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The Role of Errors in Fallibilist Theories of Knowledge[1]

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Abstract

Fallibilism in epistemology is the view that we as human beings can never be in the position of acquiring ultimate truth, there is always a chance for discovering that we were in error. Nevertheless, fallibilists are not sceptics: they still stick to the idea that we are always in the position of holding a set of temporary truths, prevalent until the moment of getting denied and replaced by a better or more attractive candidate. On the other hand, fallibilists do side with the sceptics in their opposition to dogmatics, since they do not find compelling closed systems of knowledge, as they plea constantly for genuinely new insights. According to the presented fallibilist models of knowledge, trials are necessary steps in acquiring new knowledge; there is no growth of knowledge without exercising the practice of trial and error. Errors are the necessary components of the procedure, since the usability of deductive and inductive methods getting to necessary truths in real life are strongly limited. In practice alternative strategies, like abductive reasoning, are coming to the front in our pursuit for maintainable propositions.

Keywords: epistemology, fallibilism, philosophy of science, refutation, trial and error

Introduction

Fallibilism in epistemology is the view that we as human beings can never be in the position of acquiring ultimate truth, there is always a chance for discovering that we were in error. In that sense all knowledge should be considered *fallible*, that is, constantly open to falsification. Nevertheless, fallibilists are not sceptics: they still stick to the idea that we are always in the position of holding a set of temporary truths, prevalent until the moment of getting denied and replaced by a better (or simply more attractive) candidate.

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On the other hand, fallibilists do side with the sceptics in their opposition to dogmatics, since they do not find compelling closed systems of knowledge, as they plea constantly for genuinely new insights. This means also that the traditional concept of 'error' shall be reformulated as in the fallibilist framework there will be no clear cases of knowing the truth or not-knowing the false what classical theories of knowledge would like to see. Instead, as the diversity of authors presented in this paper argue, we have to transform our thinking about errors into a more sophisticated one, where it will become the source of invention and discovery.

1.

Regarding the status of our beliefs, Haack (1979) tells us that "fallibilism, though it stresses our liability to hold false beliefs, doesn't deny that we have true beliefs" (p. 55). Similarly, Reed (2002) resumes fallibilism as combining two claims: (a) we are fallible, (b) we do have quite a bit of knowledge. That means that the place of *epistemological certainty* is overtaken here by a certain kind of *epistemological optimism*: "Despite our tendency to get things wrong occasionally, we get it right much more of the time" (p. 143).

This approach, however, provides us with a general scheme of human understanding and manipulating of the world as an endless procedure of *trial and error*. This scheme can be applied both for systematical and historical investigations. In fact, historical studies prove that the origins of trial and error go back to the 18th century as a narrow technique within teaching mathematics, later widened to the realms of psychology and education, finally to arrive at the already metaphorically generalized usage of the phrase today. In that way it got transformed from a specific tool of logical reasoning to a general theory of learning:

> In the history of 'trial and error,' we see how a peculiarly modern tool—the error, reconceived as a necessary step on the path to knowledge—was transformed into a theory of how both the individual mind adapts and scientific progress is made. The application of such theories in a range of fields helps naturalize them, so much so that we sometimes lose sight of their contingent origins. As a result, 'trial and error' may now be one of the 'metaphors we live by,' a tool drawn from a particular pedagogical context that continues to structure how science is done, how history is written, and how we understand our own limited capacities. (Cowles, 2015, p. 644)

This special relationship between trials and errors is also described as a *symbiosis*, since "trying invites failing," where "errors follow attempts" (Cowles, 2015, p. 644).

2.

Trial and error became a central topic in the philosophy of science due to Karl Popper. According to him, scientific theories are always conjectural, which means that they can never be ultimately *justified*, only *corroborated* over time. The only thing we can do with logical certainty is *falsification*, i.e. finding such counterexamples or contradictions which may prove a given statement or theory false. In that sense the cathedral of human knowledge is built up by the process of constant trials leading to errors which will show the way for the next trial, and so on bringing us closer and closer to truth.

So in Popper's world errors are getting a dual character: they may seem to be evil at first glance, but in fact they also serve for the good, as they provide indispensable help for us to go further in searching for a better model and a better understanding of the world. As the first sentences of Popper's preface to his essays say, they: "… are variations upon one very simple theme—the thesis that *we can learn from our mistakes*. They develop a theory of knowledge and of its growth" (Popper 1940/1963, p. vii).

Popper also admitted that this scheme of trial and error was not an original invention of him. As it was shown by himself (Popper 1940/1963), Hegelian dialectics, for example, may qualify also as a subtype of this pattern for the growth of knowledge, where the *antithesis* is created precisely by declaring the *thesis* erroneous, and the *synthesis* will aim at evading the errors of both in order to ascend to a next level of knowledge. In that context, Popper's falsification can be considered only giving a new name for an old idea, now applied specifically to the realm of scientific discovery.

Popper considered as one of his major philosophical achievements his development on Hume's critique of induction. He believed that after refuting the idea of induction, that is, presenting it as a rationally unjustifiable procedure, Hume chose the wrong way giving in to irrationalism saying that then all our knowledge "is merely a kind of belief—belief based on habit" (Popper, 1957/1963, p. 45). Instead, Popper argued, we shall strive to stay within the rationalist framework and find a model in which we may "obtain our knowledge by a non-inductive procedure" (1957/1963, p. 45). Popper's great idea was the following:

> I proposed to turn the tables upon this theory of Hume's. Instead of explaining our propensity to expect regularities as the result of repetition, I proposed to explain repetition-for-us as the result of our propensity to expect regularities and to search for them. … Without waiting, passively, for repetitions to impress or impose regularities upon us, we actively try to impose regularities upon the world. We try to discover similarities in it,

> and to interpret it in terms of laws invented by us. Without waiting for premises we jump to conclusions. These may have to be discarded later, should observation show that they are wrong. (Popper 1957/1963, p. 46)

So the role of errors will change substantively: they should not be frustrating collisions experienced painfully when our beliefs prove to be in contradiction with brute reality, but relieving experiences which help in adjusting our deliberately conditional belief systems to the needs of life. In that way Popper arrives at a new understanding of scientific inquiry as follows:

> This was a theory of trial and error—of *conjectures and refutations*. It made it possible to understand why our attempts to force interpretations upon the world were logically prior to the observation of similarities. Since there were logical reasons behind this procedure, I thought that it would apply in the field of science also; that scientific theories were not the digest of observations, but that they were inventions—conjectures boldly put forward for trial, to be eliminated if they clashed with observations; with observations which were rarely accidental but as a rule undertaken with the definite intention of testing a theory by obtaining, if possible, a decisive refutation. (Popper 1957/1963, p. 46)

Thus, Popper succeeded in giving a new and coherent model of science as an *inventive and self-regulating institutional system*. At the same time, he was well aware of changing also the content of the philosphical notion and epistemological status of our beliefs in general:

> If 'belief' means here our inability to doubt our natural laws, and the constancy of natural regularities, then Hume is again right: this kind of dogmatic belief has, one might say, a physiological rather than a rational basis. If, however, the term 'belief' is taken to cover our critical acceptance of scientific theories—a *tentative* acceptance combined with an eagerness to revise the theory if we succeed in designing a test which it cannot pass—then Hume was wrong. In such an acceptance of theories there is nothing irrational. (Popper 1957/1963, p. 51)

However, there are important consequences following from that regarding the status of our knowledge, since we shall admit then that all theories or laws will "remain essentially tentative, or conjectural, or hypothetical, even when we feel unable to doubt them any longer. Before a theory has been refuted we can never know in what way it may have to be modified" (Popper 1957/1963, p. 51). In this new view suggested by Popper it is at the same time a necessity and a deliberate decision of human beings to organize their lives as adaptive behaviours making use of postulated explanatory laws and theories:

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> *If we have made this our task, then there is no more rational procedure than the method of trial and error—of conjecture and refutation:* of boldly proposing theories; of trying our best to show that these are erroneous; and of accepting them tentatively if our critical efforts are unsuccessful. (Popper 1957/1963, p. 51)

The next step in this line of thought will be a generalization, where Popper presents a continuity between the intellectual procedures in human inquiry and the elementary biological counterparts.

> The method of trial and error is not, of course, simply identical with the scientific or critical approach—with the method of conjecture and refutation. The method of trial and error is applied not only by Einstein but, in a more dogmatic fashion, by the amoeba also. The difference lies not so much in the trials as in a critical and constructive attitude towards errors; errors which the scientist consciously and cautiously tries to uncover in order to refute his theories with searching arguments, including appeals to the most severe experimental tests which his theories and his ingenuity permit him to design. (Popper 1957/1963, p. 52)

At the same time, Popper is not especially interested in that psychological background of living organisms coping with their environment by trial and error. He was absorbed by the systematic processes which may lead to a certain piece of knowledge. That was because Popper held in common with the logical positivists that the real challenge is to find out the general laws, the 'logic' of science; while individual moments of specific discoveries will have their unique and contingent stories only. Thus, all aspects of science relating this latter shall go to the *psychology of experience*, which is outside the philosophical–methodological *logic of science*.

Thus, the method of trial and error practiced more and more consciously should turn into a scientific method, which can be described like this:

> Theories are put forward tentatively and tried out. If the outcome of a test shows that the theory is erroneous, then it is eliminated; the method of trial and error is essentially a method of elimination. Its success depends mainly on three conditions, namely, that sufficiently numerous (and ingenious) theories should be offered, that the theories offered should be sufficiently varied, and that sufficiently severe tests should be made. In this way we may, if we are lucky, secure the survival of the fittest theory by elimination of those which are less fit. (Popper, 1940/1963, p. 313)

In this scheme condition (3) is referring to 'trial,' and Popper makes it clear that the severness of testing means that there are no middle ways: the theory concerned will qualify as either true or false. But to have the whole system work, conditions (1) and (2) seem to be all too important for leaving them only to mere chance, since producing numerous and varied theories is one of the major challenges for any scientific enterprise.

In the end, Popper thinks that what really makes us humans is *critical attitude*—the ability of learning from our mistakes in a highest possible complexity. Later in designing his model Popper (1972) made extensive use of the evolutionary approach also: new theories born the same way as mutations occur, and those who are capable to learn the best will be the fittest to survive. Therefore, critical attitude becomes in a very pragmatic sense *life important*. No wonder then, that Popper felt like he made a really great serve not only for scientific, but for philosophical thinking as well.

3.

As a matter of fact, the modern history of fallibilism has started much earlier, namely with Charles Sanders Peirce, who proposed *abduction* as the primordial model of real life reasoning instead of traditional logical induction and deduction. As Haack (1979) put it:

> What Peirce calls 'fallibilism' is, in part, an epistemological *thesis*—a thesis about our propensity to hold false beliefs—and, in part, an epistemological *recommendation*—that we should always be willing to revise our beliefs in the light of new evidence. (p.41)

According to Margolis (1998) fallibilism is "much too casually invoked by contemporary discussants," as joining so different theses as "Peirce's evolutionism, his views on the logic of relations, on realism, on thirdness, on the theory of thought and mind, and on progressivism in science" (p. 535). Haack also notes that Peirce is giving rather diverse examples to underpin his concept of fallibility:

> Induction, he points out, always involves extrapolation, from a sample to a larger class, and this introduces an *unavoidable element of uncertainty*. Furthermore, he urges, there is irreducible indeterminancy in the world, there are, that is, no absolutely necessary and exceptionless laws, and in consequence, he claims, *our knowledge must fall short of universality*. (Haack, 1979, pp. 42–43)

It seems that Peirce's arguments for fallibilism rely on limitedness of our cognitive apparatus (intuitions), weaknesses of our cognitive methods (errors in measurement; uncertainty within inductive reasoning), and the inferiority of our knowledge (indeterminism).

In Haack's (1979) suggestion fallibilism is a thesis not only about *cognitive agents*, but also *cognitive methods*, which means that one may hold a false belief "if *either* he employs fallible methods (methods liable to yield false results) *or*, even if he uses perfectly reliable methods, if he employs them carelessly, *or*, of course, *both*" (pp. 54–55). Her example is that an error in our belief about the temperature of a room can be caused either by a faulty thermometer, or by the misreading of a reliable thermometer.

Interestingly, Peirce made an important exception from fallible knowledge with the case of mathematics. He thought that while factual beliefs cannot be other than fallible, mathematical beliefs must remain infallible. This may seem to be obvious, if we think about mathematics as a result of deductive reasoning leading from axioms through deductions to propositions which are thus necessarily true. However, there is a vision of mathematics shared among others by George Polya, which tells that this conjecture about the infallibility of mathematics is at least half-erroneous:

> Yes, mathematics has two faces; it is the rigorous science of Euclid but it is also something else. Mathematics presented in the Euclidean way appears as a systematic, deductive science; but mathematics in the making appears as an experimental, inductive science. Both aspects are as old as the science of mathematics itself. (1971, p. vii)

The latter type of mathematical activity was called by Polya *heuristics*, and he maintained that there should be a place for genuine discoveries in the description of real mathematics: "Heuristic reasoning is reasoning not regarded final and strict but provisional and plausible only, whose purpose is to discover the solution of the present problem" (1971, p. 113). In that sense classical *induction* in itself (contrasted to *mathematical* or *complete induction*) for Polya functioned similarly as *abduction* for Peirce.

In contrast, Hanson (1958) drew heavily on Peirce, but he was not aware of Popper at the time of writing his book. However, as Walton (2004) noted, there is a striking similarity which raises the question how far the descriptions of Polya and Peirce can be taken as analogous, since the logical form of *abductive reasoning* and *heuristic thinking* are described both as a reversed *modus ponens*. Here is how the case of an *abductive inference* is presented by Peirce (CP 5.189) and Hanson (1958): "The surprising fact, C, is observed./ But if A were true, C would be a matter of course./ Hence, there is reason to suspect that A is true" (p. 86).

So abduction may acquire a very special place between induction and deduction. It will suggest a possible theory which can serve as a ground for the known facts, but without any logical constraint. While induction will always fail to arrive at a general theory, deduction may lead from that to necessary individual consequences, but it will fail to provide us with any genuinely new knowledge.

Margolis (1998) contrasts two possible lines in understanding fallibilism. The *Deweyan fallibilist* maintains only an optimistic hope, without a real epistemic claim, while the *Peircean fallibilist* has in mind some regulative ideals helping us to fix errors, thus resulting in an epistemically focused *metaphysics of inquiry*. According to Margolis (1998) there are three distinct "themes" composing fallibilism:

1. Fallibility = all our assertions may turn out to be false (an exact counterpart of Cartesian indubitability).

2. Self-corrective inquiry = "it is both possible and likely that, for any mistaken belief, a society of inquirers can, in a pertinently finite interval of time, discern its own mistakes and progress toward discovering the true state of affairs" (p. 537).

3. Metaphysics of inquiry = doctrines like evolutionism, thirdness, the social construction of the self, the growth of knowledge to ensure the value of holding the merely epistemic position of fallibility.

As Margolis points it out, Dewey and his followers usually combine claims (1) and (2), but Peirce and Popper seem to need claim (3) as well. While Popper tries to avoid metaphysics and to give a methodological solution based on the concept of verisimilitude, "Peirce's account is thoroughly metaphysical, fixed on the supposed underpinning of our abductive powers" (Margolis, 1998, p. 544).

In line with that Paavola (2006) already speaks about "a Peircean–Hansonian research programme by developing abduction as a way of analyzing processes of discovery" (p. 5). Hanson (1958) discovered abductive logic for his own aims, that is, reintroducing the creation of hypotheses into the framework of a rational methodology of science. He thought that with the help of induction and deduction we can only justify knowledge that we already have, but revolutionary new ideas will never come from there; great scientific discoveries always start from guessing, abductive reasoning, or trial and error.

4.

Imre Lakatos, in his paper on Popper's idea of crucial experiments (1974), puts the question into the context of learning with its opening phrase: "Exactly how and what do we learn about scientific theories from experiment?" (p. 344). And he answers that in the actual history of science we can hardly find such decisive moments as Popper liked to imagine; instead we will see researchers working hard on correcting their errors within their original conceptual frameworks, without giving up their so-called *research programs*.

In connection with that Margolis (1998) makes the following compliment to Lakatos: “I was surprised to find that Lakatos summarizes Popper’s conception of scientific progress as ‘increased awareness of ignorance rather than growth of knowledge... ‘*learning*’ without ever ‘*knowing*,’ for although it is accurate it is not an entirely obvious reading” (pp. 547–548).

Lakatos’s criticism on Popper is quite parallel with that of Haack on Peirce: that all we get, is some set of rules about how the game of science should be played without any epistemologically substantive content. In Popper’s account, says Lakatos, scientists should be able to give the falsifiers, the results, the facts—that is, the possible “errors”—coming out from the crucial experiments which should decide about the fate of the theory. This would serve as a demarcation criterion as well: theories which cannot point out against themselves such crucial experiments or falsifiers should not be qualified as science at all.

In Lakatos’s vision “no experiment is crucial at the time it is performed,” so that falsification and rejection must be handled as logically independent. Thus Lakatos (1974) considered his own version also as “a falsification of the falsificationist theory of ‘crucial experiments’” (p. 350). In fact, Lakatos made already some inquiries along similar lines in his former work within the philosophy of mathematics. Actually, the best case studies about how anomalies are turned into perfections can be found in his brilliant essay *Proofs and Refutations* (1976). The history of mathematical theorems is presented here as an ongoing discussion in an imaginary classroom giving an extensively generalized model for the growth of knowledge. At the same time, referring also to the dialectics of Hegel and the heuristics of Polya, Lakatos succeeded in extending fallibilism to the realm of mathematics—in that respect correcting the error committed by Hegel, Peirce and Popper as well. That is how Lakatos became “the first fallibilist heuristician” (Marchi, 1980, p. 448). Here is how Haack (1979) captures what is going on there (please, also note the special appearance of *abduction*):

> Interestingly, a major theme in Lakatos’ fallibilist philosophy of mathematics is that the process of mathematical discovery is by no means a straight forward matter of deducing ‘theorems’ from ‘axioms,’ but a complex interaction of conjecture (abduction?), counter-example, modification of conjecture, rejection or revision of counter-example, and so forth. This is an idea of which—for all his stress on the importance of abduction for empirical science—there are at most occasional, fleeting glimpses in Peirce’s writing. (pp. 58–59)

In fact, within the history of the philosophy of science the narrative can be constructed in a way that the error at that point made by Popper was his insistence on keeping the *context of discovery* and the *context of justification* apart, because with that he stayed within the research programme of the Vienna Circle’s basically justificationist world view (and hence he arrived later at his notion of *verisimilitude*). Lakatos’s criticism against Popper here can be formulated as the claim that the latter is committing a category mistake concerning the role of errors in science, as he thinks *testing* and *error* to be relevant in the description of kuhnian *normal science*, but cannot give an account of their role in the *revolutionary periods*.

According to Kuhn (1970/1977) himself a paradigm seems to be flawless within its boundaries—errors may become visible only after the paradigm change. Errors committed within the paradigm will be clear miscalculations, which can be easily noticed and quickly corrected without doing any serious harm to the entire knowledge system. Thus in the normal phases of science not theories, but only scientists can be and will be tested, if they look for finding their place within the scientific community. Those puzzles will be well-formulated, so if a mistake happens, it will be clear that it was the scientist’s fault. On the other hand, when a serious anomaly takes place, itt will change the whole disciplinary framework, so in that kind of revolutionary period the notion of error itself will be completely inadequate for the situation.

Real-life scientists are more likely to work along so-called *positive heuristics*, that is, research questions and experiments designed on the assumption that the theoretical framework they are working within is essentially right and correct. In the very case when from a certain experiment an unexpected result emerges, they give themselves the time to be able to explain it using the old theory and not throwing it away immediately.

> In general he rivets his attention on the positive heuristic rather than on the distracting anomalies, and hopes that the ‘recalcitrant instances’ will be turned into confirming instances as the programme progresses. … This methodological attitude of treating as *anomalies* what Popper would regard as *counter examples* is commonly accepted by the best scientists. (Lakatos 1974, p. 348)

Therefore, Lakatos suggested that we shall always think about complete research programs, which means that simple falsifications of certain elements should not result immediately in the abandonment of our whole knowledge system. He called this position *methodological falsificationism*, and contrasted it to Popper’s *naïve falsificationism*. The latter was successful in presenting a greater proportion of what is going on in real science than traditional inductivism, while the new proposal was able to give an even better result in that respect.

5.

According to all these fallibilist models of knowledge, trials are necessary steps in acquiring new knowledge; there is no growth of knowledge without exercising the practice of trial and error. Errors are the necessary components of the procedure, since the usability of deductive and inductive methods getting to necessary truths in real life are strongly limited. In practice alternative strategies, like abductive reasoning, are coming to the front in our pursuit for maintainable propositions.

Thus we may consider, as Hintikka (1998) did, the 'problem of abduction' to be a basic question of contemporary epistemology: "Purely logical (in the sense of deductive) reasoning is not ampliative. It does not give me any really new information. Yet all our science and indeed our whole life depends on ampliative reasoning" (p. 506).

In this Peirce-Hanson-Polya-Lakatos paradigm—called *fallibilist heuristics* by Marchi (1980)—there will be no sharp boundaries between normal and revolutionary periods, but basically the same logic of abductive inference will be in work. This can also help in saving the picture of science as a rational enterprise from the threats of irrationalism coming from Polányi, Kuhn, Feyerabend, and others.

The key issue in this model is assuring development by an ongoing procedure of correcting errors, constantly leading inquiry to a higher level. For example, Reed (2002) in a thoroughly Lakatosian spirit arrives from analysing the original standard account of *fallibilist knowledge* (represented by the equivalent alternative expressions FK1 and FK2) to a completely generalized concept (FK6, resp. FK7) by eliminating all the 'errors' of the previous versions, and in this sense providing "a deeper explanation of fallibilism than has been previously offered" (p. 153):

> (FK1) *S* fallibly knows that *p* = df (1) *S* knows that *p* on the basis of justification *j* and yet (2) *S*'s belief that *p* on the basis of *j* could have been false.
>
> (FK2) *S* fallibly knows that *p* = df (1) *S* knows that *p* on the basis of justification *j* even though (2) *j* does not entail that *S*'s belief that *p* is true.
>
> …
>
> (FK6) *S* fallibly knows that *p* = df (1) *S* knows that *p* on the basis of justification *j* and yet (2) *S*'s belief that *p* on the basis of *j* could have been either (i) false or (ii) accidentally true.
>
> (FK7) *S* fallibly knows that *p* = df (1) *S* knows that *p* on the basis of justification *j* where (2) *j* makes probable the belief that *p* in the sense that *S*'s belief belongs to the class of beliefs which have the same (type) *j* and most, but not all, of which are true. (p. 153)

Which, of course, should not be taken as the last word on the topic; its status should be held as fallible, that is, waiting for a next inquirer to find an 'error' in those definitions to also be 'fixed.'

Conclusion

In my paper I showed by textual evidences from several theoreticians with various professional contexts how their fallibilist accounts can give a better understanding of the role of errors in processes of knowledge production (including even mathematical knowledge being relatively rarely seen in that way). Thus, this interdisciplinary essay aimed at showing the resemblances and commonalities among those approaches which can be developed into a comprehensive fallibilist theory of errors.

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