism, Feyerabend presented an impressive challenge to the received view in the philosophy of science. He argued that its elegant but useless epistemological accounts should be substituted by a detailed study of the primary sources in the history of science:

> *This* is the material to be analysed, and *this* is the material from which philosophical problems should arise. And such problems should not at once be blown up into formalistic tumours which grow incessantly by feeding on their own juices but they should be kept in close contact with the process of science even if this means lots of uncertainty and a low level of precision. (1999a, 137)

In this respect, Feyerabend's legacy can hardly be overestimated.

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See also **Empiricism; Incommensurability; Kuhn, Thomas; Logical Empiricism; Social Constructionism; Theories**

FITNESS

Darwin's theory of evolution by natural selection is often summarized in terms first coined by Herbert Spencer as the claim that among competing organisms the fittest survive. If there is variation among the traits of organisms, and if some variant traits confer advantages on the organisms that bear them, that is, enhance their fitness, then those organisms will have a tendency to live to have more offspring, which in turn will bear the advantageous traits. The success of Darwin's theory turns on the meaning of its central explanatory concept, 'fitness.'

What is fitness and how can one tell when a trait enhances fitness, or more to the point, when one organism is fitter than another? Some opponents of the theory of evolution by natural selection have long claimed that by defining fitness in terms of actual rates of reproduction, the proponents of evolutionary theory are unknowingly condemning the principle of the survival of the fittest to triviality: If one defines fitness in terms of actual reproductive rates, one is making the claim that those organisms with higher rates of reproduction leave more offspring. This is obviously an empty, unfalsifiable tautology bereft of explanatory power.

Evolutionary theory requires a definition of fitness that will protect it from the charges of tautology, triviality, unfalsifiability, and explanatory infirmity. If no such definition is forthcoming, then what is required from the theory's advocates is an alternative account of the theory's structure and content and the theory's role in the research program of biology.

Ensemble Properties and Population Biology

Since the modern synthesis, evolution is usually described in terms of "change in gene ratios" (see Population Genetics). Population genetics is the mathematical formalism used to describe the effects of natural selection on changes in gene frequency. The subject matter of population genetics is populations, ensembles of organisms, or genes, and not individual biological organisms or pairs of them. This has suggested to more than one philosopher that the theory of natural selection is better understood solely as a theory about ensembles and not individuals. As Sterelny and Kitcher (1988, 345) put this view, "evolutionary theory, like statistical