

Ch. S. PEIRCE

– „Credo ut intelligam¹!“ or supposed maxims of abduction.

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„Consciousness is like a bottomless lake in which ideas are suspended at different depths. Indeed, these ideas themselves constitute the very medium of consciousness itself. Percepts alone are uncovered by the medium... the deeper ideas are, the more work will be required to bring them to the surface“.

Charles Sanders Peirce (CP 7.553)

Human knowledge is a product of challenging temporal process accompanying man in his pilgrimage – and not just for one millennium. It is full of paradoxes – besides other particularly those, which we connect with its purport, with its being, its functions, its sources, and its influence on man itself. It is by no means a matter of course – not anthropologically, nor epistemically, or axiologically. Knowledge in itself as an object of inquiry is not a matter of course – at least in the optics of one of the most influential thinkers at the turning point of 19th and 20th Century in United States of America – Ch. S. Peirce (1839 – 1914). His panorama includes complex dialectics of belief, doubt, critic, and truth. *Credo ut intelligam* – *I believe so that I may understand* – changes in his optics into intense and profound motive stimulating man to grasp the ambivalent fact concerning himself and his knowledge; the fact that *humanum errare est* – that man is fallible – and that at the same time, realizing his constraints, man wants to reduce this tendency to err to minimum in order to arrive at indubitable truths².

Peirce articulates his attitude towards belief and doubt at the beginning of his philosophical activity (1877) in a well known article *The Fixation of Belief*.³ Pragmatism is – not only in Peirce’s conception – a tool by means of which we are able to illustrate permanent alternation of belief and doubt as states accompanying human knowledge. However, it is not just a pure repetition; beliefs and doubts do not change. What changes is its object.

¹ „I believe so that I may understand“ (lat.)

² “Why should there even be a reason for belief, if we cannot be certain?” – asks in a similar context Wittgenstein ([10], 93, af. 373) in his philosophical testament. Kant, on the other hand, proposes: “it still remains a scandal to philosophy and to human reason in general that the existence of things outside us (from which we derive the whole material of knowledge, even for our inner sense) must be accepted merely *on faith*, and that if anyone thinks good to doubt their existence, we are unable to counter his doubts by any satisfactory proof“ ([9], 53-54). If philosophy is not supposed to change to philodoxy, to become a game, if certainty recedes and the space of mind is filled in with opinion, it has to choose other, stronger grounds and rely on other resources. However, we hardly can avoid the feeling that belief and doubt are close relatives; one does not terminate the other, they merely change their places.

³ “Doubt is an uneasy and dissatisfied state from which we struggle to free ourselves and pass into the state of belief; while the latter is a calm and satisfactory state which we do not wish to avoid, or to change to a belief in anything else. On the contrary, we cling tenaciously, not merely to believing, but to believing just what we do believe.... Thus, both doubt and belief have positive effects upon us, though very different ones. Belief does not make us act at once, but puts us into such a condition that we shall behave in some certain way, when the occasion arises. Doubt has not the least such active effect, but stimulates us to inquiry until it is destroyed“ ([2], CP 5.373 – 5.374).

As an instrument of a process of acquiring knowledge and as a crucial aspect of mature inferential reasoning, abduction is a bridge between different levels of episteme matrix. In this manner we can interpret Peirce's claim that: „If you carefully consider the question of pragmatism you will see that it is nothing else than the question of the logic of abduction“ ([2], V, 196, 197). It is exactly abduction which outlines the sources of our hypotheses as products of our creative logic.

Abduction as a selection of hypotheses

In his quest for the substitution of Mill's *inductive guiding principle* as *guiding principle* of whole scientific inquiry, Peirce arguments as follows: we know that it is induction which approves and testifies our hypotheses, but how these hypotheses even emerged in mind at all? In order to show how it is possible for human mind to postulate hypotheses, which – even if they often show to be false – are before confirmation or confutation considerably close to reality, Peirce refers to some demonstrations from the history of science and postulates the issue of the selection of hypotheses ([2], 5.590; ON SELECTING HYPOTHESES). With him, the reader stands in speechless amazement in front of fact, which has been confirmed throughout the whole history of science: “how few were the guesses that men of surpassing genius had to make before they rightly guessed the laws of nature. . . .“ ([2], 5.604). Thus, the question goes like this: “How is it that man ever came by any correct theories about nature?“ ([2], CP 5.591).

The issue concerns inferential character of every single aspect of human knowledge and its exposition is in the competence of logic. Intellectual inferences, how Peirce sometimes calls them, are deduction, induction, and abduction. However, only two of them – induction and abduction – have synthetic character and it is only abduction alone, which “must cover all the operations by which theories and conceptions are engendered“ ([2], CP 5.590). Logic thus analyses abduction as a specific type of inference.⁴ However, it is not much one can say about abduction. Simply, it represents the process of formation of explanation hypothesis. What is crucial is that it is the only type of inference out of the three types of inferences, which introduces every new idea; it does not have any other purport except that it provides suggestions. This is also the primary reason why we find it interesting and topmost important.

According to Peirce, it was Aristotle who first mentioned the way of reasoning, which he calls *abduction*.⁵ In Latin translation the so-called *reduction* – writes Aristotle – is a kind of reasoning, or rather a hypothetical syllogism, which generates new knowledge. The kind of reasoning which Aristotle calls *reduction*, in which a mass of facts is being analyzed in order to propose the theory of their explanation, while in this process – despite many defects in argumentation – new ideas (terms) emerge, Peirce calls abduction (or hypothesis, hypothetical inference, retroduction) ([2], A Letter to Calderoni, CP 8.209, c. 1905). Hypothesis introduces new ideas and new connections, but its common characteristic trait is also a lack of justified argumentation: “As a general rule, hypothesis is a weak kind of argument. It often inclines our judgment so slightly toward its conclusion that we cannot say that we believe the

⁴ More exactly, it is the competence of *methodeutics* (speculative rhetoric), as one part of three parts of the science of semiotics, which is itself a part (or body itself) of logic. *Methodeutics* is crucial actor in exposition of validity and applicability of conceptions and scientific theories. Peirce projected his *Methodeutics* in order to propose certain field of Logic, whose function would be to control the exposition of hypotheses as well as conditions under which methods are true and appropriate for formation of systems of propositions.

⁵ If not for *Apellicon's* translation and systematization of Aristotle (considered as inapt in certain aspects), this term would be presented in 25th chapter of second book of Aristotle's *Prior Analytics*. ([2], A Letter to Calderoni, CP 8.209, c. 1905)

*latter to be true; we only surmise that it may be so“ ([2], CP 2.625). This may be the reason why Peirce considers the three forms of inferences as complementary and interdependent. However, *synthetic inferences* – *induction* and *abduction* (hypothesis) – are of primary interest.*

“*By induction, we conclude that facts, similar to observed facts, are true in cases not examined. By hypothesis, we conclude the existence of a fact quite different from anything observed, from which, according to known laws, something observed would necessarily result“ ([2], CP 2.636).*

While induction is a reasoning from particulars to the general law, hypothesis is reasoning from effect to cause. “The former classifies, the latter explains“ (ibid). Hypothesis introduces such a phenomenon, or a fact, which is under given circumstances, or even under all circumstances, of such a kind, that it is un-observable in direct perception ([2], CP 2.636 – 640). “Hypothesis supposes something of a different kind from what we have directly observed, and frequently something which it would be impossible for us to observe directly“ ([2], CP 2. 640). To generalize, hypothesis in its singularity is something as a mediator between certainty and uncertainty; between certainty about the character of the “real“, which is usually provided by induction, on one hand, and uncertainty about the nature of facts and phenomena which cannot – by nature – be directly perceived or observed, on the other hand. In *A Letter to Calderoni* Peirce refers to this important function of abduction as synthetic inference: “Abduction furnishes all our ideas concerning real things, beyond what are given in perception, but is mere conjecture, without probative force“ (([2], A Letter to Calderoni, CP 8.209, c. 1905).).

Formal exposition of hypothesis is as follows:

$$\begin{array}{r}
 C \\
 A \longrightarrow C \\
 \hline
 A
 \end{array}$$

Peirce offers simple exposition of this diagram of abductive, hypothetical inference:

*“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“ ([2], 5.189).*

If A is true, C is no longer a surprising fact, because there exists an explanation, which banks on such a state of affairs. This „reverse gear“, which proceeds from observation to hypothesis, and than back to observation is according to Peirce the only way how to acquire new knowledge. In other words, we have to produce, articulate and insert hypotheses into the field of experience, which is permanently stimulating us to new possible explanations and thus offering us still wider range of clarification of possible and actual facts and phenomena. It is clear that what Peirce proposes is that abduction is the elementary aspect of every process of reasoning used by scientists and researchers throughout the whole history of science without any limits. They just did not properly and consciously articulated the principle. *Atocha Aliseda* (pozri ([5], 37-38) offers three important aspects, which he traces in the process of reasoning, or in other words, in the process of searching for satisfying explanation of phenomena which we observe. Aliseda is convinced that if we are to consider certain

hypothesis as promising, satisfying, or interesting, it should be: a) explanatory productive; b) testable; c) economic.

Contemporary discourse in the field of linguistics, semiotics, and philosophy of language and science offers still wider group of authors favoring Peirce's postulation and articulation of abduction. Peirce projects abduction as hypothetical inference, and as such, it fulfills formal criteria of rational conscious inferences. At the same time abduction is closest to the unconscious, or rather *acritical and indubitable inferences*, and many times it is connected with them at some level of argumentation.⁶ According to medieval scholars – as Peirce proposes – “all knowledge rests either on authority or reason; but that whatever is deduced by reason depends ultimately on a premise derived from authority“ ([2], CP 5.359). Peirce did not and actually could not accept such an attitude. We could perhaps compare abduction to F. Bacon's *inner illumination*, which we use – according to Bacon – when we meet with surprising facts of experience.

When we – together with Peirce – consider the progress of scientific methodology by means of comparing influence of eminent representatives of science, we discover in it certain *guiding principles of inferences* and inquiries, by means of which belief is permanently inspired and reevaluated. Simply, there always are certain habits of mind, which govern inference. Without it, we would be like a boat on an open sea without somebody on the board, who would be skilled in navigation. But the crew must under all circumstances get the boat to the harbor; or rather – if we push this analogy to the field of discourse about knowledge – „the quest for certainty“ must get to the outcomes which shall satisfy our demands and bring reliability for which we so eagerly strive.⁷

“But what ... is the peculiar genius of the scientific method? Peirce's answer is at first sight surprisingly simple: conformity to the laws of inference. But behind the apparently naïve simplicity ... lies a revolutionary innovation on Peirce's part. For by “the laws of inference“ he does not mean, as does the traditional Aristotelian logic, simply those standards by which

⁶ As Eco, Bonfanti and Grazia ([14], 97) show, Peirce reduced whole cognitive process down to the concept of *hypothetical inference*, “in which sensations appear as the interpretations of stimuli; the perceptions as interpretation of sensations; perceptual judgments as the interpretation of perceptions; particular and general propositions as interpretations of perceptual judgment; and scientific theories as interpretations of series of propositions“ ([14], 97). *Perceptual judgments*, in Peirce's terminology, are *acritical inferences* and they differ from *abductive inferences* in one crucial aspect: they are fully beyond the reach of logical criticism. However, this aspect does not exclude them from the process of scientific reasoning.

⁷ The border-line between certain knowledge and belief is rather treachery, than thin. It can confound our reasoning when it comes to the grounding of our approaches. As Dewey shows in his *The Quest for Certainty*: “the quest for certainty has always been an effort to transcend belief. Now since, as we have already noted, all matters of practical action involve an element of uncertainty, we can ascend from belief to knowledge only by isolating the latter from practical doing and making... Greek thinkers saw dearly – and logically – that experience cannot furnish us, as respects cognition of existence, with anything more than contingent probability... Thus not merely the arts of practice, industrial and social, were stamped matters of belief rather than of knowledge, but also all those sciences which are matters of inductive inference from observation“ ([12], 21). With all due respect to Greek thinkers, it seems that the question whether sciences based on inductive reasoning yield knowledge was answered by history itself. However, there are still some surprises prepared in the course of scientific advances, which can prove our current opinions to be false. Thus, we can never be completely certain about everything we consider to be knowledge, for good. This assumption designates abduction for *leading principle* in any progressive scientific inquiry. This *leading principle* is connected with the principle of continuity, which articulates fallibilistic perspective of our knowledge, as Dewey proposes in his 1938 *Logic. The Theory of Inquiry*, congruently with Peirce. Dewey makes use of this idea to show in the end that “the question of relation of method to material is a *long run* issue. For in what has been called the experiential continuum of inquiry, methods are self-rectifying so that the conclusions they yield are *cumulatively* determined” ([13], 470).

the demonstrative character of certain arguments can be judged: nor does he simply add to this conception, in the manner of many nineteenth-century logicians, the considerations of those standards by which inductive arguments can be assessed. Among the laws of inference Peirce places one which relates to the *admissibility of hypotheses* – this law, we shall find, turns out to be equivalent to his Pragmatism – and the effects of the extension of the traditional conception of inference are considerable. But even if this innovation be acceptable, the assertion that the scientific method is to be distinguished from other than scientific habits of thought simply by its conformity to logical laws, seems at first blush very odd. Logical principles are, roughly speaking, principles of appraisal and criticism, principles for judging whether certain arguments really establish the conclusions which they claim to establish. As such, logic seems to play an entirely critical, uncreative role. How then can strict or conscientious conformity to logical principles ... account for the positive virtue, the power of discovery which we ordinarily attribute to the methods of science“ ([8], 89-90)? In this sense and in this context Peirce talks about abduction as about augmentative inferential process deprived of cognitive sterility in relation to the increase of knowledge, and he – without renouncing them – ascribes certain cognitive sterility to standardized inductive and deductive forms of inferences. So there are three forms of reasoning, which are deduction, induction, and abduction ([2], V, 161). He talks much about the first two in his methodological and logical writings, yet not much about the third – about abduction. However, there is no doubt that it was the most important. Induction was ever considered as a kind of inference when we on the basis of certain (finite) amount of cases realize certain generalizations, that means, we refer certain inferential process outcomes to all other identical cases⁸.

There is a certain difficulty in contemporary assessment concerning Peirce’s definition and consideration of his abduction, which consists in the fact that in his age induction was considered to be the elementary process of science. Peirce raised objections; in his opinion induction serves for testing theories, but not for the act of their creation. It cannot fulfill the function of emergent agent of new opinions. Deductive inference is formally more elegant, it creates more exact and strict relations, but in order to become un-analytic it would have to enter the drifting waters of experience. Probably for this reason Peirce’s attention focused on abductive form of logical inferences. The phenomena of scientific creativity explained via process of abduction lays out notable results of science. In this context Peirce is convinced that: “A man must be downright crazy to deny that science has made many true discoveries.“ ([2], V, 172). We don’t doubt the discoveries, but we accredit them in a large extend to inventions connected with abductive creativity.

“In deduction, or necessary reasoning, we set out from a hypothetical state of things which we define in certain abstracted respects. Among the characters to which we pay no attention in this mode of argument is whether or not the hypothesis of our premises conforms more or less to the state of things in the outward world... Our inference is valid if and only if there really is such a relation between the state of things supposed in the premises and the

⁸ This idea was widely advocated by *J. S. Mill*. In his *A System of Logic* he proposes: “Induction, then, is that operation of the mind, by which we infer that what we know to be true in a particular case or cases, will be true in all cases which resemble the former in certain assignable respect“ ([14], 297). Peirce was strictly against Mill’s assumptions that induction is the primary tool for the process of acquiring knowledge and that knowledge is possible only due to the uniformity of nature. He writes: “Even John Stuart Mill holds that the uniformity of nature makes the one state of things follow from the other. He overlooks the circumstance that if so it ought to follow necessarily, while in truth no definite probability can be assigned to it without absurd consequences. He also overlooks the fact that inductive reasoning does not invariably infer a uniformity; it may infer a diversity“ ([2], CP 1.92). For Peirce’s critique of Mills inductivism see also: CP 1.18; CP 2.633; CP 2.766; CP 2.775; CP 5.149; CP 5.345; CP 6.60; CP 6.100; CP 6.394; CP 6.410 – CP 6.413.

state of things stated in the conclusion. Whether this really be so or not is a question of reality, and has nothing at all to do with how we may be inclined to think“ ([2], V, 161).

Deductive processes remain only brain exercises, if we will not enter with them into the world much more complicated and complex than is the world of the deductive capacity of man. For this reason Peirce goes back to Aristotle and his notion of *apagogue* found in *Prior Analytics*. Inference capable to initiate new theories as basis for additional process of testing is called by Peirce *hypothetical inference*, or *abduction*:

*“...our first premises, the perceptual judgments, are to be regarded as an extreme case of abductive inferences, from which they differ in being absolutely beyond criticism. The abductive suggestion comes to us like a flash. It is an act of **insight**, although of extremely fallible insight. It is true that the different elements of the hypothesis were in our minds before; but it is the idea of putting together what we had never before dreamed of putting together ... If we were to subject this subconscious process to logical analysis, we should find that it terminated in what that analysis would represent as an abductive inference, resting on the result of a similar process which a similar logical analysis would represent to be terminated by a similar abductive inference, and so on **ad infinitum**“ ([2], V, 181\3).*

This knowledge is of such a kind that it is not at first connected with words or with rational recognition; it is rather a result of unconscious texture of experience and it acquires indeterminate form of belief that things are such-and-such. On the face of it, if we consider countless amount of actual valid information, everything looks easy and simple. “But every single item of scientific theory which stands established today has been due to Abduction... Think of what trillions of trillions of hypotheses might be made of which one only is true...” ([2], V, 172). The sense of human knowledge is not the description of the world which is conceived as a matter-of-fact, but it can rather be found in the process of connecting outer, matter-of-fact impersonal world, with inner, anthropic, human, personal, subjective. In abduction, inner and outer merge, they permeate into each other and only in countless approximations they compose complex mosaic of our knowledge. On principle hypothetical character of abductive processes oblige us to permanent confirmation of their validity, which – if they are to be related to reality – has to be empirically saturated. Our privilege – not to be doomed for everlasting ignorance – is due to our ability to be abductively critical to our own ideas, to our own techniques. We can look around us with ever present wonder that things can be different, after all. Their appearance is bound with circumstances and conditions, including ourselves.

In fallibilistic perspective, our knowledge is only one of many possible interpretations of the world. Every system of information built according to the rules of logical reasoning rests on specific (indirect) interpretation of experience and it can – as a ray of inspiration – throw light into the dark places of reality. Abduction plays crucial role here – it represents antennae by means of which we cognitively sense the terrain of reality in our interest; but we have to touch it many times if we want to find out how it really is, even if this process is never finished. Peirce’s philosophy of science is in this respect hodogetic. He himself considered it as a guide – as a draught of the approach by means of which it is possible to reach (un)certain goals of human knowledge. Abduction is a special kind of intuitive reasoning, which is not dependent on *a priori* principles (as deduction), nor is it dependent on experimental observations (as induction). In Peirce’s comprehension, abduction is functional and very important, in certain respect the most important supplement of the two standardized processes of reasoning, from which it differs by its creative ability to produce new hypothetical ideas, throwing them into the sieve of verification process. “Peirce’s use of abduction .. was not

entirely original... however, he was the first to employ it in scientific era and his specific account of it was somewhat original... Peirce translated *apagogue* as abduction. Thus, we have the historical source of Peirce's notion of abduction" ([7], 14-15). For Peirce, abduction is a tool of scientific creativity, but the evolution of this notion has its roots in Aristotelian exposition of the way of argumentation, by means of which „we are nearer to knowledge“ ([3], II, 25). This exposition can be found in the second book of *Prior Analytics* in the notion of *apagogue*.⁹ We conceive *apagogue* (lat. reduction or abduction) as a syllogistic process by means of which only approximate veracity and probable outcome is inferred, what results from uncertainty of selected premises. It is clear that what Peirce was after was exactly this *uncertain* kind of inference. However, uncertainty is not conceived negatively, because we cannot be certain of permanency of our results. There are many degrees, levels of abduction; their acceptance is considered by the fact that reasoning is purely inductive or deductive only exceptionally. According to Peirce all “interpretative acts are essentially abductive ... we see that abduction must devolve into perception itself“ ([7], 16). As Peirce puts it: “ abductive inference shades into perceptual judgment without any sharp line of demarcation between them...” ([2], V, par. 181\3).¹⁰

In other words, in order to follow Peirce in his articulation of abduction as the only kind of inference resulting in new ideas, we have to ask, what does scientist do when he is scientifically creative. According to Peirce it is actual creation and presentation of a new idea.¹¹

Abduction, even if it is similar to inductive reasoning, is – from the point of view of scientific creativity – more daring and more jeopardous step as induction. If Peirce was not convinced that it is inevitable to distinguish between them, he would not have to revive Aristotelian *apagogue*. In induction, one kind of facts refer to other kind of equal or similar facts, while abductive hypotheses generated from facts of one kind refer to facts of completely another kind. “Abduction really is original and ampliative (extending) in certain important sense... it accents difference instead of similarity“ ([4], 22). In psychological sense abduction is based rather on the sense element of thought, it touches facts of a different kind, while induction is based on the habitual element, on strict restriction of thought on the sphere of equivalent kind of facts. Abduction is not just a logical form,¹² but first of all a lively process

⁹ When Peirce decided to make use of Aristotelian *Prior Analytics* and the notion of *apagogue*, he was not prepared to adopt Aristotelian interpretation. According to traditional understanding, abduction is common syllogism containing certain degree of uncertainty, which is not rare not only in scientific thought, but in thought in general, as well. Peirce's abduction is a reaction to the status of science, which has to lead its inquiry exploring many facts in order to subdue these facts to certain theory and thus explaining them. At the same time it is a reaction to the status of science, which has to explore facts, whose lack of phenomenal manifestation makes their hypothetical presence just a mental experiment. By means of this, in certain mental emergence, in hypothetical inference, the Greek thinkers proposed atomistic theory of matter, which waited for its confirmation for over two millennia. Besides, we don't ascend the theory only by means of induction; it is hypothetical inference which brings us nearer to the solution, and opens new cognitive perspective.

¹⁰ Abduction is an inevitable part of emergence of perceptual judgments; it is part of something, what is not a mere amount of experiential facts. Peirce proposes approximately the same idea as B. Russell, when he shows that “imagination always enforces on logic“ ([4], 114), and that in scientific reasoning itself, whatever its methodological ground is, non-scientific opinions take part in „inspiration of pioneers of 16th and 17th century“ ([12], 128). For example Kepler's devout imagination was motivated by “Zoroastrian adoration of Sun“ ([4], 128) and it led to creation of hypothesis, with which Kepler entered into the history of cosmology.

¹¹ “This was one reason Peirce revered such scientific advances as Kepler's introduction of elliptical orbits, Newton's description of gravity, and the various forms of evolutionary theory. Each of this essentially twisted the standard view on reality in a radical way“ ([7], 18).

¹² Good example of abductive procedure is, according to Peirce, Newton's discovery of gravitation. “The notion of gravitation, the notion, which cannot be discredited, is a hypothesis of abductive inference“ ([4], 25). Peirce, considering the fundament of inference by means of which Newton proposed the notion of gravitation, was convinced that this new notion, “the notion of gravitation, is not involved in premises in the sense it is already

at the end of which something, which was not present at the beginning, emerges. Confusion between abduction and induction – also in respect to the exposition of Peirce’s thought – is not proper.

Scientific belief, however paradoxically it may sound, is a part of abductive inference, which participates on a belief common for scientists (or people with religious belief) that nature is characterized by organization (A. N. Whitehead) and that “God does not play dice“ (A. Einstein)...

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known (in intellectu) - gravitation was not known before its first hypothetical use. But gravitation is involved in the premises in the sense that there are logical relations between the premises and the conclusion... gravitation is implicit in the nature of universe, but it is not known until it is discovered“ ([4], 25). In different words, it cannot be found, but it has to be discovered. Newton did it by means of abductive, not inductive, or deductive method. Even Galilei, as Peirce shows, would not be successful with few imperfect meterings when he discovered for physics fundamental relations of celestial bodies, had he not spontaneously shifted from induction to abductive inference.