# Popper, Otto Selz, and the Rise of Evolutionary Epistemology

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# Tracing the Genesis of an Idea

## Philosophy of Science and Evolutionary Epistemology

The idea that we acquire knowledge by a process of trial-and-error elimination has been one of the truly great ideas of the twentieth century. As no reader of his philosophical and autobiographical work could have failed to notice, Karl Popper credits himself for having invented this idea. In his work from the early 1960s onwards the theory of trial-and-error elimination turns out to be not simply a part of Popper's comprehensive philosophy but rather one of its key features; it is at the bottom of some of his most spectacular achievements in methodology, epistemology, the philosophy of biology, and even political philosophy. Indeed, it is put forward at once as a model for the growth of individual knowledge (both human and animal), the growth of life (Darwin's theory of evolution), and the growth of scientific knowledge (philosophy of science). As happens so often with innovative ideas, the theory of trial-and-error elimination derives much of its glamour from the theory it rejects: because the mind is a tabula rasa, sense perception is the origin of all (human) knowledge. Popper nicknames this empiricist view as the "bucket theory" because it conceives of the mind as nothing but the conduit for sense impressions, an empty bucket to be filled by the accumulation and storage of information.[1] The bucket theory of knowledge and mind may be firmly entrenched in both philosophy and psychology (and even in common sense), yet it is roundly rejected by Popper. In his hands the bucket theory collapses under the strain of philosophical arguments and scientific facts and is replaced by a theory maintaining that our knowledge of the world

is partly drawn from our mind and constructed from the repertoire of knowledge dispositions we already possess.

Most dispositions, Popper avers, are innate and, if not innate, acquired modifications of what is innate. For instance, speaking English or German is an acquired disposition, but the disposition to learn some human language is an innate disposition of the human species. Acquiring dispositions proceeds according to the method of trial-and-error elimination. This method, Popper contends, is essentially a three-stage model, which he takes to apply to animal learning as well as to the upper reaches of scientific research: forming a problem or expectation, trying out a number of solutions to the problem, and eliminating or discarding false solutions as erroneous.[2] Individual organisms encounter problems as soon as they are disappointed in their (innate) expectations. Thus faced with a problem, organisms try out a number of solutions, which, in lower organisms such as amoebae, as well as in higher organisms such as chimpanzees, typically take the form of what Popper calls "testing movements." Stimulating the shapeless bit of jelly protoplasm, which is what the amoeba is, prompts the organism to perform not a single definite movement but a series of varied movements which subject it to different internal and external conditions. The organism may be said to investigate its environment and to test all sorts of conditions, retaining some and rejecting others. Testing movements always contain a number of false trials. In the third stage these trials are subjected to a process of error elimination. Learning means that the false trials are gradually discarded so that finally the successful trial appears to be almost the only one left; the organism has formed a new expectation – namely, the expectation that the problem can be solved by the one trial that has not been eliminated. In humans testing movements typically take the form of mental testing or setting up hypotheses, but the basic procedure, Popper insists, is the same throughout life; *All Life Is Problem Solving* is the apt title of one of his books.

This three-stage model, Popper suggests, has its counterpart in Darwin's theory of the evolution of species. A problem here is a problem of species adaptation, and the species can survive only if it solves the problem through a change or a mutation in its genetic structure. Mutations correspond to what Popper calls attempted solutions. In the next stage badly adapted trials, whole organisms in this case, are eliminated and only the more or less well adapted trials survive, resulting in an increasing fit between organism and environment.

Exploiting the biologically inspired notion of adaptive success, Popper equally considers scientific knowledge a tool, an organizing instrument in the organism's struggle to maintain its existence, to invade and even to invent new environmental niches. Here too the three-stage model of trial-and-error elimination is the fundamental mechanism of adaptation. At the scientific level dominant theories parallel the gene structure of the organism and the innate repertoire of behavioural dispositions. These structures, inherited by social tradition and imitation, are exposed to new theoretical problems which prompt new, often revolutionary solutions, leading to an increasing fit between theories and facts. Yet, Popper famously claims, scientific theories are and always will be hypotheses or conjectures susceptible to elimination. Eliminating false theories is the way science progresses or "learns."

A key feature of Popper's theory of trial-and-error elimination is its insistence on problems or expectations taking precedence over observations. The place accorded to sense perceptions in the empiricist tradition is now reversed, for rather than being the origin of knowledge their role is limited to the second and especially the third stage. Assuredly, sense perceptions inform us about the external world, but from this, Popper argues, it cannot be concluded that they are the *fons et origino* of knowledge. Observations are always preceded by expectations, points of view, questions, or problems which, as a searchlight, illuminate a certain area, thereby enabling the organism or the scientist to know what to observe in the first place.[3] Indeed, from an evolutionary point of view even our sense organs are the outcome of a series of biological problems and attempted solutions. Knowledge and experience, then, rather than being the passive outcome of the accumulation and association of sense perceptions, are constructed from the built-in repertoire of expectations and dispositions. Guided by preceding expectations, lower and higher organisms constantly and actively put forward trials or attempted solutions when faced with problems of any kind. The bucket theory of knowledge and mind of the famous British philosophers Locke, Berkeley, and Hume (and of a host of experimentalists in the pioneering era of psychology), Popper concludes, is a myth. Evidently relishing his position as the opponent, he triumphantly claims: "My theory of knowledge is thus quite revolutionary: it overturns everything my predecessors have said up to now. *We are active, we are constantly testing things out, constantly working with the method of trial and error.*"[4] Yet Popper acknowledges the affinity of his theory with Kant. His epistemological notion of genetic a priori

knowledge – that is, expectations preceding observations – like Kant's notion emphasizes the role of inborn knowledge but, unlike Kant, conceives of this knowledge as tentative and fallible, always subject to refutation on empirical grounds.

The psychologist Donald Campbell was the first to recognize Popper's theory as contributing to what he called "evolutionary epistemology." Quoting a passage from the autobiographical essay in *Conjectures and Refutations: The Growth of Scientific Knowledge* (1963), in which Popper explains his idea of genetic a priori knowledge, Campbell comments that "this insight is the earliest and most frequently noted aspect of an evolutionary epistemology."[5] This pioneering role may seem surprising to those who know Popper primarily as a philosopher of science in the tradition of the physical sciences. Indeed, as W. W. Bartley III points out, his major work *Logik der Forschung* (1935), translated by Popper as, *The Logic of Scientific Discovery* (1959), is almost exclusively dominated by physics, biology being hardly mentioned.[6] Popper's interest in evolutionary epistemology, Bartley contends, is a new episode in his career, yet not unrelated to the earlier philosophy of science because it would integrate the whole. To support his view, Bartley recalls that in *The Logic of Scientific Discovery* the problem of the growth of knowledge is the central problem of epistemology. And in *Conjectures and Refutations*, the solution to the methodological problem of demarcating science from nonscience is still called the key to most of the fundamental problems of science. On the other hand, in Popper's later work the main task of the theory of knowledge "is to understand it as continuous with animal knowledge; and to understand also its discontinuity – if any – from animal knowledge."[7]

There are, however, signs in Popper's published work suggesting an earlier engagement with evolutionary epistemology than Bartley claims. The passage quoted and interpreted by Campbell as evolutionary epistemology is part of Popper's autobiographical essay, which goes back as far as the 1920s. But the idea that expectations precede observations is there presented in the context of a criticism of David Hume's psychological theory of the genesis of cognitive states and put forward as a psychological alternative; Darwin is not even mentioned. Roughly the same picture is sketched in *Unended Quest*, Popper's intellectual autobiography from 1974, yet there are two differences. The central distinction around which he now organizes his philosophy is between the phenomena of dogmatic and critical thinking. Accordingly, the method of trial and error is called the method of "dogmatic trial and critical-error elimination." This theory of dogmatic and critical thinking, Popper tells us, had been

the topic of a thesis submitted to the Pedagogic Institute of Vienna in 1927, and although the theory concerned the development of young children, he now reconstructs it in terms of biological processes, thereby at least suggesting an intimate linkage between psychology and biology. In particular, he compares his early theory with the theory of imprinting of his countryman Konrad Lorenz, mentioned by Campbell as another early evolutionary epistemologist.[8] Lorenz observed that when recently hatched birds such as goslings and ducklings are hand-reared for a few days, they strongly prefer the company of their human keeper to that of their own species. The animals, as Popper interprets Lorenz's results, have an inborn mechanism for jumping to unshakable conclusions.[9] The problem to be solved is inborn in the sense that the gosling is genetically conditioned to look out for its mother. The theory or expectation which solves the problem is also to some extent inborn because it goes far beyond the actual observation; the observed stimulus merely releases the adoption of an expectation. The animals behave dogmatically in the sense that without waiting for premises they jump to conclusions to which they stick even when faced with evidence to the contrary.

Imprinting is not subject to change or revision, yet it is an essential part of the learning process. The critical phase of learning by trial and error, on the other hand, consists of giving up the dogmatic trials under the strain of disappointed expectations and then trying out other solutions. This readiness to test and, if necessary, to change expectations, although characteristic of the learning of most organisms, finds its most perfect expression in science. Thus Popper also equates the critical attitude with the scientific attitude. Yet the difference between science and prescientific problem solving is gradual. As Popper puts it vividly elsewhere, "The difference between the amoeba and Einstein is that, although both make use of the method of trial and error elimination, the amoeba dislikes to err while Einstein is intrigued by it: he consciously searches for his errors in the hope of learning by their discovery and elimination."[10]

Both the essay in *Conjectures and Refutations* and *Unended Quest* therefore point to an earlier interest in evolutionary epistemology than its official defence with the publication of *Objective Knowledge* in 1972 suggests. Yet the specific relationship between the early work and the later evolutionary epistemology remains to be investigated in detail, for Popper's thesis of 1927 seems to have been concerned with child psychology rather than biology.[11] Indeed, it would take another thirty-five years before the theory of imprinting would originate from the mind of his boyhood friend Lorenz. Investigating the relation between Popper's early psychology and

his later evolutionary epistemology is not only important in its own right, contributing to a more complete picture of his intellectual development, but may also provide a deeper understanding of the nature of his solutions to a variety of philosophical problems. Perhaps the best, yet often overlooked, example of Popper's bent on evolutionary reform of traditional philosophical problems is the cluster of problems referred to as the "mind-body" problem, to which Chapter 6 of this book is devoted. But even the epistemological problems he deemed fundamental, and which marked the beginning of his philosophical career, the problems of induction and demarcation, although initially approached from a purely logical perspective in *The Logic of Scientific Discovery* and the slightly earlier but later published *Die beiden Grundprobleme der Erkenntnistheorie* (1979), are presented in his autobiography in the context of a discussion of his early psychology.

In *Conjectures and Refutations*, he gives the following account of the genesis of his solution of both problems. In the 1920s and 1930s Popper had set himself the task to solve the problem of induction, stretching back to the eighteenth century of David Hume, as well as the problem of demarcation, a task made more pressing by some of the contemporary positivistic claims for the applicability of the verifiability criterion of meaning to the nature of real science. Indeed, Popper's solution of the problems of demarcation and induction seems unerringly targeted on the logical positivism of the Vienna circle in the 1930s, especially on the book from which the circle drew its main ideas, Wittgenstein's *Tractatus-Logico-Philosophicus* from 1921.

Hume is almost universally credited (and Popper is no exception here) with discovering this problem of induction. Hume recognized that when we infer inductively the existence of an unobserved effect from an observed cause (or vice versa) on the basis of past experience, our conclusions have no rational support or justification. As Popper formulates Hume's logical problem of induction, "Are we justified in reasoning from [repeated] instances of which we have experience to other instances [conclusions] of which we have no experience."[12] Our reliance on past experience rests on the assumption that instances of which we have had no experience must resemble those of which we have had experience. With respect to the future this amounts to the assumption that there will be no change in the course of nature. But what is the justification for this assumption of the uniformity of nature, Hume famously asked? As it is at least conceivable that the course of nature might change, and because what is conceivable is possible, no demonstrative argument can

be given for the assumption of the uniformity of nature. On the other hand, probable arguments involving an inference from observed events to unobserved events via beliefs about causes and effects based on past experience presuppose that the course of nature will not change, and thus the attempt to justify induction is caught up in a circular argument. Accordingly, claims that transcend the available evidence, in particular general laws and predictions, remain unwarranted.

Popper agrees with Hume's answer to what he calls the logical problem of induction, but he reformulates it in the "objective or logical mode of speech," a strategy he shares with logical positivism. Replacing "instances of which we have experience" by "test statements," and "instances of which we have no experience" by "explanatory universal theories," the problem now becomes: can the claim that an explanatory universal theory is true be justified by assuming the truth of certain test statements? In agreement with Hume, his answer to this question is no. But, he hastens to add, there is yet another version of the logical problem of induction, one arising merely by replacing in the preceding sentence "is true" by "is true or that it is false." To this question Popper's answer is positive: assuming the truth of certain test statements sometimes allows one to conclude that a scientific theory is false. Given the typical situation in which the problem of induction arises, with several explanatory theories offering competing solutions to the same problem, the latter outcome proves immensely fertile, because it enables one to distinguish between a good and a less good, or even a pseudoscientific theory. If the test statements happen to refute some but not all competing theories, it is entirely rational to prefer that theory whose falsity has not been established. Because the refutation or falsification of a theory through the refutation of its consequences is a deductive inference (*modus tollens*), Popper concludes, the proposed solution is purely logical.

Where Popper parts company with Hume is over whether establishing a theory of the actual genesis of our knowledge of the future (and the past) means that "belief" must finally rest on induction. Having refuted the logical idea of induction, the question how we actually obtain knowledge becomes indeed an urgent one for Hume. Popper calls it the psychological problem of induction. As Popper sees it, there are two answers Hume can give: by a noninductive procedure, thereby retaining a form of rationalism, or by an inductive procedure and so conceding that some of our most important modes of inference are made in the complete absence of rational insight. Hume chooses the second route, and his psychological explanation of our inferences from the observed to the

unobserved in terms of habit and irresistible association boils down to a form of inductive learning. According to him, the experience of a constant conjunction of ideas of causes and effects in individual experience ensures that the future occurrence of one idea (of the "cause") would automatically evoke the other (of the "effect") in the mind.

Although at one place admitting to having found his solution to the psychological problem earlier than to the logical problem of induction, Popper's overriding priority is again a purely logical argument.[13] He had discovered that the idea that expectations and beliefs about regularities in the environment arise out of the repeated impingement of stimuli upon our senses is a myth, fostered by the bucket theory of mind, and had to be replaced by an alternative theory of mind explaining that sense experience is always preceded by the interests and expectancies of an active, explorative organism. That is, expectations arise in our mind without our having to observe the repeated succession of paired objects or events. Indeed, in human and animal psychology a situation counts as a repetition of an earlier situation only because organisms respond to it "by *anticipating* its similarity to the previous one."[14] Anxious to point out the purely logical basis of this "apparent psychological criticism" of Hume's theory, Popper subsequently designs a different version of this argument.[15] The kind of repetition envisaged by Hume, he argues, can never be perfect. The cases he has in mind can only be cases of similarity rather than perfect sameness. "Thus *they are repetitions only from a certain point of view*. . . . But this means that, for logical reasons, there must always be a point of view – such as a system of expectations, anticipations, assumptions, or interests – *before* there can be any repetition; which point of view, consequently, cannot be merely the result of repetition."[16]

Popper's reason for attaching so much importance to the logical nature of his solution of the psychological problem of induction is related to the dramatic consequence Hume's own solution in terms of habit (repetition and association) has for our self-image as rational creatures; human knowledge, according to Popper, "is unmasked as being not only of the nature of belief, but of rationally indefensible belief – of *an irrational faith*."[17] The best way to safeguard the rationality of human cognition, he believes, is to refute psychological inductivism on logical grounds. The bridging principle he exploits here is what he calls "the principle of transference," according to which "what is true in logic is true in psychology."[18] If, on the basis of this principle, Popper can transfer his logical solution to psychology, then there can be "no clash between logic and psychology, and therefore no conclusion that our understanding is irrational."[19] But

whereas Popper speaks of *the* principle of transference, thereby suggesting a unique application of this idea, he in fact uses it in two different, albeit related cases.

The principle is appealed to in transferring his solution of the logical problem of induction to the psychological problem of induction, thereby allowing him to formulate one of his main results thusly: "[S]ince Hume is right that there is no such thing as induction by repetition in *logic*, by the principle of transference, there cannot be any such thing in *psychology* (or in scientific method, or in the history of science): the idea of induction by repetition must be due to an error – a kind of optical illusion. In brief: *there is no such thing as induction by repetition.*"[20] But the principle is also used, in the very same essay, in applying the logical argument to the effect that repetition presupposes similarity, and similarity presupposes a point of view, to the psychology of cognition and to scientific method.[21] Indeed, because the discovery that induction does not exist is based on objective logical considerations, Popper feels confident in applying the method of trial-and-error elimination to the genesis of scientific knowledge, thereby safeguarding its rational basis.[22] Rather than being a digest of observations, a scientific theory is put forward initially in uncorroborated trials or conjectures. Then predictions are compared with the actual observations to see whether they stand up to the test. If such tests turn out negative, then the theory is refuted, and the scientist has to concoct a new theory. With no negative outcomes forthcoming, scientists will continue to uphold their initial claims, not so much as a proven theory but as a nonrefuted conjecture. Science, then, does not rest on inductive procedures. On the contrary, the inferences that matter to science – refutations – are deductive.

The second big problem, the demarcation problem, is closely related to the problem of induction. The demarcation problem is the problem of distinguishing between those statements or theories which can properly be counted as belonging to empirical science, and those statements and theories which have to be relegated to pseudoscience or to metaphysics. Bacon drew a line that was to become the standard criterion for many centuries: empirical science is characterized by its faithful and secure reliance on empirical facts, facts that have been carefully and patiently gathered by the method of induction. Pseudoscience and metaphysics, on the other hand, lack this "observational basis." Popper never felt content with this inductive criterion of demarcation. Modern theories of physics, he recalls, are highly speculative and far removed from their empirical basis. On the other hand, astrologers have always supported their theories

with a great wealth of inductive material, yet astrology is rejected by modern science.[23]

The example of astrology, however, did not prompt him to develop a different criterion of demarcation so much as new and revolutionary theories in physics, psychology, and sociology. As he recounts in his autobiography, after the collapse of the Austrian Empire he was caught up in the general intellectual turbulence precipitated by Einstein's theory of relativity, Marx's theory of history, Freud's psychoanalysis, and Adler's individual psychology.[24] After a brief involvement with Marxism and individual psychology, he became more and more dissatisfied with the theories of Marx, Freud, and Adler. On the other hand, his admiration for Einstein, especially after Eddington's eclipse observation in 1919, which confirmed the former's theory of gravitation, only increased. What was wrong with Marxism, psychoanalysis, and individual psychology? he asked himself. Why were they so different from physical theories, from Newton's theory, and especially from the theory of relativity?[25]

The main drawback of the theories of Adler and Freud, as Popper saw it, is their apparent unlimited explanatory capacity. Popper illustrates this point with two radically opposed cases of behaviour: that of a man who pushes a child into the water intending to drown it, and that of a man attempting to save the child, thereby sacrificing his own life. Each of these cases, Popper goes on, can be explained easily by both Freudian and Adlerian theories. According to Freud, the first man would have suffered from repression, whereas the second man would have had achieved sublimation. But, according to Adler, the first man would have suffered from feelings of inferiority, and so would the second man.[26] Marxists and psychoanalytic theories frame their theories in such a way, Popper contends, that "every conceivable case will become a verifying instance"; hence, no possible observations need ever make them adjust their theories. Scientists like Newton and Einstein, on the other hand, indicate beforehand which outcomes of a test will have to force them to adjust or even to abandon their theories. Unlike astrology, Marxism, and psychoanalytic theories, the theories of Newton and Einstein are falsifiable, even if not provable. Falsifiablity, then, is Popper's criterion to distinguish science not just from superstitious belief systems but also from "pseudoscience." He recounted his first experience with Einstein's theory:

> Here was an attitude utterly different from the dogmatic attitude of Marx, Freud, Adler, and even more so that of their followers. Einstein was looking for crucial experiments whose agreement with his predictions would by no means establish his theory; while a disagreement, as he was the first to stress, would show his theory to be untenable.

> This, I felt, was the true scientific attitude. It was utterly different from the dogmatic attitude which constantly claimed to find "verifications" for its favourite theories.[27]

Irrefutability, rather than being a virtue of a theory, is a vice. For a theory to count as truly scientific, it has to expose itself not to verification but to falsification. But although pseudoscientific, the dogmatic attitude is a prerequisite for the scientific or critical attitude: it provides the scientific attitude with the material to exercise its critical function.

It is obvious that there is a close connection between the problem of induction and the problem of demarcation – indeed, so close that the solution to the latter is in fact the solution to the former – yet Popper initially did not notice this connection. The solution to the problem of induction occurred to him a considerable time after his solution to the problem of demarcation, and not until he had solved the former did he see the importance of the latter. What he realized in particular then was that inductivism, by clinging as tightly as possible to the empirical data, in fact allayed the fear for metaphysics that haunted the empirical scientist and philosopher. That is, inductivism was itself an answer to the demarcation problem – but a very bad one, according to Popper.

Popper's solution to what he deems the two fundamental problems of philosophy, especially in *The Logic of Scientific Discovery*, is logical and epistemological, yet, as his autobiography already makes clear, it seems somehow related to his early psychology. At the same time, Popper is also anxious to avoid relying too much on psychology for in the same essay he writes: "Provided you do not dogmatically believe in the alleged psychological fact that we make inductions, you may now forget my whole story with the exception of two logical points: my logical remarks on testability or falsifiability as the criterion of demarcation; and Hume's logical criticism of induction."[28] Given the later prominence of evolutionary epistemology, as well as its connection with the psychology of dogmatic and critical thinking, and the biologically oriented method of trial-and-error elimination, an essential prerequisite for a balanced view of Popper's oeuvre is precisely "the whole story." As discussed in the next section, however, some serious defects exist in what Popper himself calls the whole story.

## Between Autobiography and Reality

The method of trial-and-error elimination is centrally important for Popper's philosophy as a whole. So how and when did he come to it? The

picture which emerges from his autobiographical essay, "Science: Conjectures and Refutations," in his *Conjectures and Refutations*, and *Unended Quest*, is of a man who came quite independently, and remarkably early, to his core ideas. The year 1919, when Sir Arthur Eddington observed light apparently bending near the sun, thereby confirming Einstein's theory of relativity, marked a kind of watershed in his intellectual life. Then, at the age of seventeen, he first grappled with the problem of demarcation and solved it.[29] His earliest thoughts on the problem of induction stem from 1923.[30] The logical criticism of Hume's psychological theory of knowledge took shape in 1926–1927, immediately after his theory of dogmatic trial and critical-error elimination, which he elaborated, "in a clumsy terminology," between 1921 and 1926.[31] Thus at the age of twenty-four Popper had set out his core ideas, a stance to which he subsequently unwaveringly adhered.

But how can Popper maintain to have developed his theory of dogmatic trial and critical-error elimination after the solution of the demarcation problem and simultaneously contend that his solution of the latter problem makes use of the former? As is clearly stated in *Unended Quest*, the insight that the dogmatic attitude coincides with the tendency to verify theories, whereas the critical attitude induces scientists to test and, if necessary, to falsify their theories, came to him in 1919. The difficulty is that no manuscripts or other documents definitively establish the nature of Popper's solution of the demarcation problem in 1919.[32] Moreover, Popper's earliest manuscripts in the 1920s show no trace of the demarcation problem either.[33]

But perhaps Popper has been exaggerating when claiming to have solved the demarcation problem in 1919 for, as he also indicates, the awareness of a connection between this problem and the problem of induction came to him much later, at around 1928. It is not unlikely that his solution of the demarcation problem took (definitive) shape only after his becoming aware of its intimate connection with the problem of induction and, hence, with his theory of trial-and-error elimination. According to this scenario, his earliest two manuscripts, both of which were never published, and in one of which he elaborated his theory of dogmatic trial and critical-error elimination, take on a special importance as they might show us the genesis of his critique of the two ancient philosophical problems as well as the beginnings of his alternative evolutionary epistemology. Indeed, Popper refers to one of them as the source for his logical and psychological criticism of Hume's psychological problem of induction.

After having outlined, in *Unended Quest*, the psychological and logical criticism of Hume's theory of induction, he adds in a footnote that the same ideas are to be found in his thesis "'Gewohnheit' und 'Gesetzerlebnis' in der Erziehung," "which I presented (in an unfinished state) in 1927, and in which I argued against Hume's idea that habit is merely the (passive) result of repetitive association."[34] This manuscript was a protothesis (*Hausarbeit*), which students following the two-year teacher-training program at the new Pedagogic Institute of Vienna had to submit at the end of their course. Perusal of this manuscript, to be discussed in detail in Chapter 3, however, proves beyond any question that Popper does not deny the existence of induction around 1927; quite the reverse, he himself endorses induction as a matter of course. Indeed, it is clear from the first sentences of the preface that induction is not a topic of (critical) discussion at all: "The work at hand, although in its main parts highly theoretical, has yet arisen out of practical experience and has finally to serve practice again. Its method, therefore, is essentially *inductive*" (emphasis added).[35] This remark clearly conflicts with Popper's autobiographical contention to have solved the problem of induction in 1926–1927.

But perhaps this claim is too swift. In a section of *Die beiden Grundprobleme der Erkenntnistheorie* (The possibility of a deductive psychology of knowledge), written between 1931 and 1932, and generally considered transitional to the book that would make him famous as a philosopher of science, *The Logic of Scientific Discovery*, Popper speaks of a lost second part of "'Gewohnheit' und 'Gesetzerlebnis'": "This work is no longer to be found and must be regarded as lost. 'Theory of the intellect' was the theoretical part of '"Gewohnheit" und "Gesetzerlebnis" in der Erziehung: Eine pädagogisch-strukturpsychologische Monographie.'"[36] (What Popper terms his "theory of the intellect" corresponds to his sketch of a deductive psychology of knowledge.) But in *Unended Quest* the thesis was called unfinished. A glance at the content of Popper's thesis, however, shows that the claim that the thesis is unfinished is much more likely than that (part of it) is lost.

"'Gewohnheit' und 'Gesetzerlebnis' in der Erziehung" reads as a carefully constructed and self-contained empirical-psychological investigation. The text falls into two main parts and nine sections. The first part (sections 1–6) contains a preface and an extensive introduction, which is concerned largely with an outline of the problem together with Popper's methodological stance. The second part is called "The Psychology of the Gesetzerlebnis." This part contains one section called "Phenomenology"

and is further divided into three subsections encompassing eighty-three pages. Two other sections are also promised. Section 2 would be concerned with theory. In this section, Popper proposes to offer a causal-teleological explanatory theory on the (inductive) basis of the phenomenological facts gathered in section 1. Section 2, however, was never written. A third section, also unwritten, would deal with applications of his theory to several areas of psychology. The impression that these two sections have not in fact been written is reinforced by the fact that the manuscript ends with a bibliography. The concluding sentences leave no doubt about the self-contained character of the manuscript: "With this we conclude our empirical-psychological investigation."[37]

Given that two sections were not written, Popper's thesis is clearly unfinished. The crucial question, however, is whether it is unfinished as regards his criticism of Hume's logical and psychological problem of induction and the development of his own theory of trial-and-error elimination. His later comments on his thesis suggest that the proposed but unwritten causal-teleological theory would have been a deductive psychology of knowledge and, hence, akin to his theory of trial-and-error elimination. In the thesis itself, however, Popper proposes to construe this causal-teleological theory on an inductive basis, which is his methodology throughout the thesis. What is more, induction is still the path to knowledge for the young Popper, both in individual psychology and in science, one year later, in 1928, when he was finishing his doctoral thesis, "Zur Methodenfrage der Denkpsychologie," at the Psychological Institute of Vienna under the aegis of his teacher Karl Bühler, now largely forgotten but ubiquitous in the 1920s and 1930s.[38] Yet here, in embryo, is the concept of trial-and-error elimination which looms so large in Popper's later writings. Both its rudimentary form and its embodiment in an inductive psychology and methodology, however, provide further evidence that the (deductive) theory of dogmatic trial and critical-error elimination was not yet formed before 1929. Accordingly, it looks very much as if Popper considered his thesis unfinished from the perspective of developments yet to come, which, assuredly, is something different from saying, as he does while claiming to have rejected Hume's psychological theory and thereby to have solved the problem of induction between 1921 and 1927, that it is simply unfinished (or lost). On the contrary, the evidence suggests that much had to happen intellectually before he could "finish" his deductive theory of trial-and-error elimination.

Perusal of "'Gewohnheit' und 'Gesetzerlebnis' in der Erziehung" provides further evidence supporting my view that Popper's autobiographical comments on the genesis of his work have to be revised drastically.

Popper by his own account claims that in his thesis he argued against Hume's idea that habit is merely the (passive) result of repetitive association, and that this criticism was part of his theory of dogmatic thinking. Admittedly, dogmatic thinking is the main theme of the early thesis but in a way which differs significantly from the epistemological context provided by Hume's problem of induction; it is the context of education in which Popper's first thoughts on the concepts of habit and dogmatic thinking emerge. His main question in his thesis of 1927 is whether an education in which habit plays a prominent role is of any positive value. In particular, he seeks to provide the pedagogical distinction between a "stage of habit" and a "stage of self-determination" (spontaneity) with an exact psychological foundation. The thesis, then, is far removed from the abstract issue of Hume's problem of induction and is about what would nowadays be called philosophy (or psychology) of education rather than philosophy of science or general epistemology.

Admittedly, Popper provides a clue to this background in *Unended Quest*. The theory of "noninductive" learning, he there remarks, was initially a theory about young children. And, as he also recalls, he was inclined to consider dogmatic thinking a kind of neurotic aberration.[39] The point is not elaborated upon further, but in an essay from *Conjectures and Refutations* a passage occurs in which he points to a similarity between his concept of dogmatic thinking and psychoanalytic accounts of neuroses. Dogmatic thinking, he argues, is the expectation to find regularities everywhere and the attempt to find them even where there are none.[40] People stick to their expectations even when they are inadequate, and they ought to accept defeat. In this respect, he goes on, there is a "point of agreement" between his theory of dogmatic thinking and psychoanalytic theories, for a neurosis is a personal set pattern adopted very early in life and "maintained throughout, and every new experience is interpreted in terms of it; verifying it, as it were, and contributing to its rigidity."[41] Connecting this theory of dogmatic thinking with Hume's theory of inductive learning, Popper, in the same retrospective essay, subsequently attributes to him the idea that the strength of a person's beliefs, being the product of repetition, varies inversely with the degree to which he is a "primitive" person. Popper, on the other hand, observes that "dogmatic thinking, an uncontrolled wish to impose regularities, and a manifest pleasure in rites and in repetition as such are characteristic of primitives and children; and increasing experience and maturity sometimes create an attitude of caution and criticism rather than of dogmatism."[42]

This discussion of psychoanalytic theories is clearly meant as an aside and not as part of the actual genesis of his ideas, yet it has its roots in