Abduction: Between subjectivity and objectivity*

JOÃO QUEIROZ and FLOYD MERRELL

1. Why do we need a special issue on abduction?

Charles Sanders Peirce (1839–1914), creator of pragmatism, was a polymath. His contributions include such diverse areas of research as meteorology, experimental psychology, geodesics, astronomy, mathematical economy, philosophy of mathematics, theory of gravity, linguistics, history and philosophy of science, and the history and philosophy of logic (Fisch 1986: 376). In spite of the breadth of his academic purview, many Peirce scholars compress his work into the field of logic, which, for Peirce, was semiotic (Houser 1997: 1).

There is some merit to this approach, since, according to Peirce, logic in its various forms includes all of the disciplines with which he was involved. Along with Gottlob Frege, Bertrand Russell, and David Hilbert, Peirce is considered one of the founders of modern logic (Lukasiewicz 1970: 111; Barwise and Etchemendy 1995: 211; Quine 1995: 23; Hintikka and Hilpinen 1997: ix). Independently of Frege, he developed the concepts of quantification and quantifying logic (Hintikka and Hilpinen 1997: ix; Quine 1985: 767, 1995: 31; Putnam 1982: 297). He was author of the terms 'First Order Logic' (Putnam 1988: 28), and 'Trivalent Logic' (Fisch and Turquette 1966; Lane 2001). He also anticipated Henry Sheffer's 'Stroke Function' by more than 30 years (*W* 4: 218–221; Houser 1997: 3); worked with what later came to be known as Claude Shannon's correspondence between truth functions and electrical circuitry (*W* 5: 421–422; Gardner 1982); and developed a logical notation using topological forms (existential graphs) that anticipated hybrid systems of notation based on graphs, diagrams, and frames (Roberts 1973; Shin 1994, 2002; Barwise and Etchemendy 1995; Allwein and Barwise 1996; Hammer 1994, 1995).

As if this were not enough, one of his most original contributions consists of his development of a *logic of discovery* based on the concept of *abductive inference*, as outlined by various scholars (Bernstein 1980;

Semiotica 153–1/4 (2005), 1–7 0037–1998/05/0153–0001

Nickles 1980a, b). In the future, the repercussions from this aspect of Peirce's monumental work are likely to be among the most noteworthy.

2. Introducing the topic

But Peirce's concept of abduction is still poorly approached and has received no more than occasional attention since K. T. Fann's (1970) brief but intensive study of abduction and a few scattered articles. When mention has been made of abduction, it has usually been within the context of scientific discovery and scientific method, regarding what has been considered logico-rational discourse. There has been hardly more than lip service paid to abduction as a general creative process. However, a turnaround began with Umberto Eco and Thomas Sebeok's collection entitled *The Sign of Three: Dupin, Holmes, Peirce* (1983). Since that time abduction has occasionally found itself on the edge of the spotlight in Peirce studies — for example, excellent articles can be found in *Transactions of the Charles S. Peirce Society, Semiotica*, special issues of the journal *VS* (1978, 1980), and Uwe Wirth's online collection of papers at www.rz.uni-frankfurt.de/~wirth/index.html.

Abduction is a distinct form of logical inference, though in extreme cases it can be, and often is confused with perceptual judgment. Peirce defines abduction as 'the process of forming explanatory hypotheses' (*CP* 5.171), the 'only kind of argument which starts a new idea' (*CP* 2.96). It consists of two operations: the selection and formation of hypotheses for the purpose of further consideration (*CP* 6.525). As an 'act of insight' that 'comes to us like a flash' (*CP* 5.181), abduction is germane to creative and aesthetic dimensions of human cognition.

Swimming against the traditional division of inference into simple deduction and induction, Charles S. Peirce held to his tripartite division: *abduction*, *induction*, and *deduction*. Briefly, deduction was, for Peirce, a logical matter of hypothesizing much as tradition had it; induction entailed the process we would ordinarily term confirmation of deduced hypotheses through observation of particular cases. But how could hypotheses come about in the first place? If deduction involves the logical construction of hypotheses by deductive operations, how is it that insight regarding the possibility of a plausible hypothesis could emerge? Is there indeed a 'logic' for creating hypotheses? Tradition responds with an emphatic 'NO!' Logical positivists and Karl Popper were some of the most outspoken critics of the very idea of a logical process for creating novel possibilities as part of the discovery process. Popper wrote, 'the initial stage, the act of conceiving or inventing a theory, seems to me neither to call for logical

analysis nor to be susceptible of it. The question how it happens that a new idea occurs to a [person] . . . may be of great interest to empirical psychology; but it is irrelevant to the logical analysis of scientific knowledge' (Popper 1959: 20–21). Popper writes here, and elsewhere, that novel ideas are the product of irrational flights of fancy — purely random happenings. Hence there is no guarantee that any one idea popping into one's head has a better chance of success than another. Knowledge is the result of purely blind guesses, and no more — i.e., Popper's (1963) Darwinian theory of 'evolutionary epistemology' (Bartley III 1984).

3. Spotlighting the topic

Peirce once suggested that the abductive act is an instinctive capacity of the mind sufficiently prepared for informed guesses, as the mind has 'a natural bent in accordance with nature' (*CP* 6.478). This attunement of mind and nature merges into perception, which Peirce calls the 'outward clash' of the physical world on the senses, and as traditional thought would dictate, perception precedes conception. In Peirce's words, the 'elements of every concept enter into logical thought at the gate of perception and make their exit at the gate of purposive action; and whatever cannot show its passports at both those two gates is to be arrested as unauthorized by reason' (*CP* 5.212). *Perception*, *conception*, and *purposive action*. The sequence is by no means as simple as it might appear. Peirce knew this, and he elaborated on the problem on many occasions. For the present, suffice it to observe that abduction, or some feeling that gives rise to an informed guess by the prepared mind in tune with nature's symphony, precedes perception, conception, and purposive action. In other words, if induction and deduction are matters of logically hypothesizing by conception and confirmation through perception of particular cases in the physical world, then abduction is what makes it all possible in the first place.

There are no wide-eyed, innocent percepts according to Peirce. All percepts come with beliefs, preconceptions, and prejudices leading to perceptual judgments; thus, there is no hard and fast line of demarcation between perception, conception, interpretation, and knowledge (*CP* 5.184). Regarding abductive inference and these processes, there is a difference in degree rather than kind: perception, conception, and interpretation can be, to an extent, subject to the willful, controlling mind, while abductions arise spontaneously, as it were. But the mind, having less control over the workings of abductive 'logic' than more willfully controlled deductive and inductive logic, is consequently privy to hardly more than the tip of the

iceberg. Below the level of the mind's conscious and willful control, there is 'a vast complexus, which we may call the instinctive mind' (*CP* 5.212).

However, the reader who cavalierly takes Peirce's instinct to be outmoded biological thinking has not read him closely. Instinct entails embedded tendencies as well as inborn propensities. Although obviously it cannot be specified — and Peirce, as far as we are aware, never denied this — it serves as a tool, offering a conceptual grasp of an exceedingly complex phenomenon: namely, a nonconscious linking of the qualitative feeling or Firstness of a sign, its object and its interpretant by way of some resemblance or other.

Upon evoking Peirce's category Firstness and his concept of the sign, a few words are in order in that respect. Peirce defined the semiosic process of signs becoming signs as irreducibly triadic, between sign, object, and interpretant (*CP* 1.363, 7.537, 8.331). These are the minimal constitutive components making up the sign, and their triadic interdependent, interrelated interactivity integrates his three categories delineating natural and mental processes (*MS* 318: 81, *CP* 2.242, 2.274). In brief, the categories can be defined as:

1. *Firstness*: what is such as it is, without reference to, or interrelation with, anything else.
2. *Secondness*: what is such as it is, in interrelation with something else, but without relation to any third entity.
3. *Thirdness*: what is such as it is, insofar as it is capable of bringing a second entity into interrelation with a first one in the same way that it is interrelated with the first and the second entity (for further information on the categories, see Almeder 1980, Hookway 1985).

Briefly, the sign or representamen, outside any and all considerations of the object with which it interdependently and interactively interrelates, is Firstness; its entering into interrelatedness with its object ushers in Secondness; and its taking on an interpretant that brings about mediation between sign and object in the same manner in which it enters into interdependent, interrelation interaction with them, involves Thirdness. This triadic semiosic process allows the sign to suggest a plausible hypothesis to its interpreter, by way of its potential interpretant, which can be realized only through interdependent, interrelated interaction with its interpreter. Then, and only then, can the emerging sign become a subservient sign by opening itself to the mind's whims and prejudices.

In this manner, linkage by Firstness can enable the interpreter-interpretant to process the sign in conjunction with the character of its object, such interpretation providing for the possibility of an alteration of feeling, thought, and action. To put this another way, feeling is a

sensation of some abduction arising as the plausible solution to some problem situation (Firstness); the problem situation came about as the consequence of something in the physical world that seemed contrary to what was expected (Secondness); and the emerging interpretant involved some possible hypothesis or solution to the problem situation that recently entered the scene uninvited (Thirdness).

Feeling, or the sign of Firstness, issues forth as a stream, though this stream may be inordinately vague. Its specification can be made possible only after the fact of Secondness and by way of mediating Thirdness. For example, an abduction emerging as feeling is at that point acritical, without doubt, and enshrouded in exceeding uncertainty, though on the spur of that particular moment it may seem to be a paragon of clarity (*CP* 5.446). And it might bring with it, as Secondness bounds onto the scene, a shock of surprise, for it is entirely different from what was expected; it contradicts recently acquired or well-worn habits of perception and of thought.

4. An example

Take Henri Poincaré's discovery of the Fuchsian functions in mathematics (Poincaré 1914). Poincaré's lively account has him working on the problem for fifteen days without success. One evening, after drinking black coffee, he spent a sleepless night experiencing jumbles of ideas colliding until they interlocked, convincing him that the tentative hypothesis he had constructed was incorrect. This turned out to be an erroneous abduction by his nonconscious style of dream reasoning. Then he went on vacation, and, while boarding a bus, he suddenly realized that the Fuchsian functions were identical to a set of functions that already existed in mathematics, the transformation of non-Euclidean geometry, which he could then use to solve his problem. This, he discovered, was a correct abduction, arrived at by a spontaneous shock of surprise in his waking state — and as a consequence Poincaré writes that he nearly missed a step into the bus and went toppling to the ground.

Poincaré goes on to tell us that the incidents of travel put his mathematical work in 'cerebral limbo,' where it gestated and gelled on its own, to surface at an unexpected moment (as an abduction). This 'cerebral limbo' is a timeless *ensemble* (of possible abductions). His next, somewhat arduous task was that of patiently, and in a more or less linear, continuous operation, taking up pen and ink and setting his discovery down on paper (by constructing a well-formulated hypothesis and a proof or confirmation, in deductive and inductive fashion). This is a *time-bound*

process. Comparable stories abound: Kekulé's discovery of the benzene ring experienced as intertwined snakes after a coffee-drinking marathon; Coleridge's dream of Kubla Khan and his palace which, upon awakening from a drug-induced slumber, he wrote as if the composition were all there and awaiting its realization on the page; Mozart's melodies coming to him in their entirety in one massive clash. In each case, there is something that remains beyond control (cerebral limbo, the *ensemble*), which, after arising, can be subjected to the willful workings of the mind (a linearly logical *time-bound* process).

The abductive act, coming in many guises and from within many forms of cognitive activity, merits considerable more inquiry than it has received in the past. With this in mind, we have designed this special issue for the purpose of awakening interest in Peirce's abductive process.

Note

* João Queiroz is funded by a grant from FAPESP.

References

Allwein, Gerard and Barwise, Jon (1996). *Logical Reasoning with Diagrams*. Oxford: Oxford University Press.

Almeder, Robert (1980). *The Philosophy of Charles S. Peirce: A Critical Introduction*. Totowa: Rowman and Littlefield.

Bartley III, William M. (1984). *The Retreat to Commitment*, 2nd ed. LaSalle: Open Court.

Barwise, Jon and Etchemendy, John (1995). Heterogeneous logic. In *Diagrammatic Reasoning — Cognitive and Computational Perspective*, J. Glasgow, N. Hari Narayanan, and B. Chandrasekaran (eds.), PAGE NUMBERS. Menlow Park CA: AAAI Press.

Bernstein, Richard (ed.) (1980). *Perspectives on Peirce*. New York: Greenwood.

Eco, Umberto and Sebeok, Thomas A. (1983). *The Sign of Three: Dupin, Holmes, Peirce*. Bloomington: Indiana University Press.

Fann, K. T. (1970). *Peirce's Theory of Abduction*. The Hague: Martinus Nijhoff.

Fisch, Max (1986). *Peirce, Semeiotic, and Pragmatism*. Bloomington: Indiana University Press.

Fisch, Max and Turquette, Atwell (1966). Peirce's triadic logic. *Transactions of the Charles S. Peirce Society* 2, 71–85.

Gardner, Martin (1982 [1951]). *Logic Machines and Diagrams*. Chicago: University of Chicago Press.

Hammer, Eric (1994). Reasoning with sentences and diagrams. *Notre Dame Journal of Formal Logic* 35 (1), 73–87.

—(1995). *Logic and Visual Information*. Stanford: CSLI Publications.

Hintikka, Jaakko and Hilpinen, Risto (1997). Preface. In *Studies in the Logic of Charles S. Peirce*, N. Houser, D. Roberts, and J. Van Evra (eds.), ix–x. Indiana: Indiana University Press.

Hookway, Christopher (1985). *Peirce*. London: Routledge and Kegan Paul.
Houser, Nathan (1997). Introduction: Peirce as logician. In *Studies in the Logic of Charles S. Peirce*, N. Houser, D. Roberts, and J. Van Evra (eds.), PAGE NUMBERS. Indiana: Indiana University Press.
Lane, Robert (2001). Triadic Logic. In *Digital Encyclopedia of Charles S. Peirce*, J. Queiroz (ed.). www.digitalpeirce.org.
Lukasiewicz, Jan (1970 [1961]). *Selected Works*, L. Borkowski (ed.). Amsterdam: North-Holland.
Nickles, Thomas (1980a). *Scientific Discovery: Case Studies*. Dordrecht: D. Reidel.
—(1980b). *Scientific Discovery, Logic, and Rationality*. Dordrecht: D. Reidel.
Peirce, Charles S. (1967). Manuscripts in the Houghton Library of Harvard University, as identified by Richard Robin, *Annotated Catalogue of the Papers of Charles S. Pierce*. Amherst: University of Massachusetts Press. [Reference to Peirce's manuscripts will be designated *MS*.]
—(1982–). *Writings of Charles S. Peirce*, 5 vols., M. Fisch, E. Moore, and C. Kloesel (eds.). Bloomington: Indiana University Press. [Reference to Peirce's writings will be designated *W* followed by volume and page number.]
—(1994). *The Collected Papers of Charles S. Peirce*. Charlottesville: Intelex Corporation. Original edition (1931–1966), 8 vols., C. Hartshorne, P. Weiss, and A. W. Burks (eds.). Cambridge: Harvard University Press. CD-ROM. [Reference to Peirce's papers will be designated *CP* followed by volume and paragraph number.]
Poincaré, Henri (1914). *Science and Hypothesis*, F. Maitland (trans.). New York: Dover.
Popper, Karl R. (1959). *The Logic of Scientific Discovery*. New York: Basic Books.
—(1963). *Conjectures and Refutations: The Growth of Scientific Knowledge*. Oxford: Oxford University Press.
Putnam, Hilary (1982). Peirce the logician. *História Mathemática* 9, 290–301.
—(1988). Lógica combinatória. In *Enciclopédia Einaudi*, vol. 13. Lisbon: Imprensa Nacional Casa da Moeda.
Quine, Willard V. O. (1985). *The Time of My Life: An Autobiography*. Cambridge: MIT Press.
—(1995). Peirce's logic. In *Proceedings of the Charles S. Peirce Bicentennial International Congress*, K. L. Ketner, J. M. Randsell, C. Eisele, M. H. Fisch, and C. S. Hardwick (eds.), 23–31. Lubbock: Texas Tech Press.
Roberts, Don (1973). *The Existential Graphs of Charles S. Peirce*. Berlin/New York: Mouton de Gruyter.
Shin, Sun-Joo (1994). *The Logical Status of Diagrams*. New York: Cambridge University Press.
—(2002). *The Iconic Logic of Peirce's Graphs*. Cambridge: MIT Press.

João Queiroz (b. 1963) is a post-doc researcher at the State University of Campinas (Unicamp) ⟨queirozj@dca.fee.unicamp.br⟩. His principal research interests are cognitive science, biosemiotics, and C. S. Peirce's philosophy. His major publications include 'Semiose segundo C. S. Peirce: evidências empirico-teóricas' (in press); (with P. Farias), 'On diagrams for Peirce's 10, 28, and 66 classes of signs' (2003); as well as guest editing (with R. Gudwin) a special issue on Computational Intelligence and Semiotics for the S.E.E.D. journal (2003).

Floyd Merrell (b. 1937) is Professor of Semiotics and Latin American Culture and Literature at Purdue University, Indiana ⟨fmerrell@purdue.edu⟩. His recent major publications include *Complementing Latin American Borders* (2004); *Sensing Corporeally* (2003); *Living Learning, Learning Living: Signs, East and West* (2002); and *The Mexicans: A Sense of Culture* (2003).

(V7(M) 19/11/04 14:20) WDG/G J-1209 Semiotica, 153 PMU: WSL(W) 17/11/04 Times_M (0).3.04.05 (148×225mm) pp. 1–8 001_P (p. 7)