

## *Abduction And The Limits Of Formalization*

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Paul Bourguine's text "Models of Abduction" is undoubtedly ingenious, bringing forth a theory of abduction whose purpose is to check its adequacy for the whole field of cognitive science. I will not face Bourguine's text directly and I have sincerely to confess that such an enterprise would go further beyond my competence. Hence, the route I chose for this possible dialogue with Bourguine is an indirect one. I will construct another view of abduction and take it as a starting point to raise some doubts about the state of the art of abduction in cognitive science.

Peirce's theory of abduction involves many aspects (see Santaella 1993). All of them may be summarized in one central issue: its initiative, originary, spontaneous, and free character. The selection of quotations below will be able to highlight this character.

*All the ideas of science come to it by way of abduction. Abduction consists in studying facts and devising a theory to explain them (5.145).*

Abduction is the process of forming an explanatory hypothesis. It is the only logical operation which introduces any new idea (5.171). Abduction is originary in respect to being the only kind of argument which starts a new idea (2.96).

...Every single item of scientific theory which stands established today has been due to Abduction (5.127).

Abduction, although it is very little hampered by logical *rules*, *nevertheless is logical inference, asserting its conclusion only problematically or conjecturally, it is true, but nevertheless having a perfectly definite logical form (5.188).*

In fact, abduction refers to the creative act of raising an explicative hypothesis. It is the type of reasoning through which creativity manifests itself not only in science and in art but also in everyday life. When we are confronted with something that surprises us, abduction is the process through which a hypothesis or conjecture appears as a possible answer to that surprising fact. Where does this power of raising hypothesis that most of the time are correct come from? This is a crucial question. The one I wish to explore.

According to Peirce, abduction is a rational instinct. It is the result of spontaneous conjectures produced by our creative reason. It is instinctive and rational at the same time. By the word "instinct", Peirce means the capacity to correctly divine the ways of Nature.

*Man has a certain insight [...] into the Thirdness, the general elements of nature [...]. This faculty is of the general nature of Instinct resembling the instincts of the animals in its so far surpassing the general powers of our reason and for its directing us as if we were in possession of facts that are entirely beyond the reaches of our senses. It resembles instinct too in its small liability to error; for though it goes wrong oftener than right, yet the relative frequency with which it is right is on the whole the most wonderful thing in our constitution (5.173).*

Hence, the new is apprehended by us through nothing more than divination. However, it is not divination in itself, neither the hypothesis that it engenders that are instinctive. What is instinctive is the human capacity to guess the correct hypothesis, the one which is able to explain the surprising fact. Peirce calls this capacity *il lume naturale*, indicating that man has a natural insight of the laws of nature. *This faculty of guessing corresponds to a bird's musical and aeronautic powers; that is, it is to us, as those are to them, the loftiest of our merely instinctive powers (7.48).* For Peirce, instinct functions as a common thread uniting all the realms of nature, from plants to animals and mankind. In every realm and in every level at which instinct manifests itself, it is always concerned with protection and survival through the capacity of adequately reacting to the environment conditions. In mankind, adequate reaction is creative reaction. *The human mind is a part of nature and has emerged by the same evolutionary process. Consequently there is a conaturality between mind and cosmos which means that the mind has an affinity with nature, is attuned to it, and has a natural adaptation to imagining correct theories of some kinds. [...] Mind and nature develop together. From this it follows that abduction is not only linked to instinct but it is also the result of an evolutionary development which explains both the biological origin of humans and their ability to form hypotheses in logic (Roth 1988: 133-135).*

Besides being instinctive and evolutionary, abduction is, at the same time, a logical inference. This is, for sure, the most polemical issue among Peirce's commentators. If abduction is born of an instinct to guess, how can it have a logical form? Answering this apparent ambivalence, Fann (1970: 412) says that the moment of insight and the adoption of the hypothesis are instantaneous. But the process of construction and selection of hypothesis is conscious, deliberate and controlled, being open to criticism and self-criticism. Along the same line of argument, Anderson (1986: 156-60) says that the hypothesis and its application may occur at the same moment so that abduction may be originary and, nevertheless, a logical form. As Peirce's notion of instinct is not psychologically determinist, it can be logically explained. Hence, the ambivalence solely exists to those who understand instinct in a psychological frame. Besides, the source for guessing, the

suggestion for a conjecture is given by experience. Coherent as they undoubtedly may be, these explanations still do not face the most intricate dilemma, the dilemma of the origins of abduction. Where do the first premises of abduction come from?

To answer this question, firstly we have to understand the originality of Peirce's conception of inference. For him, *we must distinguish an inference (a causally ordered system of acceptings) from an argument (an ordering of propositions). Terms like 'therefore' and 'hence' must be understood as indicating what is permissible for the controlled movement of thought, i.e., from some acceptings to another, that constitutes reasoning. Peirce described belief as a 'holding for true' or 'any kind of holding for true or acceptance of a representation' (NEM 4.39-40), and to say we really believe in the truth of any proposition is no more than to say we have a controlling disposition to behave as if it were true' (MS 652: 15). Peirce also used 'acceptance' to characterize inference, and indicated by it a notion of assent or favorable attitude towards a proposition with which positive belief was sometimes contrasted (MS 873: 23). The choice of terms is important in defining inference, since he wrote that abduction is not a matter for belief (5.589), that belief is out of place in science (5.60; 1.635), and that non-truth-valued items can be inferred (MS 293:37). To achieve the requisite generality, a broad sense of acceptance, viz, 'favorable attitude towards' a proposition, is more suitable for defining inference (Kapitan 1990: 509, n.2).*

However, this concept of inference is only a first step in the direction of the most original of Peirce's conceptions: the one of abductive inference. In abduction, the insight that leads to a hypothesis is referred by Peirce *to the same general class of operations to which Perceptive Judgements belong* (5.173). For him, abduction and a perceptive judgement are exactly similar until a certain point, the separation between them only occurring at the end of the process. The result of abduction, which is the hypothesis or conjecture, may be subjected to criticism, while it would be as absurd to criticize a perceptive judgement as it would be to criticize the growth of our nails. This means that abduction follows some steps: (1) the creative observation of a fact, (2) an inference which has the nature of a guessing, (3) evaluation of the reconstructed inference. It is important to recognize that *we might not be aware of the 'habit' or 'rule' by which we initially conceive a hypothesis, and only later does it emerge and submit itself to critical scrutiny* (Kapitan 1990: 510, n.6). The habit or internalized rule that guides the raising of a hypothesis is the most intriguing aspect of abduction, the one that has to deal with the perceptive judgement. But what is a perceptive judgement?

Peirce's theory of perception is triadic (see Santaella 1998). Three logical elements are involved in every perception: (1) the percipuum, (2) the percept, and (3) the judgement of perception. The percept is the object of perception, something that is out there, mute, foreigner, that which knocks at the door of our senses. The percipuum corresponds to the way the percept is translated by our sensory organs. This translation is immediately interpreted in a judgement of perception. This is a kind of rudimentary proposition which informs us about that which is being perceived. Although its type is very special since it is involuntary, this judgement is an inference because we accept the information it brings, we do not doubt it.

The judgement of perception is fallible but indubitable. While our mind is producing a judgement of perception, and even when we recover it through memory, we are psychologically incapable of conceiving that it may be false. It is only in this aspect that an abductive inference differs from a perceptive judgement. Despite the fact that both take a departing course that is exactly similar, the hypothesis that results from abduction claims for a critical acceptance and for an inductive confirmation. However, in their origin, both are identical, that is, both are unconscious inferences, out of control. They force themselves on us and we can exert no influence on them. To ask why this is so is the same thing as asking why birds fly. It simply happens that this is the stuff we are made of. At the immediate instant in which the percept knocks at the door of our senses, it is filtered by our sensorial equipment and captured in the web of the mental schemas with which we are also equipped to translate what is presented to our minds. The mental operations involved in this process completely escape the control of our conscience.

Now we are in the condition to understand what Peirce calls habits of inference. In the case of judgements of perception and abduction which is the case of involuntary, unconscious inferences, the place of the guiding principle (rule, ideal or form) and the required premiss is occupied by a totally unconscious habit of inference. We infer, or better, we jump to a conclusion without knowing why, that is, without being able to articulate our reasons to do so. If in deliberate reasoning, habits of inference also play an important role, the difference between deliberate reasoning, of which an argument is the best example, and the implicit forms of inference, such as a perceptive judgement, is the following: in the former, the normal habits of inference are subjected to the control of a habit of a higher order, while in the latter, the habits of inference are not subjected to critical control. This does not mean that for being involuntary they are immutable. Although they are beneath the critical control of logic, unconscious habits of inference may undergo changes which are provoked by the shocks of experience.

This notion of unconscious habits of inference is the converging point for the understanding of both faces of abduction as simultaneously inferential and originary. Although they are inferences, for being unconscious, they come into our thoughts as if they were originary, first premises. That means: they are habits, but unconscious. They are inferences but come to us as if they were originary. They are inevitably fallible, but the only source of discovery. They are fragile and consequently incomplete. That is why they are inseparable from deduction and induction. In sum: this is the melting pot of abduction.

It is exactly this melting pot that I can never find in the understanding and use that the cognitive sciences have and make of the concept of abduction borrowed from Peirce. And this is done to such an extent as to turn the concept of abduction unrecognizable. That is what I feel when I find in your paper statements as the followings: "For the sake of clarity inferences are not considered to be probabilistic and are only analysed in a set-theoretic framework, which supposes that Nature's responses are deterministic". Or: "abductive reasoning is based on beliefs". Or: "abduction is nothing else than the relation reciprocal to deduction". And still: "Abductive reasoning, like deductive reasoning, happens in a static context of beliefs".

It seems that cognitive science only deals with the upper part of the iceberg, that is, the hypothesis, which is the final result from the inferential process of abduction. This would not be a fault if the most fundamental aspects of abduction were not missed, namely, the role of experience and surprise, the role of perception, and the role of the unconscious in the process of discovery. And here I raise my fundamental question: what is the use of abduction when these roles are missed?

In the light of abduction, the three paradigms of cognition with which you deal in your paper, the cognitivist, the connectionist and even the constructivist are rationalist and logocentric paradigms. That means that the real nature of abduction is reduced to a mere variant of deduction. This can be evinced by the environment where abduction is forced to fit, that is, the context of beliefs, axioms, theorems. I do agree that abduction should have a status of the same importance as deduction. That is exactly the status that Peirce gives to it in his *methodetics*, his theory of the scientific method which embraces abduction, deduction and induction as interrelated and complementary steps of a single method. Each one of these modes of reasoning in itself is incomplete and in need of the others to support a methodic thought. Even if it is true that logical formalization is imperative in the state of the art of the cognitive sciences of today, the price that abduction has to pay for this formalization is so high as to disfigure its real character. That is why this paper of mine is called "Abduction and the limits of formalization". As far as I can see, to face the real nature of abduction is to face the limits of formalization.

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