IDEAS IN ACTION

Proceedings of the *Applying Peirce* Conference

Edited by:
Mats Bergman,
Sami Paavola,
Ahti-Veikko Pietarinen,
Henrik Rydenfelt

Nordic Studies in Pragmatism 1

IDEAS IN ACTION

Nordic Studies in Pragmatism

Series editors:
Mats Bergman
Henrik Rydenfelt

The purpose of the series is to publish high-quality monographs and collections of articles on the tradition of philosophical pragmatism and closely related topics. It is published online in an open access format by the Nordic Pragmatism Network, making the volumes easily accessible for scholars and students anywhere in the world.

IDEAS IN ACTION

PROCEEDINGS OF THE *APPLYING PEIRCE* CONFERENCE

Nordic Studies in Pragmatism 1

Edited by
Mats Bergman,
Sami Paavola,
Ahti-Veikko Pietarinen &
Henrik Rydenfelt

Nordic Pragmatism Network,
Helsinki 2010

www.nordprag.org

ISSN-L 1799-3954
ISSN 1799-3954
ISBN 978-952-67497-0-9

This work is typeset with Donald Knuth's TeX program, using LaTeX 2ε macros and the 'Nnpbook' class definition.

Contents

Part II

Part III

Preface

This volume contains selected papers presented at the *Applying Peirce* conference at the University of Helsinki, 11–13 June 2007. The meeting brought together scholars and researchers to explore and discuss Charles S. Peirce's thought and its applications. With more than a hundred participants and more than 60 papers presented by an internationally diverse group from many different fields, the organizers felt that a selection of extended papers representative of the contents of the conference should be made available to the public.

The *Applying Peirce* conference, organized by the members of the Helsinki Peirce Research Centre, was arranged in conjunction with the 9th World Congress of the International Association of Semiotic Studies. The meeting was made possible by the financial support received from the University of Helsinki (project 2023031, "Peirce's Pragmatistic Philosophy and Its Applications") and the Academy of Finland, and the sponsorship of the Philosophical Society of Finland and the Charles S. Peirce Society. We would also like to acknowledge the help we received from Prof. Douglas Anderson, who commented on the whole of the volume, and Mr. Jukka Nikulainen, whose competence and eye for detail was crucial to its technical production.

This volume is the first in the series Nordic Studies in Pragmatism, which publishes peer reviewed monographs and collections of articles on philosophical pragmatism. We feel that there is no better way to start this series than with a book highlighting the range and contemporary relevance of the founder of the pragmatist movement.

Helsinki, December 2010

The Editors

Note on References

The following standard abbreviations of editions of Charles S. Peirce's writings are used:

CN n:m — Charles Sanders Peirce: Contributions to the Nation. K. L. Ketner (Ed.). Vols. 1–4. Lubbock: Texas Tech University Press. 1975–87

CP n.m — Collected Papers of Charles Sanders Peirce. C. Hartshorne, P. Weiss, & A. W. Burks (Eds.). Vols. 1–8. Cambridge, MA.: Harvard University Press. 1931–58

EP n:m — The Essential Peirce: Selected Philosophical Writings. N. Houser, C. J. W. Kloesel, & The Peirce Edition Project (Eds.). Vols. 1–2. Bloomington: Indiana University Press. 1992–98

HP n:m — Historical Perspectives on Peirce's Logic of Science. C. Eisele (Ed.). Vols. 1–2. Berlin: Mouton de Gruyter. 1985

NEM n:m — The New Elements of Mathematics. C. Eisele (Ed.). Vols. 1–4. The Hague: Mouton. 1976

PM m — Philosophy of Mathematics: Selected Writings. M. E. Moore (Ed.). Bloomington: Indiana University Press. 2010

PPM m — Pragmatism as a Principle and Method of Right Thinking: The 1903 Harvard Lectures on Pragmatism. P. A. Turrisi (Ed.). Albany: State University of New York Press. 1997

RLT m — Reasoning and the Logic of Things: The Cambridge Conferences Lectures of 1898. K. L. Ketner (Ed.). Cambridge, MA: Harvard University Press. 1992

SS m Semiotics and Significs: The Correspondence between Charles S. Peirce and Victoria Lady Welby. C. S. Hardwick (Ed.). Bloomington: Indiana University Press. 1977

W n:m Writings of Charles S. Peirce: A Chronological Edition. The Peirce Edition Project (Eds.). Vols. 1–6, 8. Bloomington: Indiana University Press. 1982–

In references to CP, citations of the form *n.m* refer to paragraph *m* in volume *n*. Citations of the form MS *n:m* are to page *m* in manuscript *n*, as numbered in Richard S. Robin's *Annotated Catalogue of the Papers of Charles S. Peirce* (Amherst, MA.: University of Massachusetts Press, 1967). In all other editions, *n* refers to volume and *m* to page number.

Reconsidering Peirce's Relevance

Nathan Houser
Indiana University–Purdue University Indianapolis

In June 2007, an international conference convened at the University of Helsinki to explore the emerging interest in the thought of Charles S. Peirce and to consider the applicability of Peirce's ideas to diverse fields of inquiry.[1] To underscore the breadth they were aiming for, the conference organizers listed the following fields of relevance: logic, abductive reasoning, communication and rhetoric, contemporary philosophical debates, mathematics, artificial intelligence, cognitive science, linguistics, literary studies, the study of fine arts and design, physics, biology, psychology, sociology, and anthropology. The Helsinki Conference was held in conjunction with the 9th World Congress of Semiotics, so semiotic and textual studies were also areas of interest. The conference opened with a general survey of the breadth and influence of Peirce's thought[2] and with a stimulating discussion of T. L. Short's newly published book, *Peirce's Theory of Signs* (2007).[3] As the conference unfolded, the application of Peirce's thought in additional fields or sub-fields was explored including architecture, virtual reality, data modeling, and other new media applications, geology, and such intriguing and specialized studies as distributed intentionality and semantic webs. Several papers dealt with graphical logic; in particular, with applications of Peirce's well-known (at least becoming so) Existential Graphs, and those applications dealt with a number of interesting issues including

[1] The conference, *Applying Peirce*, was arranged by the Helsinki Peirce Research Centre and was sponsored by the Charles S. Peirce Society and the Philosophical Society of Finland.

[2] This introductory essay is a revision of the keynote lecture for the Helsinki Conference.

[3] The participants in this Author Meets Critics symposium were Mats Bergman, Risto Hilpinen, James Liszka, and the author, T. L. Short.

problems in information theory as well as in language representation and processing. Some papers, and a workshop, dealt with how Peirce's ideas inform, or might inform, editing theory and practice.

This overview of topics covered during the three days of the Helsinki Conference provides a comprehensive glance at where to look for effective applications of Peirce's ideas. As I go on, I will add a few more areas in which Peirce's thought has been found relevant, although I will certainly not attempt to be exhaustive – that, I believe, would be an all but impossible undertaking in any case. But first I want to remark on why I believe the theme of the Helsinki Conference, *Applying Peirce*, might at first strike one as a little curious, and might even be slightly unsettling.

The crux of this concern has to do with what is meant by "Applying Peirce." The idea of applied philosophy as opposed to pure philosophy comes to mind, a distinction similar to that between applied and pure science. It may seem ironic to ask of the father of pragmatism what part of his work could be usefully applied. Is it not very nearly the point of pragmatism to undo the dichotomy between pure and applied thought? Can we not think of Peirce's pragmatic maxim as a formula, or routine, for turning every meaningful conception into something of practical relevance – for turning conceptions, we might say, into something that can be applied? Once we get the idea of this connection between conceptions and practice we can begin to appreciate the profound link Peirce saw between ideals and behavior. This suggests that perhaps the regimens we have to undertake to impose self-control on the development of our habits of behavior are among the most important applications of Peirce's philosophy that we can imagine. Yet, it seems to me that this is not quite the kind of application the organizers of the Helsinki Conference had in mind.

If Peirce held that the gist of his pragmatism was to bridge the dichotomy between pure and applied thought why did he, in 1898, make his much criticized distinction between theoretical issues and matters of vital importance? Here is his claim:

> [P]ure theoretical knowledge, or science, has nothing directly to say concerning practical matters, and nothing even applicable at all to vital crises. Theory is applicable to minor practical affairs; but matters of vital importance must be left to sentiment, that is, to instinct.
>
> EP 2:33

This seems inconsistent. However, the apparent inconsistency disappears if appropriate emphasis is given to Peirce's qualifiers: "directly" and "vital." This was not a denial of any of the basic tenets of pragmatism but was, instead, a statement of Peirce's belief that science is, and should be, guided by reason, with the test of experience coming in due time, while actions in response to matters of vital importance should be guided by instincts and traditional sentiments because 1) urgency requires immediate action and 2) the fallibility of instincts and developed sentiment has *already* been mitigated over time by trial and error. So, it does not seem to me that this view, which Peirce labels sentimental or true conservatism (CP 1.661), contradicts his recognition of the inseparable union of theory and practice. In fact, Peirce, of all the classical American philosophers, had perhaps the strongest inducement for accepting that union.

Peirce spent thirty years working as a physical scientist for the U.S. Coast & Geodetic Survey where, for most of that time, he was engaged in unmistakably theory-laden scientific practices. For most of his years with the Coast Survey, Peirce was in charge of gravity determinations which, in his day, were made by counting the number of swings per second of very precisely measured pendulums. But to determine gravity as exactly as Peirce demanded, many possible sources of error had to be accounted for and theoretical considerations abounded in every case: How does one determine the effect of the dulling of the pendulum's knife edge? What is the effect of the flexure of the pendulum support? What is the effect of the viscosity of the air in which the pendulum swings (what is a satisfactory theory of hydrodynamics that can be applied to the movement of pendulums through viscous air)? What is the effect of temperature on pendulum measurements? What is the effect of the observer on observations? What are the most useful units for measuring or representing the force of gravity? And so on. Peirce spent much time working on these and other problems that explicitly concerned the application of theory or the theory of application and practice.

Gravity research was not Peirce's only work for the Coast Survey. He also worked with weights and measures and for a time was in charge of the office that oversaw these standards for the United States. Peirce carried iron bars to London and Paris to compare the U.S. standards with the British yard and the French meter. Once again, the obviously very practical comparison of the distance between the scratches on one bar and the scratches or the ends of another is very complicated by theoretical considerations concerning the choice of standards, the effects of temperature on the expansion of metals, the effectiveness of different methods of comparison, and so on. In 1885, in testimony before the Allison Commission, a special committee of the United States Congress, Peirce was questioned extensively about U.S. physical standards. His knowledge of the weight of air at different altitudes enabled him to inform the Commission that the gold coins minted in Denver contained more gold than their counterparts minted in Philadelphia, because the standard used to weigh out the gold was a hollow brass weight and the air trapped inside weighed more in Denver than it did in Philadelphia. Peirce expressed his belief that the United States needed a special agency to manage weights and measures, and it is thought that his testimony contributed to the congressional decision to create the U.S. National Bureau of Standards.[4]

Peirce also worked on cartography for the Coast Survey, especially on map projections. Between 1876 and 1879, he created a new projection called the quincuncial projection, which allowed for repetition of the Earth's sphere in transposed positions on a map so that any location might be viewed as occupying a central position relative to the rest of the Earth. This projection preserved the angles at the junctions of latitude and longitude as much as possible by consolidating distortions near the poles. Peirce's map was used during World War II for charting international air routes and is still used for educational purposes today.[5]

One can see from these examples, and I could give many more, that Peirce's work as a scientist would have given him strong inducement for accepting the intimate union of theory and practice. Theory, for Peirce, is like the law; practice like the sheriff. Theory is thirdness; practice secondness. Theory conceives and guides; practice gets things done. Although he seems always to have favored theory over practice as the focus of his own intellectual energy, he certainly understood that each required the other: "Law, without force to carry it out, would be a court without a sheriff; and all its dicta would be vaporings" (CP 1.212). Indeed, as I have briefly illustrated, Peirce contributed to applied science in many ways and there is good reason to believe that the application of theory to practice was of considerable interest to him, so we might even suppose, with the caution due counterfactual suppositions, that Peirce would have warmly welcomed the attention the organizers of the Helsinki Conference drew to applications of his thought. I believe, however, as evidenced by the scope of the papers

[4] The Allison Commission (1884–85) was a bipartisan congressional committee which, among other things, investigated a charge that several government agencies, the Coast Survey among them, were doing research for abstract and not strictly practical purposes. It was not long after those hearings when a great effort was started to reduce the cost of science by severely limiting funding for primarily theoretical research. For a brief recounting of Peirce's encounter with the Allison Commission see W 5:xxviii–xxx.

[5] See Carolyn Eisele's "The Problem of Map Projections", in Eisele (1979, pp. 145–59).

presented at the conference, that the idea of application that the organizers had in mind was not so much "practical application" as it was "*relevance* for contemporary issues and problems" whether those issues and problems were theoretical or practical – or inseparably both at once.

Using this broad conception of what it means to "apply" Peirce, I'll turn now to a consideration of a prior estimate of Peirce's relevance, that of the renowned Peirce scholar, Max H. Fisch. When Fisch wrote his well-known article, "The Range of Peirce's Relevance," for the 1980 special Peirce issue of *The Monist*,[6] an earlier resurgence of interest in Peirce's philosophy was just getting underway (partly due, perhaps, to the work of the Peirce Edition Project, and also to such stimulants as the 1976 Peirce Bicentennial International Congress in Amsterdam and a 1979 Peirce issue of *Synthese*.[7] But Peirce's contributions to philosophy were still mainly referenced only in footnotes and even then not all that often. It was not until 1982, two years after Fisch's article appeared, when Hilary Putnam, in his paper "Peirce the Logician" announced that most of the important developments that shaped modern logic before 1900, including quantification, derived from the Boole-Peirce tradition. The *Synthese* Peirce issue and Putnam's paper appeared at a time when historical questions about logic and analytical philosophy were beginning to gain interest and it helped launch a new assessment of Peirce's contributions. Discussions of Peirce's importance for the development of modern logic began to move out of footnotes and into articles and books. By 1989, even W. V. O. Quine was ready to admit that it was Peirce's breakthrough with the theory of quantification that mattered historically.[8]

But when Fisch wrote his paper, Peirce's relevance and his polymathic scope were for most philosophers and historians of ideas only rumors and were often thought extravagant, so Fisch had to spend a lot of time convincing his readers of much that we take for granted now – even that Peirce had made an important contribution to semiotics. Fisch consid-

[6] Fisch's article originally appeared in two parts in *The Monist* 63 (1980): 269–76 and in *The Monist* 65 (1982): 123–41. It was reprinted in *The Relevance of Charles Peirce*, ed. E. Freeman (LaSalle, IL: The Hegeler Institute, 1983, pp. 11–37) and in *Peirce, Semeiotic, and Pragmatism; Essays by Max H. Fisch*, eds. K. L. Ketner and C. J. W. Kloesel (Bloomington: Indiana University Press, 1986, pp. 422–48). References to Fisch's paper throughout the remainder of this paper will be to the reprint in the Ketner and Kloesel volume.

[7] The proceedings of the 1976 congress were published in *Proceedings of the C. S. Peirce Bicentennial International Congress*, eds. K. L. Ketner, J. M. Ransdell, C. Eisele, M. H. Fisch, and C. S. Hardwich (Lubbock: Texas Tech Press, 1981). The Peirce issue of *Synthese*, "Essays on the Philosophy of Charles Peirce", was issue no. 1 of vol. 41 (1979).

[8] For Quine's assessment of Peirce's historical importance, see Quine (1999).

ered Peirce's relevance in three sections, one that looked back to Peirce's relevance for his own time, one that considered his relevance for the scene current at the time of Fisch's article, and a third section that looked forward to relevance arguably yet to come. I'll follow Fisch through a select few of his observations and predictions remarking on developments during the thirty years since he wrote his article.

Fisch emphasized "Peirce's almost single-handed advocacy of infinitesimals against the long dominant method and doctrine of limits" and noted that "The philosophical relevance... lies in the proof that we *can* reason logically and mathematically about infinity, and therefore about continuity" (Fisch, 1986, p. 432). As we move into the 21st century, the study of Peirce's philosophy of mathematics is on the ascendance. Many papers and dissertations in recent years have addressed topics in this area, and a philosopher from Brooklyn College, Matthew Moore, has recently edited a selection of Peirce's writings on set theory and the continuum (PM) and, also, a new collection of essays on Peirce's philosophy of mathematics (Moore, 2010).

Another very interesting contribution of Peirce's that Fisch discussed was his early work in experimental psychology, leading some to claim that Peirce was America's first modern experimental psychologist (Cadwaller, 1974). This is not a far-fetched claim. It is based on Peirce's collaboration at Johns Hopkins with his student, Joseph Jastrow, the person who indirectly provided Wittgenstein with the famous duck-rabbit example. I described Peirce's collaboration with Jastrow in the introduction to Volume 5 of the Indianapolis Chronological Edition (W5:xxv–xxvi):

> Peirce suggested to Jastrow that they undertake an experiment to test Fechner's claim that human sensations are subject to a limitation he called a *Differenzschwelle* (the minimum perceptible difference of sensation). Below this threshold it was said to be impossible to discern differences of intensity. Peirce and Jastrow conducted elaborate experiments between 10 December 1883 and 7 April 1884 that constituted the first psychological investigation undertaken at Johns Hopkins and one of the earliest studies in experimental psychology in North America. Peirce described the experiment in a letter to Simon Newcomb dated 7 January 1908:
>
> "I note that you ac[c]ept as *established* the dictum of Gustav Theodor Fechner that the least sensible ratio of light is 101/100. If you will look in volume III Mem. of the U.S. Nat. Acad. of Sci. you will find a paper by me and my then student in logic Joseph Jastrow devoted to the question whether there is or is not such a thing as a "Differenz-

> Schwelle" or least perceptible difference of sensation... [We] began with sensations of pressure and for a reason I will shortly mention we ended there. At once, using such precautions as any astronomer would use in observing faint nebulas, without any practice we found that if there were any least perceptible ratio of pressure, it was twenty or thirty times nearer unity than the psychologists had made it to be. We afterward tried to do the same thing for light; but were stopped by the utter impossibility of getting a piece of Bristol board containing a square inch of uniform luminosity. No doubt this might have been overcome. But Jastrow and I were severally pressed with other work and we dropped the investigation – contenting ourselves with what we had done."
>
> They had good reason to be content. Their report ..., presented to the National Academy of Sciences on 17 October 1884 and published in the Academy's *Memoirs* in 1885, is described by Stephen M. Stigler as unexcelled in the nineteenth century and "a good example of a well-planned and well-documented experiment today". Stigler points out that the study was the first to employ a "precise, mathematically sound randomization scheme," and also the first to require subjects to state their confidence in their choice (weight A is lighter or heavier than weight B) and to choose even when the level of confidence was zero. Ian Hacking, who also discusses the experiment, points out that Peirce's understanding of the importance of randomization was at least three decades ahead of his time. Yet, Peirce's idea was forcefully rejected by E. B. Titchener for being out of touch with psychological reality, and it was not reintroduced until R. A. Fisher's *Design of Experiments* appeared in 1935. Hacking also remarks on the interesting last paragraph... where Peirce and Jastrow indicate that their conclusion has important bearings on such questions as women's insight and telepathic phenomena. The word "telepathy" was less than two years old, according to Hacking.

So here we have a good example of ground-breaking work based on theory, tested by experiment, and with application to the study of the limits of human perception and intuition (as well as claims concerning paranormal experiences such as those investigated today by such institutions as the Center for Inquiry in Amherst, New York).[9]

Another example of Peirce's relevance, also discussed by Fisch, was Peirce's 30 December 1886 letter to Marquand recommending that he try

[9] The Center for Inquiry (`http://www.centerforinquiry.net`), with its affiliate Committee for Skeptical Inquiry, promotes science-based inquiry and serves as a watch dog for paranormal and fringe-science claims that masquerade as objective science.

electricity for his logic machine. Peirce's letter contains the first known design for using an electric switching circuit for computing. Here, again, Peirce made a very practical and I would say prophetic application of theory. Whether Peirce's idea directly influenced the early development of modern computing is mainly a matter of historical interest, but it is noteworthy that the idea of using electricity for computing was mentioned in Baldwin's *Dictionary of Philosophy and Psychology* with specific reference to Marquand's machine. Certainly the importance of the application of the theory of electrical switches, first to logic and then to computing, cannot be minimized whether or not it was Peirce's insight that directly bore the fruit.[10]

It is possible that the application of Peirce's logical ideas to computing is still in its early stages. Consider, for example, the sign-engineering work of Shea Zellweger who has perfected Peirce's sixteen connective logic notation to the point where truth-functional transformations are completely mechanical and can be performed with mirrors – thus potentially at the speed of light. In recent years, Zellweger's work has spawned a small but intense flurry of research in Peirce-inspired symmetry-based logics, which I anticipate will have important computational as well as theoretical applications, though that remains to be seen.[11]

Also along these lines is the work of Kenneth L. Ketner who, with physicist G. R. Beil, has developed an application of Peirce's logic of relations for the study of elementary particle interactions and has patented a triadic logic switch based on Peirce's mathematical formulation of his categories (Beil & Ketner, 2006). Josiah Lee Auspitz and Kilian Stoffel, applying Peirce's categories differently, were awarded a U.S. software patent for a semiotic switch for an improved process for the storage and retrieval of multi-media computer data.[12]

Perhaps even more promising for computational applications of all kinds are developments stemming from Peirce's graphical logic, especially his Existential Graphs (EG). A great deal of the promise in this area is due to John Sowa's research on automated natural language understanding and

[10] See the article "Logical Machines" in Baldwin's *Dictionary of Philosophy and Psychology*, vol. 2 (`http://psychclassics.yorku.ca/Baldwin/Dictionary`). For a discussion of Peirce's and Marquand's contributions to computing see "Logic of Electronic Switching", Appendix A of Burks & Burks (1989).

[11] See `http://www.logic-alphabet.net` for references to Zellweger's papers and for links to related work.

[12] *Annual Report of the Sabre Foundation for 2004* (Cambridge, MA: Sabre Foundation, Inc., 2004).

the school of logic that has grown up around Sowa's EG-based Conceptual Graphs. Several Helsinki Conference participants addressed applications based on Peirce's graphs.[13]

Another, perhaps more surprising, area of Peirce's relevance discussed by Fisch was economics. Fisch pointed out that Peirce was included as a precursor in mathematical economics in a 1968 book on that subject edited by William J. Baumol and Stephen M. Goldfeld, a judgment based on Peirce's 1871 correspondence with Simon Newcomb published in 1957 by Carolyn Eisele.[14] Eisele showed that Peirce was one of the first to recommend the application of the calculus to political economy and to show how to use the calculus to express basic relationships between supply and demand, the cost of production, price, and so on. Peirce's now famous 1876 "Note on the Theory of the Economy of Research," where he developed a theory intended to guide scientific researchers in their efforts to balance the benefit of advancing knowledge against the costs of the research, was also a factor in early recognition of his contribution to economics.[15]

But over the past decade it has begun to become evident through the work of Dave Dearmont, economist James Wible, and others, that Peirce's contribution to economic thought has been underestimated. Without going into detail, it is noteworthy that Peirce was one of the first to understand and promote A. A. Cournot's model of duopoly and that by 1871 he had refined Cournot's model in a way that exhibited key concepts of Nash equilibrium. In 1874 Peirce discovered the axiom of transitivity that is usually attributed to Kenneth Arrow, or to other mid-20th century economists: "If a person prefers A to B and B to C, then he also prefers A to C" (W 3:176). According to Wible, Peirce also developed advanced models of utility theory and by the 1890's he had provided "a brief, but scathing critique of utilitarian philosophies of punishment and rehabilitation". Wible also points out that in his [fourth] Harvard Lecture of 1903, "Peirce rejects the concept that economists have assumed for…decades, that consumer tastes and preferences should be taken as given (CP 5, p. 71)".[16]

[13] Among the participants of the Helsinki Conference who addressed applications based on EG were John Sowa, Sun-Joo Shin, Fernando Zalamea, and Ahti Pietarinen. See John Sowa's homepage (`http://www.jfsowa.com`) for information about the Conceptual Graphs and for links to active researchers in the field.

[14] Carolyn Eisele, "The Correspondence with Simon Newcomb," in Eisele (1979, pp. 52–93).

[15] Peirce's paper was originally published in the *U.S. Coast Survey Report for 1876* (see W4:72–78). It was reprinted in *Operations Research* 15 (1967): 643–48. For discussion of Peirce's paper see Rescher (1976), and Wible (1994).

[16] The quotations are from Wible's contribution to a discussion of Peirce's contributions to economics carried out on the Peirce-L forum. For Wible's reference to

Finally, in recent years it has become better-known that the founders of the so-called Institutional School of Economics had close ties to Peirce and Dewey[17] – Thorstein Veblen, for example, one of the founders, was a student of Peirce at Johns Hopkins. Recently, Joseph Ransdell made the astute observation that the "Institutional School's conception of economic institutions as mediational systems" appears to apply Peircean semiotic principles to economics. This is a highly suggestive clue for future research.[18]

Fisch discusses many more contributions of significance including Peirce's theory of abduction, which began to be considered relevant in the 1960's, with the work of Norwood Russell Hanson, and is now a growth industry and is understood, rather as I believe Peirce would have hoped, to be of critical importance for cognitive science.[19]

Fisch's second section began with a long discussion of the relevance of Peirce's theory of signs. In 1980, semiotics "as a field of systematic study" was still very young and in some quarters there were doubts about Peirce's relevance. Fisch's (1986) view was that "It may be safely predicted that in [semiotics] at least Peirce will long remain relevant as providing a framework within which semioticians can locate the more limited ranges of their own researches" (p. 430). Fisch then pointed out that Peirce had been "a lifelong student of comparative linguistics" and he quoted Jakobson's claim that Peirce is "the deepest inquirer into the essence of signs" and Jakobson's belief that Peirce's statement that "a symbol may have an icon or an index incorporated into it" as opening "new, urgent tasks and far-reaching vistas to the science of language" (ibid.; see Jakobson, 1959, p. 233; 1965; 1971, p. 357). I believe this is as germane today as it was when Jakobson wrote it.

Fisch predicted a continuing and increasing relevance of Peirce for linguistics and that prediction seems to be proving true. Among those who take a neo-Piagetian conctructivist approach to cognitive development there is an increasing enthusiasm for abandoning language dominated lin-

---

Peirce's fourth Harvard Lecture see CP 5.111 (also EP 2:189). Also see Wible's "Economics, Christianity, and Creative Evolution: Peirce, Newcomb, and Ely and the Issues Surrounding the Creation of the American Economic Association in the 1880s" (`http://www.cspeirce.com/menu/library/aboutcsp`).

[17] According to Dearmont in discussion on the Peirce-L Forum.

[18] In discussion on the Peirce-L Forum.

[19] See Hanson (1958, 1961), for some of his early references to Peirce's abduction. Also see Hanson (1965). For a collection of articles that surveys current research on abduction see *Semiotica* 153–1/4 (2005), a special issue on abduction: *Abduction: Between Subjectivity and Objectivity*.

guistics for a broader semiotic approach, one that takes seriously Peirce's idea of pre-linguistic, or pre-symbolic, sign processing. This opens the way for a linguistic theory and, for that matter, a general theory of learning, that can account for a continuous development of cognitive functioning from the earliest stages of infancy to full intellectual maturity (see, e.g., Rodríguez & Moro, 1998; 2008). Somewhat more unexpected, perhaps, is the growing interest in applying Peirce's complex sign analysis and classifications in radical reappraisals of received linguistic categories.[20]

Fisch (1986, pp. 432–3) also discussed Milton Singer's argument for a Peircean anthropology and the growing interest in Peirce on the part of sociologists and social psychologists. By 1973, through the work of John Lincourt and Peter Hare, Peirce was becoming recognized as having contributed, along with Chauncey Wright and Josiah Royce, to symbolic interactionism, the Chicago-based sociological movement centered on the idea that human life is lived principally in the symbolic domain. Since then much work has been done by philosophers like Vincent Colapietro (1989) and by sociologists like Norbert Wiley (1994) on Peirce's social-semiotic theory of the self. This is an area that I believe is rich for future relevance, particularly as very new kinds of selves begin to emerge from the growing technologies that are bound to find unforeseen ways to connect brains, computers, data-bases, and proto-perceptive instruments into new kinds of conscious systems.[21]

Without wishing to neglect important areas of relevance and application, I'll just briefly mention that Fisch also reviews Peirce's growing relevance for psychiatry which, I believe, is yet to be fully comprehended, and for psychology, especially for the psychology of perception. Here is an area where theory and practice can be easily understood to walk hand in hand; those who struggle with the philosophy of perception understand very well how crucially the diagnosing and treating of perceptual deficiencies and abnormalities depends on the theory of perception embraced by the psychologist or psychiatrist. I believe it is the role Peirce gives to abduction in perception that is the crucial element that may eventually transform the way psychiatrists and psychologists understand perception and

[20] For example, see Andrew LaVelle's "Metonymy: A Peircean Semiotic Categorization and Typologization in Relation to other Tropes and Sign Types," PhD dissertation, University of New Mexico, 2007, and Anderson Vinícius Romanini's "Minute Semeiotic; Speculations on the Grammar of Signs and Communication based on the work of C. S. Peirce," PhD dissertation, University of São Paulo, 2006.

[21] Also see N. Houser, "Form of Life to Come", forthcoming in the *Balkan Journal of Philosophy*.

treat patients with perceptual problems (see, e.g., Houser, 2005; Muller & Brent, 2000; Rosenthal, 2004).

When Fisch glanced forward to Peirce's relevance for the future he made a special point of stressing the untapped potential of Peirce's normative thought, noting especially Peirce's neglected esthetics and ethics. Peirce's life-long investigation of standards, originally in connection with his interest in scientific measurement, provided a richly developed basis for axiological studies. As Kelly Parker has shown, Peirce was an early proponent of applying the conception of normativity to philosophy and by 1903 the normative sciences (identified by Peirce as aesthetics, ethics, and logic) had come to occupy the central ground of his philosophy (see Kent, 1987).[22] Peirce's normative thought has received occasional attention over the years but recently there has been growing interest in his work in this area and it promises to be of increasing relevance in years to come.[23] I believe that one rich area for future study will be Peirce's regulative conception of value[24] and his idea that normative values grow, like everything else, though not in a way that can be reduced to biological evolution but more-or-less in the way that semiosis develops toward final interpretants.

Fisch quickly finished his forward glance without making many sustained predictions. Here is his final paragraph: "Philosophers will readily think of other questions equally worth pursuing, and now, like those above, about to become more readily pursuable. So also will inquirers coming to Peirce from mathematics, from the natural and social sciences, and from humanistic studies – say, for examples, from chemistry and physics, astronomy and geodesy, cartography and metrology; from anthropology and psychology, economics, history, and literature; from folklore, linguistics, and lexicography. The amazing range of his relevance we are only beginning to guess at. A decade from now we may have begun to measure and comprehend it." (Fisch, 1986, pp. 445–6).

---

[22] See also Kelly Parker, *Charles S. Peirce on Esthetics and Ethics; A Bibliography*. (`http://agora.phi.gvsu.edu/kap/CSP_Bibliography/`)

[23] See, for example, Goudge (1950), and Thompson (1953). Of special importance among the earlier studies are the five papers (by the authors: Walter P. Krolikowski, S.J., Richard S. Robin, W. Donald Oliver, Roulon Wells, and Thomas A. Goudge) in the section on "Normative Science, Final Causation, and Evolution" in Moore & Robin (1964, pp. 257–341), and Potter (1967). One sign of growing interest in this area is the international conference held at the University of Opole, Poland, in 2007. The conference, organized by Krzysztof Skowroński and N. Houser, brought together thirty scholars from ten countries to discuss the growing relevance of Peirce's normative thought (see `http://www.filozofia.uni.opole.pl/show.php?id=78`).

[24] For the best discussion of Peirce's regulative theory of the normative value, truth, see Hookway (2004).

Well it is now three decades since Fisch tried to foresee Peirce's future relevance and we now know that in making his predictions he was remarkably prescient. Indeed, now we are much closer to comprehending the range of Peirce's relevance but of course it grows and shifts as science and culture evolve. Some of the more exciting new areas for applying Peirce, areas not already mentioned, where I see him beginning to be applied are ecology, biosemiotics, medicine, the theory of memes in cognitive science, management, critical editing, where Peirce's semiotics offers a way to maintain a respect for authorial intent, evolutionary religion, and the fine arts: painting, music, literature, and poetry. I anticipate that we will someday find a great poet to explore Peirce's categories in a profound and revealing way. The prospects for applying Peirce are legion – he was a polymath, after all, with a mind surprisingly open to possibilities.

In conclusion, I want to share a short verse that one of my students brought to my attention. He told me it was a poem by William Makepeace Thackery which he believed well-expressed the dynamics between thought, action, and habit, characteristic of pragmatism. Here is the verse:[25]

> Sow a thought, and you reap an act;
> Sow an act, and you reap a habit;
> Sow a habit, and you reap a character;
> Sow a character, and you reap a destiny.

In this verse we have what seems to me to be a succinct expression of the development of character and destiny by way of thoughts, acts, and habits, that is quite Peircean. It is also a reminder that applied ideas are expressed in actions which do not entirely stop when they terminate; they may start tendencies or habits and in that way can have long-term consequences never imagined. As Peirce becomes more frequently applied in ways I've indicated and in ways treated by the participants of the Helsinki Conference, and by the growing company of students and scholars who are increasingly seeking direction from Peirce's thought, the destiny of human culture may, for some time to come, become more Peircean than Peirce could ever have hoped for – except perhaps briefly when he imagined that his *Guess at the Riddle* might launch a new age analogous to that begat by Aristotle.

[25] It turns out that this verse in unlikely to have been authored by Thackery. It is sometimes said to be a Buddhist Proverb and is attributed to at least nine different authors, including Thackery. Besides Thackery, the verse has been attributed to Charles Reade, Andre Maurois, Samuel Smiles, James Allen, George D. Boardman, Francis E. Willard, Ralph Waldo Emerson, and William James. The attribution to William James was apparently made because the verse was found in his hand, but I believe he was simply quoting it, presumably as my student did, as an expression of the dynamics within pragmatism.

References

Baumol, W. J., & Goldfeld, S. M. (Eds.) (1968). *Precursors in Mathematical Economics: An Anthology.* London: London School of Economics.

Beil, G.R., & Ketner, K.L. (2006). *A Triadic Theory of Elementary Particle Interactions and Quantum Computation.* Lubbock: Institute for Studies in Pragmaticism.

Burks, A., & Burks, A. (1989). *The First Electronic Computer: The Atanasoff Story.* Ann Arbor: The University of Michigan Press.

Cadwaller, T. C. (1974). "Charles S. Peirce (1839–1914): The First American Experimental Psychologist." *Journal of the History of the Behavioral Sciences*, 10, 293–296.

Colapietro, V. M. (1989). *Peirce's Approach to the Self: A Semiotic Perspective on Human Subjectivity*. Albany: State University of New York Press.

Eisele, C. (1979). *Studies in the Scientific and Mathematical Philosophy of Charles S. Peirce.* R. M. Martin (Ed.). The Hague: Mouton.

Fisch, M. H. (1986). *Peirce, Semeiotic, and Pragmatism.* K. L. Ketner & C. J. W. Kloesel (Eds.). Bloomington: Indiana University Press.

Goudge, T. A. (1950). *The Thought of C. S. Peirce.* Toronto: University of Toronto Press.

Hanson, N. R. (1958). *Patterns of Discovery.* Cambridge: Cambridge University Press.

Hanson, N. R. (1961). "Is There a Logic of Discovery?" In H. Feigl & G. Maxwell (Eds.), *Current Issues in the Philosophy of Science* (pp. 20–35). New York: Holt, Rinehart, and Winston.

Hanson, N. R. (1965). "Notes Toward a Logic of Discovery." In J. Bernstein (Ed.), *Perspectives on Peirce* (pp. 42–65). New Haven: Yale University Press.

Hookway, C. (2004). "Truth, Reality, and Convergence." In C. Misak (Ed.), *The Cambridge Companion to Peirce* (pp. 127–149). Cambridge: Cambridge University Press.

Houser, N. (2005). "The Scent of Truth." *Semiotica*, 153(1/4), 455–466.

Jakobson, R. (1959). "On Linguistic Aspects of Translation." In R. A. Brower (Ed.), *On Translation* (pp. 232–239). Cambridge, MA: Harvard University Press.

Jakobson, R. (1965). "Quest for the Essence of Language." *Diogenes*, 51, 21–37.

Jakobson, R. (1971). *Selected Writings, II: Word and Language*. The Hague: Mouton.

Kent, B. (1987). *Charles S. Peirce: Logic and the Classification of the Sciences*. Kingston: McGill-Queen's University Press.

Moore, E. C., & Robin, R. S. (Eds.) (1964). *Studies in the Philosophy of Charles Sanders Peirce* (Second Series). Amherst: The University of Massachusetts Press.

Moore, M, E (Ed.) (2010). *New Essays on Peirce's Mathematical Philosophy*. LaSalle, ILL: Open Court Publishing Co.

Muller, J., & Brent, J. (Eds.) (2000). *Peirce, Semiotics, and Psychoanalysis*. Baltimore: The Johns Hopkins University Press.

Potter, V. G. (1967). *Charles S. Peirce On Norms & Ideals.* Amherst: The University of Massachusetts Press.

Putnam, H. (1982). "Peirce the Logician." *Historia Mathematica*, 9, 290–301.

Quine, W. V. O. (1999). "A Tribute from the National Academy of Sciences." In K. L. Ketner & D. E. Pfeifer (Eds.), *Peirce Studies*, No. 6 (pp. 15–22). Elsah, ILL: The Press of Arisbe Associates.

Rescher, N. (1976). "Peirce and the Economy of Research." *Philosophy of Science*, 43, 71–98.

Rodríguez, C., & Moro, C. (1998). *El mágico número tres. Cuando los niños aún no hablan*. Barcelona: Paidós.

Rodríguez, C., & Moro, C. (2008). "Coming to Agreement: Object Use by Infants and Adults." In J. Zlatev (Ed.), *The Shared Mind: Perspectives on Intersubjectivity* (pp. 89–113). Amsterdam: John Benjamins.

Rosenthal, S. B. (2004). "Peirce's Pragmatic Account of Perception: Issues and Implications." In C. Misak (Ed.), *The Cambridge Companion to Peirce* (pp. 193–213). Cambridge: Cambridge University Press.

Short, T. L. (2007). *Peirce's Theory of Signs.* Cambridge: Cambridge University Press.

Thompson, M. (1953). *The Pragmatic Philosophy of C. S. Peirce.* Chicago: The University of Chicago Press.

Wible, J. R. (1994). "Charles Sanders Peirce's Economy of Research." *Journal of Economic Methodology*, 1, 135–160.

Wiley, N. (1994). *The Semiotic Self.* Chicago: University of Chicago Press.

PART I

Serving Two Masters: Peirce on Pure Science, Useless Things, and Practical Applications

Mats Bergman
University of Helsinki

1. Introduction[1]

During his long but often troubled intellectual life, Charles S. Peirce said some *prima facie* incompatible things about the relationship between theory and practice. In his energetic early pragmatism, abstract science was construed as an outcome of the natural striving to escape doubt – to establish pragmatically and socially fitting belief – with no definite line drawn between theory and practice as modes of life. But in his Cambridge Conferences lectures of 1898 (RLT), theoretical science was explicitly separated from vital matters, leading to an almost Platonic view of scientific philosophy as Pure Theory. At the same time, Peirce denounced all aspirations to application in genuine heuretic science – that is, the kind of inquiry engaged in the undiluted search for truth.[2]

In this article, I will review the principal motivations and arguments underpinning Peirce's seemingly clashing stances. The inconsistencies, while not quite as devastating as they may at first blush appear, are nonetheless real and consequential; even the most sympathetic interpreter can

[1] The research underlying this article has been financially supported by the Ella and Georg Ehrnrooth Foundation and the Academy of Finland. I also thank Henrik Rydenfelt for his insightful – and eminently applicable – comments on an earlier version of the paper.

[2] In his mature classification of the sciences, Peirce recognizes three broad groups of heuretic inquiry: mathematics, philosophy, and special science (the last including both "physical" and "psychical" branches).

hardly avoid recognizing some degree of tension in Peirce's oeuvre with regard to the issue of the theory/practice relationship. Nor do I think that the discrepancy can be simply solved with appeal to biographical arguments or dismissed as a matter of correcting earlier errors, as the writings from Peirce's final phases do not satisfactorily settle the matter. If his early account basically glosses over the potential problem, his later position would – at least if his rather polemical assertions were taken seriously – isolate the philosopher from practice in a rather un-pragmatistic fashion. Yet, Peirce manifestly continues to adhere to the most basic tenets of pragmatism, even as his own position is specified and demarcated as *pragmaticism*.

However, I will also argue that Peirce's mature philosophy contains certain elements that may allow us to avoid both ivory-tower idealism and base utilitarianism. In particular, I will contend that a balanced reconstruction of Peirce's approach should embrace a conception of philosophy that on the one hand does not succumb to short-term demands for applicability, but which on the other hand fully recognizes the value of considering *possible* applications of abstract ideas – not merely as a secondary stage to be left in the hands of more practical inquirers and engineers, but as a substantial component in theoretical investigation itself.

2. The practical roots of scientific inquiry

Peirce presents the classic pragmatistic perspective on the relationship between theory and practice in the seminal articles 'The Fixation of Belief' (1877) and 'How to Make Our Ideas Clear' (1878). The basic idea is deceptively simple. Peirce contends that human beings normally possess a set of more or less coherent beliefs. A belief can be defined as a readiness to take action, were the suitable occasion to arise; if we believe something, then we are prepared to act on that belief, although we do not need to be fully aware of the inclination and its potential consequences. At any rate, the feeling of believing something can be taken as a more or less certain indication that a *habit of action* has been established in our nature (W 3:247 [1877]).

If our habits always would work faultlessly, there would be no incentive to inquire; in fact, there would hardly be any need for advanced thought. We would, like the other animals, cope mainly with our innate habits or dispositions, or never question the patterns of action inherited from previous generations. The principal part of our conduct *is* arguably of this broadly instinctual or commonsensical kind. Yet, human beings obviously do encounter surprises, resistances, and disappointments, and react upon them differently than other animals tend to do. We become painfully aware of the fact that nature refuses to bow to our will; we meet people who hold different opinions and beliefs. Such occasions lead to what Peirce denotes as *doubt*. When in doubt, we recognize the fallibility of our beliefs, and indeed become aware of them *as* habitual beliefs.

It is only at this stage that the mutability of habits becomes an actual issue. Although most – if not all – habits are continuously self-adapting (that is, adjusting without the cognizant input of an agent), the consciousness of error and dysfunction introduces the possibility of a higher level of potential intelligent transformation. Admittedly, this issue is complicated by Peirce's liberal usage of the term "habit". At times, the concept seems to be limited to the determined aspect of human conduct (see, e.g., CP 6.300 [1893]), apparently to be distinguished from the plastic capacity of habit-losing and habit-taking that characterizes intelligence (see, e.g., CP 6.613 [1893]); but on other occasions, he uses "habit" to denote a broader, more dynamic principle operative in all of nature.[3] In the latter acceptation, the term is in danger of being so indiscriminately applicable – with humans, other animals, plants, rivers, galaxies, and sub-atomic particles all involved in the same nebulous process of habituation – that it all but loses its pragmatic import. This terminological confusion is at least partly clarified by a distinction that Peirce introduces in his later writings: in the broader sense, "habit" "denotes such a specialization, original or acquired, of the nature of a man, or an animal, or a vine, or a crystallizable chemical substance, or anything else, that he or it will behave, or always tend to behave, in a way describable in general terms upon every occasion (or upon a considerable proportion of the occasions) that may present itself of a generally describable character", while the narrower and more proper acceptation entails a distinction between *acquired habit* and natural disposition (CP 5.538 [c. 1902]). In this respect, a differentiating mark of a human being may be the comparatively large amount of acquired habits (habit in the narrow sense) among our habits (in the broad sense that also includes dispositions). But this division between the human and the non-human is not

[3] In view of the anti-determinist metaphysics that Peirce begins to develop in the 1880s, it might be most appropriate to assert that he takes all habits (including natural laws) to be mutable in principle – or, in other words, to be more or less of the character of "mind". This would accord with his controversial thesis that the "one intelligible theory of the universe is that of objective idealism, that matter is effete mind, inveterate habits becoming physical laws" (CP 6.25 [1891]).

absolute; arguably, many different kinds of creatures possess at least the rudiments of the central capacity needed for genuine habit-transformation: the ability to learn from experience, that is, the defining competence of a "scientific intelligence" (cf. CP 2.227 [c. 1897]). Awareness of belief *as* belief is perhaps at this moment in time a uniquely human characteristic; but from an evolutionary point of view, there is no justification for assuming that this would be a permanent state of affairs.

Be that as it may, we can, to simplify matters, treat belief and doubt as facets of human conduct; like consciousness of belief is a characteristic of developed "scientific" intelligence in action, so is its inevitable companion, doubt. In other words, doubt and belief are both related to acting in a broad sense, but in different ways. A belief, or rather the underlying habit, could lead to action in certain situations; it is real, even if it is not constantly actualized. Doubt, on the other hand, functions as a direct incitement to action. There is a gap in the normal pattern of behaviour, and this practically requires the agent to take measures. In a sense, doubt is a mark of dysfunction or error – that is, of the failure of established habits to operate smoothly in a certain field of experience and practice. The feeling of irritation, which accompanies doubt, leads to a struggle to achieve a new state of belief. This effort is *inquiry* (W 3:247 [1877]). It is always concerned with a limited part of our beliefs, never with our entire web of beliefs. While any habit – or at least any acquired habit – may be doubted, all-out doubt would entail total paralysis. It is not pragmatically feasible.

Understood as a process that carries us from doubt to belief, inquiry is an everyday phenomenon. In fact, Peirce straightforwardly contends that "the settlement of opinion is the sole end of inquiry" (W 3:248 [1878]). Does this mean that there is no heuretic research, even of a mathematical or philosophical kind, unless we first encounter surprises and resistance? Yes, for if "we did not struggle against doubt, we should not seek the truth" (CP 2:84 [c. 1902]). But the doubt that brings forth inquiry must be genuine. It is not sufficient to say or write that one doubts; "paper doubt" does not amount to legitimate disbelief. Here, Peirce is particularly targeting philosophers, who seem to be plagued by an almost compulsive proclivity for "doubting" things that no one really disbelieves. According to Peirce's commonsensist stance, we should "not pretend to doubt in philosophy what we do not doubt in our hearts" (W 2:212 [1868]).

However, this maxim does not prevent us from performing thought experiments concerning situations in which we do not actually find ourselves. Peirce gives a humdrum example; if one sits at a railway station and waits for a train, one can examine advertisements and schedules, and as an intellectual exercise try to figure out how it would be best to get from town A to town B – even if one is not planning to make such a trip (W 3:262 [1878]). This process involves a real uncertainty concerning the best path of action and a genuine attempt to establish how it would be reasonable to behave. Such a play of thought can establish a habit of action; in fact, Peirce indicates that this kind of imaginary experiment exemplifies the basic model of scientific and philosophical investigation. It is a rudimentary piece of research, a controlled process of reasoning executed with the assistance of mental diagrams (cf. CP 2.227 [c. 1897]).

But could not almost any artificial doubt be defended on the grounds that it can produce habits that might prove to be valuable in the future (cf. Haack, 1983)? This is a complex problem; here, it suffices to emphasize that a doubt-inducing thought experiment is acceptable as long as it relates to a potentially consequential question within a particular line of inquiry. The cause and setting may be imaginary and diagrammatic, but at least outside of the purely hypothetical domain of mathematics, the generated doubt – however mundane it may be – must possess a connection to possible experience and action.[4] Thus, if we do not genuinely distrust the reality of the external world or the fact that two people are able to communicate with each other, then there is nothing to be gained by a wholesale philosophical programme of methodical scepticism that involves extreme requirements of certainty and precision. To put it in very simple pragmatist terms: habits that actually could guide our actions ought to always prevail over feigned disbelief in experiential science, even in philosophy. At best, paper doubts are distractions that indirectly obstruct inquiry; at worst, they may lead to a futile loss of the ability to act. As Peirce later observes in a letter to Victoria Lady Welby, useless doubts are actually "worse than useless" (SS 141 [1911]).

Although I have merely outlined a part of the argument in the early pragmatistic writings, it should be clear that they exhibit certain naturalistic leanings. "Higher" cognitive activities, such as conscious thought and science, build on the interaction between the basic natural states of doubt and belief. There is a vital connection between reasoning and action; the goal of controlled thought is to create the conditions for successful conduct,

[4] In an attenuated sense, mathematics can be said to involve experiential consequences of an ideal or diagrammatic kind, related to obstacles and surprises mathematical theorizing produces. But in his mature phase, Peirce does not typically classify mathematics as an experiential or positive science.

that is, beliefs and habits of action that help us to avoid surprise and doubt (cf. W 3:263 [1878]). In this sense, it would appear that reflection serves action; it is not clear whether it possesses any value in itself, as "pure" theory or speculation.

Furthermore, there is a connection between everyday practical problems and their solutions, on the one hand, and scientific and theoretical activity, on the other. In both cases, it is a matter of fixating beliefs and opinions. Of course, we are talking about different levels of activity, but the dynamics is the same. While science naturally evolves into a quest for general truth, culminating in abstract mathematics, the pragmatist turn can be construed as a reminder of the practical heredity and liability of theory. From this point of view, the pragmatic maxim is not merely a method of conceptual clarification, but also a commonsensical check on the human tendency to abstraction – which, especially if combined with rhetorical or stylistic flair, can produce elegant but ultimately empty theoretical constructs in philosophy.

3. Philosophy without passion

Based on the early pragmatistic writings, one is tempted to infer that Peirce wishes to collapse the traditional dichotomy between theory and practice (cf. Niklas, 1988). In this account, inquiry is intimately connected to action, and theoretical science appears to be explicable as a product of natural processes of doubt and belief-fixation. Science may not be straightforwardly reducible to such elements, but nor is it independent of the pragmatic field of practical existence. However, especially in the lectures of 1898, we find Peirce advocating a very different approach. In this context, Peirce supports the separation of theory and practice as two modes of life, wishes to defend the autonomy of scientific inquiry, and argues that conservatism is the appropriate attitude in morals and non-scientific social affairs. This is a Peirce who declares that "the two masters, *theory* and *practice*, you cannot serve" (RLT 113 [1898]).[5]

At first, it might seem that Peirce's advocacy of such a surprisingly sharp dualism between the theoretical and practical is simply motivated by his wish to protect scientific inquiry from outside pressures – an effort to defend the autonomy of science from moralists who would stipulate that

[5] The allusion is of course Biblical: "No man can serve two masters: for either he will hate the one, and love the other; or else he will hold to the one, and despise the other. Ye cannot serve God and mammon." (Matt. 6:24.)

the scientist must not offend traditional mores as well as from the kind of utilitarians who would demand that the scientist must legitimize his or her activity by producing technological applications or socially useful results.[6] The truly scientific inquirer is allegedly not concerned with the actual consequences or utility of his or her activities; even in sciences with obvious applicability, such as chemistry, the genuine investigator simply loses sight of the practical aspect (RLT 107 [1898]).

> True science is distinctively the study of useless things. For the useful things will get studied without the aid of scientific men. To employ these rare minds on such work is like running a steam engine by burning diamonds. CP 1.76 [c. 1896]

This is a picture of the idealized scientist as a self-sacrificing truth-seeker. Peirce is in effect attempting to delimit a social domain, identified as "Theory" or "Science", within which the true heuretic inquirer would be allowed to engage in open speculation and the free formulation of hypotheses without being weighed down by the baser concerns of the world of "Practice" – a broad category that seems to encompass traditional morality and sentiment as well as technological application and social reforms. It amounts to an emphatic defence of the autonomy of heuretic science. However, while Peirce's contention that "to distinguish between speculative and practical opinions is the mark of the most cultivated intellects" (CP 1.50 [c. 1896]) may seem rather innocuous in spite of its somewhat elitist overtones, it is not immediately clear how he manages to reconcile the theory/practice split with the naturalistic framework in which inquiry – and by extension, science – purportedly emerges from practice.

In particular, the elevation of unadulterated theory seems to clash badly with the idea that the sole purpose of inquiry would be the fixation of belief. Peirce certainly seems to reject his own early pragmatistic stance when he declares that "pure science has nothing to do with belief" (CP 7.606

[6] There is also a well-documented biographical reason for Peirce's unusually testy tone in the 1898 lectures. Instructed by James to give talks on "vitally important topics", and to keep them "unmathematical" and "popular" (RLT 25), Peirce reacted by giving an opening lecture – popular in tone – about the lack of relevance of philosophy for the conduct of life. There is certainly more than a hint of sarcasm and vitriol in these talks. Thus, at least a part of the abnormally strong rhetoric might be dismissible as hyperbole. On the other hand, Peirce did advocate similar viewpoints when discussing theory and practice in other late writings; so even if one were to accept biographical explanations of philosophical positions, the stance of the 1898 lectures cannot be easily explained away as a mere anomaly. Peirce's outburst could also be partially accounted for as a reaction to the utilitarian programmes of positivists and proponents of eugenics such as Karl Pearson.

[1903]; cf. RLT 112 [1898]). True, it is possible to qualify this blatant contradiction by introducing a clearer distinction between inquiry and science, in which the latter is taken to mean "institutionalized inquiry"; but the fact remains that Peirce comes close to shedding one of the most attractive features of his early account of science in his zeal to defend the purity of theory, as the belief-doubt model apparently now only pertains to pre-scientific inquiry and not to science in a more delimited sense of the term. Discontinuity between theory and practice replaces the continuum of habit, belief, and knowledge.

Such a major break in continuity can be taken as a sign that something is amiss, either in Peirce's account or in our understanding of it, as he identifies *synechism* – "the doctrine that all that exists is continuous" (CP 1.172 [c. 1897]) – as the "keystone" of his system (CP 8.257 [1902]). He also characterizes the synechist principle as "a regulative principle of logic, prescribing what sort of hypothesis is fit to be entertained and examined" (CP 6.173 [1902]). Thus, a postulation of a discontinuity, like the one we seem to have at our hands, would fly in the face of one of the major guiding ideas of Peirce's thought.

Some commentators (e.g., Colapietro, 2006) have argued that Peirce is not really imposing a strict partition of theory and practice; rather, theory should be construed as one kind of practice. Peirce certainly suggests as much when he states that "inquiry is only a particular kind of conduct" (MS 602:8). Then again, pure theory (or science) seems to function on an entirely different level than inquiry in the broad sense. Perhaps the doubt-belief model should be viewed merely as an attempt to explain how inquiry may have originated from everyday coping; but the end-product, heuretic science, should be seen as something that transcends its humble origins by not any longer being concerned with beliefs and habits as guides of action in weighty matters of ordinary life, but rather with theories that can be easily discarded.

> pure science has nothing at all to do with *action*. The propositions it accepts, it merely writes in the list of premisses it proposes to use. Nothing is *vital* for science; nothing can be. Its accepted propositions, therefore, are but opinions at most; and the whole list is provisional. The scientific man is not in the least wedded to his conclusions. He risks nothing upon them. He stands ready to abandon one or all as soon as experience opposes them. RLT 112 [1898]

Here, Peirce makes a distinction between two degrees of belief; "full belief" denotes the readiness to act according to a proposition (of which we need not have a clear conception) in vitally important circumstances, while "opinion" refers to a readiness to act in a similar way only in relatively inconsequential situations (RLT 112 [1898]). If we form or adopt a belief in practical life, it entails that we are really prepared to act in certain way in a possible situation. The proposition practically believed possesses a degree of vital relevance or meaning; we cannot simply *choose* to change our living beliefs. Consequently, Peirce claims that the scientist's hypotheses and propositions are not beliefs in the strictest sense of the word. However, all beliefs – practical and theoretical alike – can be said to involve expectation and thus a reference to the future (Potter, 1996, p. 73).

What Peirce puts forward is a *segregationist* viewpoint, according to which "Theory" (i.e., primarily heuretic science) and "Practice" (i.e., tradition, morality, and sentiment) ought to be kept separate and not be allowed to intrude on each other's turfs.[7] Remarkably enough, it is philosophy that Peirce most stringently wishes to disengage from the sphere of Practice. Defining himself as an "Aristotelian" and a "scientific man", he denounces "the Hellenic tendency to mingle Philosophy and Practice" (RLT 107 [1898]). Again, such comments can appear almost anti-pragmatistic; but as in the case of science in general, Peirce has two reasons for proposing a partition of this kind. On the one hand, he wants to keep philosophy free from external demands. As a student of "useless things", the philosopher should be free to entertain hypotheses that may violate existing moral norms and not be expected to prove the utility of his or her activity by producing applications. The utilitarian standpoint is rejected because it reduces science to technology and philosophy to ideology (Potter, 1996, p. 68). On the other hand, Peirce adopts an explicitly conservative stance as he argues that traditions, sentiments, and habits of instinctive reflection ought not to be directly affected by ethical and logical speculation. In "philosophy, touching as it does upon matters which are, and ought to be, sacred to us, the investigator who does not stand aloof from all intent to make practical applications, will not only obstruct the advance of the

[7] Obviously, these categories are broad and rather vaguely defined. At times, Peirce – with notable lack of scientific precision – treats "science" and "theory" as equivalent, while mostly making a basic distinction between theoretical and practical science. In a more detailed study, these concepts ought to be methodically scrutinized and sorted out; but for the modest aims we are pursuing here, it suffices to indicate the "modes of life" as "Theory" and "Practice" (with capital "T" and "P"), and to employ "theoretical science" and "practical science" when referring to the disciplinary division. The ambiguity of Peirce's basic conceptual apparatus is, I believe, a reflection of some inherent tensions in his views, especially as these are put forward in the 1898 lectures.

pure science, but what is infinitely worse, he will endanger his own moral integrity and that of his readers" (RLT 107 [1898]). Peirce is quite prepared to exclude those who do not agree with this point of view from the sphere of scientific philosophy.

> No doubt a large proportion of those who now busy themselves with philosophy will lose all interest in it as soon as it is forbidden to look upon it as susceptible of practical applications. We who continue to pursue the theory must bid *adieu* to them. But so we must in any department of pure science. CP 1.645 [1898]

Consequently, it would appear that the upshot of Peirce's account of Theory and Practice is a purified idea of philosophy. In order to be scientific, philosophical inquiry should ignore all questions of practical applicability and usefulness. Its function is not to reform conditions of life, but to contribute to science in the narrower sense of Theory. True philosophy must be "purely intellectual" and not attempt to cover "every department of man's nature"; it is, as Peirce puts it, an "abstract" and "passionless" pursuit (CP 5.537 [c. 1905-8]).

4. The vitality of application

As Peirce readily admits, the distinction between Theory and Practice he postulates leads to a rather abstruse and arid conception of philosophy (CP 5.537 [c. 1905-8]). However, there may again be some polemical overstatement involved;[8] at times, Peirce's defence of intellectualism runs the risk of losing sight of curiosity, interest, and imagination as vital (*sic*) facets of science. Indeed, his insistence that philosophical investigation ought to be "passionless" would, were it taken literally, entail the elimination of the very spirit of inquiry, which Peirce repeatedly and emphatically identifies with an unfaltering *desire* to know and learn – this *passion* purportedly being the *only* thing that is absolutely indispensable for genuine research (CP 6.428 [1893]; MS 860:2 [c. 1896]; MS 326:6; MS 693:48 [1904]). This, as we soon shall see, is not the only problem with placing philosophy plainly

[8] Peirce's characterization of scientific philosophy as "abstruse, arid, and abstract" is a reaction to F. C. S. Schiller's humanistic programme. Curiously, however, Peirce's attitude toward this particularly verbose variant of pragmatism is rather ambivalent. At times, he seems to dismiss it as an unsophisticated spin-off; but in other contexts, Peirce indicates that Schiller's pragmatism is actually closer to his own *pragmaticism* than any other variant of pragmatistic thought (except perhaps that of Josiah Royce). The reason for this *prima facie* perplexing association is, I believe, Schiller's explicit recognition of the purposive/teleological aspect of pragmatism, and of its anthropomorphic implications.

in the Theory box; but before considering some internal qualifications to Peirce's viewpoint, it is important to stress that the emphasis on the intellectual character of philosophical inquiry does not, as such, commit Peirce to scientistic *rationalism*. Theory is not privileged in the sense of covering all aspects of reality (cf. Colapietro, 1998). From a certain point of view, Theory is actually of less weight than other forms of life; although decisively dependent on mundane inquiry, human beings could live without pure science. Its accepted propositions can be abandoned without thereby causing irrevocable problems for everyday conduct. Peirce is arguably an *anti-theoreticist* in this particular sense, for he does not hold "the position that the strictly theoretical provides the most adequate, least distorted, representation of reality attainable by human beings" (Colapietro, 2006, p. 25).

At least a part of Peirce's criticism of mixing philosophy and Practice should be understood as a reminder of the limitations of reasoning. While there is no point in postulating artificial limits to human imagination and speculation – which would be like introducing a legal ban on jumping over the moon (cf. CP 5.536 [c. 1905]) – human beings are nonetheless fallible reasoners who necessarily rely on uncriticized habits in their daily conduct. Such commonsense habits of feeling, action, and thought will appear to be practically infallible to the individuals who live their life without doubting their satisfactoriness. Obviously, we often use our intelligence when confronted with practical problems in everyday life; but it does not require an expressly developed theory of reasoning. Peirce claims that human beings possess what he (following medieval philosophers) calls *logica utens*, a kind of habitual "logic in use" or a rudimentary logical theory (see, e.g., RLT 109 [1898]; CP 2.186 [c. 1902]; PPM 212 [1903]). He argues that many "of our reasonings are [...] performed instinctively", and adds that he would never "recommend that such modes of action be given up in favor of theoretical procedures, except to compare theory with practice or for some other peculiar and quite theoretical purpose" (MS 693:20 [1904]). In most cases, we manage nicely without being fully aware of the logic we employ; in fact, it is on the whole wiser to rely on the *logica utens* that manifests itself as mechanical inferences and "gut feelings" than to try to reflect profoundly on everyday problems.[9]

[9] Peirce argues that the more important – or "vital" – such problems are, the less room there is for deliberate reasoning. This feels a bit simplistic, and should perhaps be taken with a grain of salt. No doubt, some "vital crises" are best handled "instinctively"; but there are obviously also major practical decisions that can benefit from reasoning. Of course, the time

> Most men are incapable of strong control over their minds. Their thoughts are such as instinct, habit, association suggest, mainly. Their criticism of their thoughts is confined to reconsideration and to asking themselves whether their ideas seem reasonable. I do not call this reasoning: I call it instinctive reflexion. For most purposes it is the best way to think; for instinct blunders far less than reason. Reasoners are in danger of falling into sophistry and pedantry. Our instinctive ways of thinking have become adapted to ordinary practical life, just as the rest of our physiology has become adapted to our environment. Wisdom lies in nicely discriminating the occasions for reasoning and the occasions for going by instinct. CP 7.606 [1903]

If anything, Peirce privileges the "instinctive" groundwork of sentimental habit, for he argues that it embodies "the traditional wisdom of ages of experience";[10] indeed, he maintains that it is not even prudent to reason about such matters, "except in a purely speculative way" (CP 1.50 [c. 1896]). According to the "sentimentalism" advocated by Peirce, reasoning is actually a comparatively superficial faculty, unable to provide ultimate foundations for conduct; human reason "appeals to sentiment in the last resort" (RLT 111 [1898]). Arguably, it is not through deliberate reasoning that we discover "the most vital factors in the method of modern science" (CP 7.87 [1902]); they are encountered or experienced in the more immediate and practical field of sentiment.

Paradoxically, theoretical reflection on the Theory-Practice relationship ends up showing that philosophical inquiry is not strictly speaking autonomous, but dependent on the virtually instinctive groundwork of sentimental habit, which is not directly affected by reasoning. Yet, this relative inscrutability does not mean that this experiential underpinning would be completely indistinct and unknowable. In the early article 'The Doctrine of Chances' (1878), Peirce identifies "three sentiments, namely, interest in an indefinite community, recognition of the possibility of this interest being made supreme, and hope in the unlimited continuance of intellectual activity, as indispensable requirements of logic" (W 3:285). He adds that it is not odd that we should find social sentiment presupposed in reason-

to reason may be limited in such a situation; but that only highlights the need to cultivate adequate habits of sign use, in preparation for what may come.

[10] Peirce's use of "instinct" tends to be broader than the contemporary acceptation. Here, the concept primarily denotes something that is not governed by conscious reasoning. Consequently, the sphere of instinct can encompass natural dispositions as well as certain acquired sentiments – and perhaps even less constant habits of tradition. Again, as the lines between various types of habit are not definite, it is safest to treat the "instinctive" as a matter of degree.

ing, since logic (or semeiotic) depends on a struggle to escape doubt, terminating in the formation of habits of action but beginning in emotion. The method of science is adopted because other methods of fixating belief – tenacity, reliance on authority, the a priori method – fail on account of "the social impulse" (W 3:285). If anything is taken as a primitive or given in Peirce's account, it is this impulse or sentiment that is intrinsically connected to the desire to learn. Thus, this sentimentalist viewpoint corroborates the claim that sociality and ethicality are intrinsically linked in Peirce's account of scientific inquiry. Consequently, it would appear that the postulated chasm between Theory and Practice, or between scientific reason and moral sentiment, is not as absolute as it might appear on first encounter.

Yet, there is something troubling in the way Peirce tends to separate Theory from Practice and philosophy from application in his defence of pure science and sentimentalism. According to the pragmatism that he adjusts but never abandons, the meanings of concepts and propositions cannot be properly understood without reference to their conceivable practical consequences. Moreover, he notes that "practical considerations enter into scientific reasonings, unavoidably" (NEM 3:874 [1909]). These contentions seem to fit poorly with the autonomy of science that Peirce advocates. In fact, they do indicate certain limits to the ideal freedom of scientific inquiry. In a pragmatistic spirit, Peirce maintains that acceptable theoretical conceptions must have at least *some* connection to actual or possible practice; it is the basis of their testability, their communal validity. In other words, the claims must in some sense be open for public trial, although their truth is not dependent on any set of *actual* tests. Moreover, science typically gives rise to new possibilities for experimentation; "although heuretic scientists look upon their work as purely theoretical, and many of them feel a utilitarian application, even of the highest kind, is comparatively lacking in the sacredness of pure science, they are nevertheless particularly given to thinking of their results as affording conditions for new experiments, if not in the narrower, then in the broader sense of the term,[11] although they may have the vaguest possible notions of what those experiments may be" (EP 2:372 [c. 1906]). Even though science, unlike food and shelter, is not strictly a necessity of life, it is nonetheless the prime means by which human beings can deliberately develop their cognitive capabilities. The fact

[11] Peirce specifies the "broader sense of experiment" as "any observation made to test the hypothesis", and opposes it to the narrower sense, in which "special conditions of experience are purposely created" (EP 2:372 [c. 1906]).

that theoretical claims are always idealizations without exact correspondents in the practical world does not render them useless.

> Of course, no proposition of theoretical science is true in practice. In other words it is only true of an ideal world that differs from the actual world. What of that? It is the only way to attain any kind of mastery of the real world. NEM 3:833 [1905]

Peirce's seemingly contradictory statements concerning the relevance of practical considerations and implications can be partly reconciled. Vincent Colapietro (1998, p. 248) identifies two principal acceptations of "the practical" in Peirce's writings. In the narrowest sense, "practical" refers to a restricted interest in immediate satisfaction; but Peirce also defines the term as "apt to affect conduct", adding that conduct is "voluntary action that is self-controlled, i.e. controlled by adequate deliberation" (CP 8.322 [1906]).[12] Philosophy and Theory should be severed from practical concerns in the first sense, but theory (with a small "t") cannot be wholly isolated from conduct in the second pragmatistic meaning. In this more substantial acceptation, science can be said to depend on practice, for the ultimate meaning of its concepts and propositions must involve some reference to possible practical consequences;[13] as Peirce notes, "regarding a truth as purely theoretical does not prevent its being regarded as a possible determinant of conduct" (EP 2:372 [c. 1906]).

Yet, even if we accept this relatively charitable reading, at least two points of contention remain. First, it is questionable whether a philosopher can truly adopt the stance of scientific disinterest, in which practical belief allegedly plays little or no role, and still be able to practise philosophy in the Peircean sense. The philosophical inquirer is purportedly engaged in a general examination of common interpretative experience or facts of everyday life (see, e.g., CP 3.428 [1896]; CP 7.527; PPM 151 [1903]), and it would thus seem that practical belief is not only an object of research but also a necessary testing ground for any theoretical hypothesis that a philosopher might conjure up (cf. CP 2.333 [c. 1895]). At the very least, it seems prudent to keep in mind that unguided speculation in philosophy easily can turn

12 To the two senses identified by Colapietro, we could add the previously noted acceptation of "the practical" as a sphere of life – Practice – distinguishable from Theory.

13 Obviously, many contemporary sciences deal with concepts that would appear to have little or no connection to actual or possible experience; but if Peirce is right, there must be at least an indirect link to some such pragmatic dimension or else the terms used and propositions put forth by scientists are meaningless. Even in science, human beings cannot fully transcend their experience (cf. CP 5.536 [c. 1905]).

into a fabrication of paper doubts. Arguably, philosophy needs a twofold anchor in experience and belief if it is to produce something more than intellectual play.

Secondly, and perhaps more controversially, I would argue that that Peirce overstates his case when he wishes to separate theoretical philosophy from application. Although philosophers are theorists *par excellence*, in the sense that their primary "laboratory" is the world of ideas, it is worth emphasizing that Peirce maintains that such efforts constitute the only way to attain some command of the world of experience (NEM 3:833 [1905]) – which also involves an implied reference to the limited but real capacity to exercise control of our habits by means of imaginative, diagrammatic experiments (in both mundane everyday self-governance and higher-level ideal projections of future selves and communities). This already suggests that his conception of philosophy is not quite as strictly separated from application as he lets on – not, at least, if applicability is understood broadly enough. Ultimately, philosophy is not pursued for the benefit of speculation or aesthetic amusement as such, but with the aim of improving habits.[14] This does not turn the Peircean agenda into a utilitarian approach, for the ideal of a perfect habit, as something that would function without glitches and never give reason for doubt, is not incompatible with the idea that science pursues truth (see, in particular, EP 2:336 [1905]). To some extent, it does bring the notion of "truth for truth's sake" down to the level of practice, but arguably without thereby denigrating theoretical science, diminishing the value of the fundamental desire for truth, or inexorably infringing on the reasonable autonomy of Theory.

However, the separation between philosophy and application needs to be further qualified, if not partly reconsidered. While it is certainly plausible and imperative to maintain that philosophy ought not to be concerned with the satisfaction of immediate interests, this does not mean that it should drop all considerations of applicability from purview in the devel-

[14] This claim seems to conflict with the views of some Peirce scholars. For example, Vincent Potter (1996) argues that action "through thought is only the upshot of inquiry; it is neither its purpose nor its legitimate motive" (p. 74). However, although it is true that Peirce emphatically denies that pragmatism makes "Doing to be the Be-all and the End-all of life" (EP 2:341 [1905]), he is simply criticizing the notion that singular deeds or actual collections of actions could be viewed as exhaustive of the meanings of thoughts and symbols. Peirce reserves this status for rationally and purposefully developed habits of action. In this sense, continuously successful action *is* the purpose and motive of inquiry; but so are "finding truth" and the growth of reasonableness. From the point of view of habit, they are but two sides of the same coin.

opment of theoretical conceptions. The dictum that philosophers should be forbidden to even consider their work as susceptible to practical application is too austere; if it does not completely block certain paths of inquiry, the directive can *a priori* discourage imaginative reflection that may be crucial for the purposeful direction of research.[15] Peirce is certainly aware of this danger, as he shows in the following reflections on the applicability of logic:

> a theory cannot be sound unless it be susceptible of applications, immediate or remote, whether it be good economy so to apply it or not. This is perhaps no more true of logic than of other theories; simply because it is perfectly true of all. [...] It might be that a normative science, in view of the economies of the case, should be quite useless for any practical application. Still, whatever fact had no bearing upon a conceivable application to practice would be entirely impertinent to such a science. It would be easy enough – much too easy – to marshal a goodly squadron of treatises on logic, each of them swelled out with matter foreign to any conceivable applicability until, like a corpulent man, it can no longer see on what it is standing, and the reader loses all clear view of the true problems of the science. CP 2.7 [c. 1902]

"Logic" (whether understood more narrowly as formal logic or more broadly as semeiotic) is undeniably the backbone of Peirce's philosophical edifice; consequently, it seems plausible to take the quotation above as a strong argument for the contention that Peircean philosophy should not be absolutely severed from application. Again, this does not mean the surrender of Theory to the domination of short-term utility and satisfaction. What is needed is a significant but not absolute distinction between *actual* application and *conceivable* application – not a division between pure philosophy, which floats in the clouds of Theory, and utilitarian application, isolated to the worldly sphere of Practice. While Peirce at times argues too straightforwardly for the view that the settlement of opinion would be the sole aim of inquiry and sometimes conversely overstates the case for pure science, a plausible elucidation of his approach to philosophy should

[15] The material conditions under which science, as an actual mode of conduct, must function are not only limitations posed on inquiry; they can also serve as guides in the endeavour. While a scientist is in principle free to entertain any proposition he or she likes, it is rational to try such hypotheses that could be credibly proven true or falsified within a reasonable timeframe, given certain initial conditions and plausible expectations of the future. Although it is not possible to discuss these issues in detail here, we may note that Peirce even develops a theory of such factors under the name "the economics of research" (W 4:72-78 [1879]; RLT 178 [1898]; CP 5.600 [1903]).

arguably lead to a balanced and nuanced conception of the relationship between Theory, Practice, and application.

5. Some theoretical and practical implications

If the programmatic compromise proposed in this article is viable, it should, according to its own rationale, have conceivable upshots for the complex theoretical practice we call "philosophy". That is, having come thus far, we should ask the naive but sobering pragmatist question: "What difference does it make?" More specifically, one may wonder whether deliberation on "conceivable application" truly can – or should –affect the future pursuit of Peircean philosophy in any consequential way. In spite of the vagueness of the proposal sketched, I believe this to be all but unavoidable; and I will therefore conclude this article by briefly suggesting two potential implications of taking application seriously for our understanding and use of Peircean thought.

On a relatively pure theoretical level, consideration of conceivable application supports the idea (briefly referred to above) that a pragmatistic attitude in philosophy serves as a useful – perhaps even necessary – curb on the tendency toward excessive abstraction. At first blush, such a claim may feel rather un-Peircean; for surely, Peirce is a resolute proponent of formal and exact methods in philosophy, and a well-known defender of abstract thought and real generality against the particularistic worldviews of materialism and nominalism. This is all true, but it should be balanced by Peirce's warning against inflated formalism, in which logic is turned into a "mathematical recreation" (W 4:421 [1883]). Keeping in mind that logical science in the broad sense is equivalent to semeiotic – and that philosophy is meant to be a study of familiar *experience*, and hence distinct from pure mathematics – we may identify a part of Peircean philosophical inquiry that is arguably particularly susceptible to such over-abstraction: the classification of signs.

By this, I do not mean to disqualify the grammatical pursuit of systematic classification; unquestionably, the methodical ordering of sign classes is a key part of Peirce's sign-theoretical pursuit, as it delves into ever-finer distinctions grounded in his relational theory of categories. However, there is also a slightly disconcerting aspect to the endeavour, which has perhaps not received sufficient attention. Namely, Peirce's suggestion that we should set out from a *purely* mathematical or formal conception of semiotic relations – something from which "all accidents of experience, however universal, must be excluded" (EP 2:389 [1906]) – in effect leads to a division of semeiotic into an *a priori* phase, preoccupied with the "phaneroscopic"[16] scrutiny of purely possible sign classes, and a secondary *a posteriori* phase of checking whether the theoretical entities so obtained actually happen to correspond to anything in the reality where signs are used (EP 2:289 [1903]). This seems to work smoothly enough as long as the basic elements of the examination are limited to sign, object, and interpretant (as in the 1903 *Syllabus*), but the whole approach begins to look more dubious as Peirce's semeiotic develops and the number of components to be taken into account increases. Arguably, semiotic experience forces us to recognize different kinds of objects and interpretants; and the latter in particular, understood as semiotic effects in a broad sense, have a tendency to proliferate in a way that renders the orderly formal classification of the earlier semeiotic either insufficient or infeasible. To put it very simply, strictly formal considerations do not provide any rule for definitely determining the number of theoretically and practically relevant semiotic effects.[17] Although the question of how many interpretants Peircean sign theory truly necessitates continues to be debated (see, e.g., Lalor, 1997; Liszka, 1990; Short, 1996), any figure higher than three would turn the pursuit of comprehensive classification into a virtually endless glass-bead game.[18]

In semeiotic, the question of what constitutes a pragmatically meaningful class of sign – in distinction from a purely formal possibility – will

[16] In this context, *phaneroscopy* (or *phenomenology*) is restricted to a study of the formal facets of the "phaneron", or "the collective total of all that is in any way or in any sense present to the mind, quite regardless of whether it corresponds to any real thing or not" (CP 1.284 [1905]).

[17] From a strictly relational point of view, there is actually no end to the pursuit of triadic classification; by repeatedly applying the categoreal scheme, we can in theory keep going as long as our heads do not explode, identifying relations between relations, and introducing ever more subtle trichotomies. Peircean analysts may have to fight the "triadomanic" temptation to distinguish a further 1st, 2nd, and 3rd of any x (such as of a branch of science, or of a class of sign); sometimes, the relevant question is not whether a further logical division is possible, but rather when and why one should stop analyzing.

[18] A theory with two objects and three interpretants gives us 3^{10} or 59 049 "difficult questions to carefully consider" (CP 8.343 [1908]). With orders of determination and dependence taken into account, this purportedly leads to the 66-class arrangement of sign types (see SS 160–6, for Irwin Lieb's version of how this is achieved; but cf. Sanders, 1970). With more objects and interpretants, one would (1) need to settle which trichotomies are relevant for the classification at hand, and (2) decide on principles for the order of semiotic determination and dependence (possibly taking multiple dimensions into account) – or else be faced with 3^t "difficult questions" (where "t" indicates number of trichotomies). The full classification would, unless constrained by extra-formal considerations, almost certainly be unwieldy (swelling like a "corpulent man" that cannot see the ground on which he is standing, to use Peirce's metaphor).

almost inevitably arise at some point; and that takes us back to potential experience and possible application in a more concrete sense. That is, the question of what the use of the proposed classificatory scheme is or might be will inescapably crop up; and to a large extent, this turns out to be a rhetorical or methodeutic matter, for grammatical sign classifications should be expected to cast light on issues of scientific inquiry, cognition, and communication. This is not merely a secondary stage of deriving scientific applications from theory, for such comparatively practical considerations help guide theoretical development itself, suggesting directions and hopefully a reasonable economy of research efforts; accordingly, they can be said to function analogously to self-control in Peircean ethics. Without such constraint – which, however, never should be allowed to form an absolute block on the path of inquiry – classification according to Peircean principles may turn out to be an elegant arrangement of lifeless elements, which could be dismissed using Peirce's own stinging assessment of Ernst Schröder's algebra: "it has too much formalism [...] too many bushels of chaff *per* grain of wheat" (CP 3.451 [1896]).[19]

Lest I be misunderstood, I wish to repeat that this does not entail vulgar, satisfaction-focused pragmatism or utilitarianism; the pragmaticist consideration of practical consequences and applications in question is primarily theoretical. But this deliberation does caution against excessive formalism in philosophy, a danger to which Peirce himself draws our attention as he notes that the failure of many philosophers has been caused by their tendency to ape mathematics, "crudely mimicking its externals" (NEM 4:228 [1905-6]). While Peirce asserts that philosophers certainly have much to learn from more successful sciences, especially the natural sciences and mathematics, and notes that all sciences have a mathematical aspect inasmuch they involve hypothetical and diagrammatic reasoning, he also emphatically defends the distinctiveness of philosophical investigation as a general study of everyday experience.[20] Therefore, the argument sketched here does not deny the significance of formalist approaches in philosophy; it is simply a reminder that such strategies do not by themselves suffice to cover the philosophical field. And this qualification should always be balanced with an emphatic warning of the dangers of attempts to reduce

[19] See Bergman (2009) for a more detailed discussion of formalism in the context of Peirce's semeiotic.

[20] In a sense, the mathematical facet is the domain of free play of imagination, with the experiential aspect providing a needed dose of "brute fact" in addition to raw materials for the imagining.

philosophy to a mere instrument of special science ("physical" and "psychical" alike), practical science, technology, politics, or combative rhetoric.

In view of this Peircean recognition of the status of philosophical study as a sovereign mode of inquiry, my final contention may seem doomed; for I want to suggest that the consideration of application (in the sense sketched above) is connected to a *melioristic* aspect of Peirce's conception of philosophy. This proposal can undoubtedly feel inappropriate in view of his strong condemnation of his "Hellenic tendency" to mix Theory and Practice; but if construed sufficiently generally, meliorism is arguably a key element of his project. It is, in fact, more than implied by his mature rendering of esthetics, ethics, and logic as the normative core of philosophy; for normativity can, in this context, be conceptualized in terms of the improvement of habits of feeling, action, and thought. From this point of view, we do not simply pursue philosophy in order to understand and describe what *is* there (in us and in the world, to use a somewhat un-pragmatistic dichotomy), but also in order to imaginatively transform and develop personal and communal habits of thought, communication, action, feeling, etc. This is a *vital* matter, for as Peirce puts it, "continual amelioration of our own habits [...] is the only alternative to a continual deterioration of them" (MS 674:1 [c. 1911]). Possibly, at least, one of the key functions of normative philosophy is to aid human beings in this task. This does not entail that philosophers must be able to identify and enumerate the utilitarian value of their activities, not even in the long run; but it arguably indicates that the creative employment Peircean ideas in more concrete fields of inquiry – and possibly even in "real" life – may not be quite as preposterously misguided as one might think in light of the 1898 lectures. And to the extent that such "applications" produce new occasions for experience, they ought to be considered as significant feedback for the theoretical endeavour. Consequently, one could argue that Peirce's philosophical project is, in this particular sense, inherently entrenched in Practice as well as in Theory, without thereby denying the value of the divisions of intellectual labour that he emphasizes.

References

Bergman, M. (2009). *Peirce's Philosophy of Communication*. London: Continuum.

Colapietro, V. M. (1998). "Transforming Philosophy into a Science: A Debilitating Chimera or a Realizable Desideratum?" *American Catholic Philosophical Quarterly*, LXXII(2), 245–278.

Colapietro, V. M. (2006). "Practice, Agency, & Solidarity: An Orthogonal Reading of Classical Pragmatism." *International Journal for Dialogical Science*, 1(1), 23–31.

Haack, S. (1983). "Descartes, Peirce and the Cognitive Community." In E. Freeman (Ed.), *The Relevance of Charles Peirce* (pp. 238-263). La Salle: The Monist Library of Philosophy.

Lalor, B. J. (1997). "The Classification of Peirce's Interpretants." *Semiotica*, 114(1/4), 31–40.

Liszka, J. J. (1990). "Peirce's Interpretant." *Transactions of the Charles S. Peirce Society*, XXVI(1), 17-62.

Niklas, U. (1988). "On the Practical and the Theoretical in Charles S. Peirce." *VS*, 49, 31–38.

Potter, V. G. (1996). *Peirce's Philosophical Perspectives.* New York: Fordham University Press.

Sanders, G. (1970). "Peirce's Sixty-six Signs?" *Transactions of the Charles S. Peirce Society*, VI(1), 3–16.

Short, T. L. (1996). "Interpreting Peirce's Interpretant: A Response to Lalor, Liszka, and Meyers." *Transactions of the Charles S. Peirce Society*, XXXII(4), 488–541.

The Function of Error in Knowledge and Meaning: Peirce, Apel, Davidson

Elizabeth F. Cooke
Creighton University

1. Introduction

What does it mean to recognize the possibility of error in one's beliefs? This question is central to epistemology from Descartes' skepticism to Peirce's fallibilism, and, more recently, Donald Davidson's holism. This paper considers the question of error in Peirce's fallibilism, in contrast to Karl-Otto Apel's transcendental semiotics, on the one hand, and Davidson's principle of charity and triangulation, on the other. Apel argues reasonably that Peirce's long run is a necessary condition for meaning. But his view is insufficiently open to error in the short run. Such openness to error, however, helps to make sense of our commitment to truth in the long run. Davidson's theory of meaning and knowledge, by contrast, seems to run more parallel to Peirce's since both maintain central roles for error in the short run. Yet, in contrast to Davidson's view, Peirce's account of error actually does more work because it maintains fallibilism as both a philosophical position and a second-order belief of the inquirer. Here, despite very different epistemological positions, Peirce actually shares something important with Descartes' method. Both Peirce and Descartes hold that individuals can and should reflect on their beliefs from several different points of view. Such points of view include the first person point of view (i.e., the point of view of the inquirer), and the detached, third person observer point of view. The dialectic between these two points of view leads Descartes to skepticism, and Peirce to fallibilism, and this dialectic in Peirce's fallibilism has significant advantages over Davidson's analysis of error in inquiry.

2. Apel

According to Apel, the long run functions as a necessary presupposition of meaningful discourse. This normative theory of meaning (which includes the long run theory of truth, the pragmatic maxim, triadic semiotics, and the unlimited communication community) serves as the infallible condition for the possibility of all further fallible science and metaphysics (Apel, 1995, p. 388). Apel seeks to make explicit those performative presuppositions of our speech acts (following Jaakko Hintikka). We necessarily presuppose that the truth of the claim we utter will be settled in the long run. And, as Apel explains, "we cannot in fact suppose, as many claim we can, that even these presuppositions are fallible metaphysical hypotheses, for that would mean that it would be possible to falsify them by simultaneously presupposing them" (Apel, 1995, p. 388).

Now, I think Apel is mistaken in insisting that necessary presuppositions must also be infallible, simply because we cannot falsify or revise them while simultaneously presupposing them. Peirce himself took mathematical claims to be both necessary and fallible, which suggests that the necessary claims we make still do not achieve epistemic certainty. But the problem with Apel's view is not simply that he does not see how thoroughgoing Peirce's fallibilism is (and that it would apply to necessary arguments as well). A further problem is that Apel's infallibilism, when it comes to the conditions for meaning, actually makes other empirical and fallible claims impossible (from the point of view of the speaker). To remedy this, we should consider pushing Apel's view to include fallibilism (see Cooke, 2006, p. 126).

Apel argues that we must presuppose consensus by the unlimited communication community in the long run regarding any truth claim we utter; but implicit in this presupposition is also the presupposition of fallibilism in the short run, i.e., that we could be wrong until the final state of inquiry is reached. While Apel may be correct that an assertion or belief presupposes my assenting to its truth, if that commitment to its truth is a *Peircean* truth, i.e., truth in the long run, then I must be open to its revision in the short run. On Apel's reading, my assertion "I believe *p*" turns into "I believe *p* would be agreed upon in the long run." I want to add to that truth claim the phrase "but I could be wrong," or, "but I'm open to revision." Without such a fallibilist presupposition, Apel's claim is, at best, a form of tenacity, and, at worst, incoherent, since the long run, as a condition for truth and meaning, presupposes many trials and errors prior to any convergence. The very notion of the long run presupposes the possibility of pervasive error in the present. Apel recognizes this connection between a commitment to truth and the possibility of error, but only from the third person/observer point of view. When Apel unpacks the necessary presuppositions of the actual speaker, he leaves out the Peircean speaker who must presuppose *both* a commitment to truth *and* a commitment to the possibility of error in every truth claim she makes.

Now the question arises. How is it possible to claim "I believe that *p*" which, according to our line of reasoning, now presupposes two implicit claims additionally, namely, "I believe that *p* will be agreed to in the long run," and "but I could be wrong"? This will strike many as a logical contradiction. But here I think we can avoid this problem by seeing Peirce's implicit view (evident in his fallibilism) that we should reflect on inquiry and communication from both third and first person points of view (Cooke, 2006, p. 125). From an unreflective first person point of view, I am committed to making this assertion, knowing or hoping or expecting that it will be agreed to in the long run. To believe something is to believe it to be true, and so it is a contradiction to say: "I believe *p*, but I could be wrong." But given Peirce's fallibilism, we must also consider a belief from a third person (observer's) point of view. So, like Descartes, Peirce recognizes that many of our beliefs have been wrong, and the inquirer simply does not know that *now* is not one of those times. Fallibilism is precisely this second-order awareness of one's first-order limitations, which informs our understanding of our own claims from a first person inquirer's point of view. I'm aware on a meta-level that I may not have the full picture. But these third person reflections must make their way back to the first person participant point of view, though, this time, a more reflective one. So, I add, "but I could be wrong." Thus, it is only by looking at our beliefs from one point of view, namely, the *unreflective* first person participant point of view, that fallibilism looks like a contradiction. Peirce, however, did not look at it that way (EP 2:353).

Here I follow T. L. Short who has in "Fallibilism is Omega-inconsistent" argued that fallibilism is not the contradictory position it seems to be and that the apparent contradiction is due to looking at beliefs in too formal a way. It depends on an "artificial ideal of a 'system of beliefs' – one in which there is the same rigid exclusion of meta-theoretical reflections as there is in a formal system. But belief is not like that. A fallibilist's meta-theoretical ruminations enter into his beliefs, producing an uncomfortable new one, that he is being inconsistent" (Short, 2006, p. 300). Short says that "what counts as belief is relative to the circumstances in which we are called upon to act" (Short, 2006, p. 300).

Considering our claims from both first person and third person points of view will affect the way we come to see our beliefs. In fact, for pragmatists, perhaps it is best that we think of our beliefs more on the model of questions. Beliefs are like questions since to ask a question is to presuppose that there is an answer and that some future responder will contribute toward settling the final opinion on the matter. In fact, in some places Peirce suggests that a question is a judgment with a low modality.[1] A question is a commitment to the truth of the matter regarding that issue – but also openness to several possibilities. Similarly a meaningful belief presupposes (à la Apel) the possibility of a settled opinion, as well as openness to revision.

3. Davidson

In this respect, Peirce's view of fallibilism in the short run resembles Davidson's view of belief and meaning more than Apel's view. Of course, for Davidson radical interpretation is the starting point, while for Peirce inquiry is the starting point. Yet, both seem to share common ground in their views of fallibilism, holding that although one can be wrong about *any of one's beliefs*, one cannot doubt all of one's beliefs at once, as the skeptic claims.

Despite this agreement, however, when it comes to fallibilism, Davidson and Peirce have quite different approaches to the skeptic. As L. S. Carrier argues, when Davidson rejects the possibility of massive error, he cannot mean that massive error is *logically* impossible, but only that it is *epistemologically* impossible, i.e., incompatible with what we already know (Carrier, 1993, p. 406). Carrier further points out that Davidson's argument falls short of demonstrating anything more than that there is a performative necessity of accepting most of one's beliefs as true. But the skeptic could accept that much, while still insisting that none of this proves we have knowledge (rather than mere belief) (Carrier, 1993, p. 407).

Similarly, Bruce Vermazen considers that Davidson may succeed in showing that one cannot interpret another's beliefs as largely false. But then Vermazen further considers someone who simply reflects on past mistakes throughout history. For this person, says Vermazen, "massive error can be imagined without attributing to the speaker a preponderance of

[1] Peirce (CP 4.57 [1893]). Other passages suggest that Peirce thought of questions as rational contrivances expressing a need (CP 3.514 [1897]).

general beliefs the interpreter *holds* false; what is needed is a preponderance of general beliefs *actually* false, an independent quantity to be made up from those held false and those (necessarily unidentified) held true but actually false" (Vermazen, 1983, p. 72). Here Vermazen describes the difference between Davidson's radical interpreter, for whom massive error is impossible, and what we may take to be Peirce's fallibilist for whom massive error is imaginable from a certain detached point of view.

Drawing on Vermazen's point, what Peirce's fallibilism has, that Davidson's lacks, is a strong distinction between belief and reality. On the level of meaning, Peirce rejects the skeptic's position because it amounts to holding an incognizable – a known unknowable – which is self-referentially incoherent. But Peirce's fallibilism takes seriously the possibility of massive error from just this historical, third person (contextualized) point of view, which Vermazen describes. In fact, one of the reasons that Peirce rejects the possibility of a faculty of intuition is just this sort of reflection on the history of error, recognizing that often people have thought their views indubitable and then found them to be false (W 2:195), even within mathematics (EP 2:49). Peirce shares this much with Descartes' skepticism in the *Meditations*, and Peirce like Descartes holds that one can take a third person reflective perspective on one's beliefs, which can and should inform one's beliefs. This is not to say that Peirce's account of inquiry takes only first and third person points of view as relevant; there is an important role to play for both first person plural as well as second person points of view as well. These different points of view that an individual can take regarding her own beliefs are a result of interacting with and within a community.[2]

As a result of these multiple points of view, Peirce's fallibilism functions differently from Davidson's. Fallibilism, for Peirce, is a philosophical position about the conditions of inquiry, but it can also be a second-order belief of an inquirer. And in this latter respect fallibilism has its normative function, as Mark Owen Webb has argued (see Webb, 1999, pp. 86–97). In his discussion of the many attempts and difficulties of articulating fallibilism as a descriptive thesis, Webb argues that fallibilism is best understood, as all epistemic principles should be, as normative, and as "strategies for acquiring information" (Webb, 1999, p. 96). And this function can be found in Peirce's "First Rule of Logic" where he argues that considering the possibility of error from a more third person point of view and remaining open to error can be good for inquiry from a (more reflective) first person point

[2] I am grateful to Vincent Colapietro for discussion on this point.

of view. There Peirce argues that in order to learn we must be dissatisfied with what we already know (EP 2:47–48). In several places, Peirce takes both the reflective third person, as well as the first person point of view of the inquirer. Now, Akeel Bilgrami claims that the first person participant point of view of *actual* inquiry is the only one really available to pragmatists (Bilgrami, 2000). But, for Peirce, the inquirer can also be informed by this third person, more theoretical view of inquiry. And in further contrast to Davidson, Peirce holds that it is not a mere logical possibility that I could be wrong about many of my beliefs; rather it is a real possibility. And reflecting on this point has real pragmatic value, from the perspective of the inquirer, in that it can inform how she conducts inquiry. Knowing she lacks certainty for any of her beliefs, and knowing the history of error in seemingly certain beliefs, both serve important, practical lessons for the inquirer. Indeed, inquiry makes progress especially when we are open to these kinds of mistakes.

Returning now to Davidson, his view is considerably more problematic as a response to skepticism when we consider how this might be reconciled with his triangulation and his account of how the individual forms beliefs. In this latter discussion, Davidson insists that one must have a concept of a belief in order to have a belief, because one must be able to make sense of "getting it wrong" (Davidson, 2001, p. 104). And to do this one must have a sense that his belief is distinct from the way things are (ibid.). As Deborah Soles explains, when a sunflower turns its bloom toward an artificial light source, rather than the sun, it is not proper to call this a mistake. But a child, referring to a cow as a "dog" has made a mistake (Soles, 2004, p. 15). According to Soles, Davidson follows Wittgenstein in holding that one cannot say he knows something if there is no way to go wrong (Soles, 2004, pp. 4–7). *An understanding of the distinction between believing and reality* is a necessary condition for making mistakes. And since belief requires the possibility of error, Davidson turns to triangulation, which, as Kirk Ludwig explains, is used to describe the conditions for the possibility of error (Ludwig, 2003, p. 11). Triangulation refers to the conditions under which most of us learn to communicate about the world, and consequently achieve the normative network required for belief and error. An individual believer speaks with another person, whom she recognizes to be caused by similar stimuli.[3] This form of ostensive learning allows for error when the individual recognizes a disparity between her belief and the belief of an-

[3] See Hans-Johann Glock on Davidson's view of how we learn to distinguish between our beliefs and reality through linguistic interaction (Glock, 2003, pp. 289–90).

other, despite the fact that the other person appears to be caused by common stimuli. These three things – an apparent common causal influence (the world), another person (who helps the individual interpret the cause), and the individual who recognizes the shared causality – are required for the normativity essential to beliefs.

Peirce would, of course, agree with much in Davidson's view of triangulation: especially meaning as social and triadic, and even the view that beliefs require second-order beliefs. This last point is seen in Peirce's account of how a child learns the mind/world distinction through error. Once a child realizes he has made a mistake – i.e., that there is an appearance/reality distinction, the child must suppose a self to which he can attribute the error. Vincent M. Colapietro describes this account in Peirce: "...with the recognition of something private, the awareness of error appears, and error can be explained only be supposing a self that is fallible ..." (Colapietro, 1989, p. 73). The child's experience of the world, as resistant, enables her to have a view of herself *as a self* (or, in Davidson's language, a view of herself as a "believer") – *as distinct from the world* (the object of her beliefs).

But a problem arises for Davidson when it comes to the issue of the normativity of second-order beliefs. For, if beliefs are normative in the way described above, then one would presume that beliefs about beliefs would be normative as well. That is, if there is a way to make a mistake regarding any of my other beliefs, then there must be a way for me to make a mistake regarding my belief about my beliefs. But, at least within the context of triangulation, Davidson does not seem to offer a sufficient discussion of which kind of second-order belief the individual should have, or how one would go about forming a belief about which kind of second-order belief is the best to have. After all, there are many alternative views on just what kind of distinction the belief/reality one is.

Of course, the second-order belief which seems to be at work within triangulation entails the view of a real world as causing believers to have beliefs, and determining their truth or falsity. But the second order belief, which Davidson himself defends, does not seem to favor a strong belief/reality distinction. Consider what might happen if the believer in Davidson's triangulation, accepts as his second-order belief, Davidson's own principle of charity and the rejection of the possibility of massive error. Davidson's own view of the belief/reality distinction, his own second-order belief about beliefs, is that we cannot make sense of such a massive disparity between our beliefs and reality. But if the individual believer were to accept this philosophical view in the context of triangulation, it is not clear that this second-order belief could do the normative work (as a condition for the possibility of error in one's other beliefs) it is supposed to do.

Davidson recognizes the need for a stronger mind/world split from the point of view of the individual believer in his discussion of triangulation, but does not incorporate that into his philosophical position. The question here is whether Davidson's principle of charity is workable at the level of the individual in triangulation. If the individual adopts the view that there cannot be a huge disparity between reality and belief, can she also make sense of the fact that any of her beliefs (by necessity) can be wrong?

Davidson's point about the need for a second-order belief to make sense of error is an important one. And, in fact, we can consider this point to be Peirce's very reason for endorsing the scientific method over the other three methods of fixing belief, namely, its hypothesis of an external permanence that can do the normative work of separating true from false beliefs. Davidson recognizes the indispensable role a second-order belief has for normativity in our other beliefs, but he does not follow through on this idea as Peirce does by articulating and defending the kind of belief/reality distinction we need in the context of triangulation.

4. Conclusion

For both Peirce and Davidson, I realize the possibility of my own error in a community with others. But Peirce's view of second-order beliefs has several advantages. Peirce argues for one second-order belief over and above others, namely, the scientific method which posits an external permanence. In addition to allowing for error, and its ability to explain why doubt irritates, it can also reconcile our understanding of beliefs on both a first person inquirer point of view as well as a philosophical observer point of view. As David Wiggins argues, in Peirce's fixation model, reflecting on the conditions under which I fix belief can bring me to the scientific method and its commitment to truth. Wiggins argues that in Peirce's fixation model, with the move from the *a priori* to the scientific method comes a change in motivation and "the need for this transition incorporates a real elucidatory insight about *truth as a property forced upon us by reflection upon the state of belief*" (Wiggins, 1998, pp. 14–15). Wiggins makes the case that reflecting on one's conditions *as an inquirer* can bring one to *these beliefs about one's beliefs*. The scientific method can attain true beliefs, which are most efficient at satisfying doubt. Wiggins reads Peirce as saying "once you follow through upon the simple object of fixing belief, you will be forced to see yourself as finally committed to the ideas of fact, reality, and truth" (Wiggins, 1998, p. 14).

Reading Peirce this way, we see that what he endorses on a third person philosophical level can and should be adopted by the actual inquirer. Davidson, in contrast, does not seem to give us a way to go from "doing philosophy," taking a third person point of view of our epistemic situation, to this first person point of view of regular belief formation (this, despite the fact that he emphasizes the perspective of the radical interpreter). Ernest Sosa has pointed out a similar disparity between justification for the individual believer and justification for the philosopher in Davidson's view (Sosa, 2003). The problem for our discussion is that Davidson's philosophical positions on our beliefs (that there cannot be a significant disparity between our beliefs and reality) do not do much work when adopted by the individual believer. Davidson does not seem to offer his believer multiple viewpoints of his beliefs. And as a result, Davidson does not seem to handle different contexts of inquiry, different purposes of inquiry, or the possibility of explaining conceptual change.

Of course, Peirce's belief/reality distinction might look like metaphysical Cartesianism to someone like Davidson. And part of the point of Davidson's principle of charity is to reject the value of metaphysical Cartesianism – an irresolvable mind/world gap.[4] But Peirce's view of reality provides more of a middle ground. And Peirce's stronger belief/reality distinction does more epistemic work in inquiry. Peirce would agree that there is no value or meaning to holding such a severe Cartesian mind/world split such that they cannot be reconciled. But there is value, for Peirce, in maintaining a mind/world split in which they are *not yet reconciled*, but are reconcilable in the future. The idea that our beliefs can meet with reality in the future has pragmatic value, since it makes sense of our everyday error in the short run. Peirce's view of the belief/reality distinction admits of fallible beliefs about a reality which is necessarily knowable. In this way, a stronger metaphysical notion of reality serves a key normative function in its role as a regulative idea.[5]

[4] I am grateful to Chris Pliatska for a discussion on this point.

[5] For comments and conversations, I am grateful to Jerold J. Abrams, Vincent M. Colapietro, Chris Pliastska, Sami Pihlström, Jukka Nikulainen, Henrik Rydenfelt, an anonymous referee and the participants of the *Applying Peirce* conference, where an earlier version of this paper was presented.

References

Apel, K.-O. (1995). "Transcendental Semiotics and Hypothetical Metaphysics of Evolution: A Peircean or Quasi-Peircean Answer to a Recurrent Problem of Post-Kantian Philosophy." In K.L. Ketner (Ed.), *Peirce and Contemporary Thought: Philosophical Inquiries* (pp. 366–397). New York: Fordham University Press.

Bilgrami, A. (2000). "Is Truth a Goal of Inquiry?: Rorty and Davidson on Truth" In R. Brandom (Ed.), *Rorty and His Critics* (pp. 242–262). Oxford: Blackwell.

Carrier, L. S. (1993). "The Impossibility of Massive Error." *Philosophy and Phenomenological Research*, 53(2), 405–409.

Colapietro, V. (1989). *Peirce's Approach to the Self: A Semiotic Perspective on Human Subjectivity.* Albany: State University of New York Press.

Cooke, E. (2006). *Peirce's Pragmatic Theory of Inquiry: Fallibilism and Indeterminacy.* Bristol, England: Continuum Press.

Davidson, D. (2001). *Subjective, Intersubjective, Objective.* Oxford: Clarendon Press.

Glock, H.-J. (2003). *Quine and Davidson on Language, Thought and Reality.* Cambridge: Cambridge University Press.

Ludwig, K. (1992). "Skepticism and Interpretation." *Philosophy and Phenomenological Research*, 52, 317–39.

Short, T. L. (2006). "Fallibilism is Omega-inconsistent." *Cognitio*, 7(2), 293–301.

Soles, D. (2004). "Error." *Southwest Philosophy Review*, 20(1), 1–24.

Sosa, E. (2003). "Knowledge of Self, Others, and World." In K. Ludwig (Ed.), *Donald Davidson* (pp. 163–182) Cambridge: Cambridge University Press.

Vermazen, B. (1983). "The Intelligibility of Massive Error." *Philosophical Quarterly*, 33, 69–74.

Webb, M. O. (1999). "Giving Up on Certainty." *Colloquia Manilana*, 7, 86–97.

Wiggins, D. (1998). "Reflections on Inquiry and Truth Arising from Peirce's Method for the Fixation of Belief." *Canadian Journal of Philosophy.* Supp. Vol. 24, 87–126.

Peircean Modal Realism?

Sami Pihlström
University of Helsinki

1. Introduction: the metaphysically realist assumptions of contemporary modal realism[1]

The purpose of this paper is to critically compare Charles Peirce's *metaphysics of the modalities* – or a "Peircean" approach to this metaphysical issue derived from his defense of *scholastic realism* – to the *modal realist* views defended by important twentieth century and contemporary philosophers. In this introductory section, I note that the contemporary discourse on modality is firmly rooted in metaphysical realism. In section 2, I suggest that the Peircean approach is closer to Kantian transcendental metaphysics. The contrast between metaphysical realism – or what Kant called "transcendental realism" – and the properly transcendental metaphysics in my view inherited by pragmatism turns out to be important, both generally and in the case of modality. Section 3 examines the possibility of interpreting Peirce's scholastic realism (a key doctrine in his modal theory) as

[1] In addition to the *Applying Peirce* conference (Helsinki, June 2007), parts of this material were presented at the conference on Peirce's normative thought in Opole, Poland (also June 2007). This paper is partly a fragment of the more comprehensive paper written for the Opole conference, and forthcoming in the volume based on that conference (a paper itself a part of a more comprehensive research on pragmatist metaphysics). See also Pihlström (2009), ch. 6. The following people, among others, have shaped my picture of Peirce (either by directly commenting on, or challenging, the views defended here or more generally and indirectly), which I gratefully acknowledge: Mats Bergman, Vincent Colapietro, Elizabeth Cooke, Leila Haaparanta, Peter H. Hare, Christopher Hookway, Nathan Houser, Ivo A. Ibri, Erkki Kilpinen, Heikki A. Kovalainen, James Liszka, Rosa Mayorga, Cheryl Misak, Dan Nesher, Ilkka Niiniluoto, Jukka Nikulainen, Jaime Nubiola, Mateusz Oleksy, Helmut Pape, Ahti-Veikko Pietarinen, Henrik Rydenfelt, T. L. Short, Tommi Vehkavaara, and Kenneth R. Westphal. Thanks are also due to the participants of my seminar on Peirce's pragmatism and scholastic realism at the University of Tampere (spring 2007).

grounded in a naturalized form of transcendental argumentation. Section 4 concludes my discussion. Much of what I will say about pragmatism and scholastic realism is relatively familiar to Peirce scholars; nevertheless, I hope to be able to put these topics into a slightly novel perspective by emphasizing their Kantian background.

There is a variety of views available in the contemporary debate over the metaphysics of modality; I cannot do justice to the richness of this debate here. For example, actualists like D. M. Armstrong (1997, 2004) and possibilists, or possible worlds realists, like David Lewis (1986, 2001) sharply disagree with each other on the correct treatment of the metaphysics of possibility and necessity. While Armstrong maintains that only the actual world exists and that "possible worlds" can (fictionally) be constructed only as recombinations of the elements of the actual world, in such a way that the truthmakers for any truths about mere possibility (or about necessity) we need can be found among the denizens of the actual world, Lewis postulates a vast plurality of possible worlds, understood as complex concrete individuals. While Armstrong needs universals to account for the truthmakers of simple truths of predication (e.g., *a* is F), Lewis has no use for such repeatable entities, as he can employ properties as classes of concrete particulars distributed across possible worlds. Yet another influential theory is Alvin Plantinga's (2003), according to whom possible worlds can be construed as abstract entities, maximal possible states of affairs, and things possess individual essences, properties they have in all possible worlds. In Plantinga's view, Lewis's possible worlds nominalism is not a realist theory about possibility at all but a form of "modal reductionism" (2003, ch. 10).

These and other modal metaphysicians[2] are, obviously, *metaphysical realists*, regardless of how violently they disagree with each other about the correct metaphysical picture of modalities, for instance, regarding such matters as possibilism vs. actualism, the nature of possible worlds, necessary vs. contingent truth, or transworld identity. Works by Armstrong, Lewis, Plantinga, and Stalnaker provide ample evidence of the widespread and virtually unquestioned assumption of metaphysical realism among modal metaphysicians. One need not embrace essentialism *à la* Saul Kripke (1980) in order to be a metaphysical realist in modal metaphysics. One can even be a modal fictionalist, as Armstrong is, and still construe one's theory of modality under the auspices of a general system of metaphysical

[2] Compare also, e.g., the form of actualism defended in Stalnaker (2003).

realism, arguing that we only need to commit ourselves to the existence of actual states of affairs and their constituents.

Metaphysical realism is here understood roughly in the Putnamian sense, as a commitment to there being a way the world is "in itself", and a complete, absolute truth about the way that world is, independently of human conceptual categorization or epistemic situations (Putnam, 1990; Pihlström, 1996). We might call someone a metaphysical realist, if s/he believes that "truth is supervenient on what things there are and which perfectly natural properties and relations they instantiate" (Lewis, 2001, p. 207). We are here interested in the specific applications this position may have to the issue of modality. No general discussion of metaphysical realism, or its particularly controversial issues such as truth, is possible.

2. An alternative conception of metaphysics

A *very* different treatment of modalities can be derived from Kantian transcendental metaphysics.[3] Kantian essentially epistemic modalities, constituting one of the four groups of the categories of understanding, cannot be accounted for within metaphysical realism but require an "epistemologized" approach to metaphysics. Kant's transcendental idealism is a major presupposition here. Yet, far from being a metaphysically neutral standpoint (as argued by Allison, 2004), it opens the doors for a reinterpreted form of metaphysical inquiry into the categorial structure of the human world, the fundamental structure(s) of any humanly categorized or categorizeable world (Pihlström, 2006). "Methodological" interpretations of transcendental idealism, such as Allison's, are correct to insist on the incoherence of metaphysical (transcendental) realism, and to abandon implausible "two worlds" accounts of the transcendental distinction between things in themselves and appearances, but they are wrong to construe Kant's idealism in a thoroughly non-metaphysical fashion.

Arguably, the Peircean pragmatist can exploit the Kantian transcendental understanding of the nature and aims of metaphysics, instead of embracing metaphysical realism (about modalities, or generally). Peirce, who

[3] On this specific theme in Kant scholarship, I have benefited from the work by Markku Leppäkoski (2001). This paper will make no contribution to the interpretation of Kant; nor will I try to settle the question of whether there can be *any* metaphysics within a Kantian framework critical of traditional ("pre-critical") metaphysics, but the Kantian context of my proposal for a rival conception of metaphysics (and the metaphysics of modality in particular) must acknowledged. For a more detailed case for "Kantian" readings of pragmatism, see Pihlström (2003); also cf. Pihlström (2006).

was undeniably a metaphysician,[4] was also a Kantian of sorts, though his treatment of modalities may also require modification from the Kantian perspective. Here it is sufficient to note the analogy between Kantian and pragmatist approaches to metaphysics. Both ought to be seen as ways of examining the constitutive features of the world as a possible object of (human) experience, cognition, or inquiry. Although Peirce rejected a number of specific Kantian ideas, such as the aprioristic account of cognition (and of philosophy) and the notion of an incognizable thing in itself (EP 1:25 [1868]), the basic thrust of his metaphysics is not very far from Kant's. Throughout his discussions of reality, truth, and inquiry, at various stages, Peirce was interested in how we can know and (semiotically) represent reality as a possible object of cognition and inquiry. The "real", for him, may be "ideal"; the fundamental issue is not the structure of a mind-, cognition-, or inquiry-independent reality, but precisely the way(s) in which the structure of the world is open to us in inquiry and semiosis.

The Peircean pragmatist may argue for the reality of certain kinds of entities, or the ontological status – "objective reality", in Kantian terms – of certain (groups of) categories, such as modality, by referring to what we *must presuppose* in our inquiries into the world we inhabit. This pragmatic "need" may be construed as a quasi-transcendental *conditio sine qua non*; unless we, say, construe modalities realistically, we cannot really make sense of our efforts to inquire into the way the world *is*, in terms of its habits, regularities, and developmental tendencies. Unfortunately, *neither* the Kantian *nor* the Peircean approach seems to be acknowledged, let alone seriously elaborated on, in standard accounts of the metaphysics of modality today.[5]

[4] Peirce seems to regard the view that metaphysics consists of "thoughts about thoughts" as both Aristotelian and Kantian: see EP 1:45–46 (1868); for his acknowledgment of the Kantian background of modal concepts, see also EP 2:283 (1903). Scholastic realism seems to be incorporated in Peirce's very concept of metaphysics, because in 1898 he defined metaphysics as "the science of being, not merely as given in physical experience, but of being in general, its laws and types" (EP 2:36). In the same lecture, we are told that the conclusions of metaphysics have a "necessity of matter", informing us "not merely how the things are but how from the very nature of being they *must* be" (EP 2:35). On metaphysical necessity and possibility, see also Lowe (1998, ch. 1).

[5] For instance, the only reference to Peirce in Lewis's (2001) thick volume is to the "Peircean" idea of ideal scientific truth, discussed by Lewis in connection with a critique of Putnam's internal realism (2001, p. 69). Plantinga (2003) and Stalnaker (2003) are examples of recent studies of modality that fail to mention Peirce. Nor is the Peircean alternative acknowledged in textbooks, such as Loux's (2002), or in Lowe (1998) and Kim and Sosa (1998).

Peirce's approach to modality is different not only from actualism, such as Armstrong's (according to which the elements of the actual world suffice as truthmakers for truths about mere possibility), but also from the possibilism defended by Lewis (for whom possible worlds as concrete individuals enjoy their static existence disconnected from one another) and from the view Plantinga favors (connecting possible worlds *qua* states of affairs with propositions, yielding, again, a static rather than a dynamic picture of modalities). Armstrong's and Lewis's accounts might be seen as paradigmatically un-Peircean, even anti-Peircean, the former because it rejects "real" modalities (especially real possibilities) altogether and the latter because it treats possible worlds as separate and discontinuous. Peirce would also reject those approaches to modality that view possible worlds as mere logical or methodological devices devoid of metaphysical significance. Such a position would, like metaphysical actualisms, sacrifice *real* possibility and *real* generals.

Moreover, the relation between Peirce's pragmatism and his scholastic realism is tight; the two doctrines are more or less inseparable in his thought, enabling a unique combination of metaphysical inquiry and a critical perspective on metaphysics (which helps us to make the obvious point that pragmatism is *not* simply positivist instrumentalism):

> [Pragmati(ci)sm] will serve to show that almost every proposition of ontological metaphysics is either meaningless gibberish [...] or else is downright absurd [...]. In this regard, pragmaticism is a species of prope-positivism. But what distinguishes it from other species is, first, its retention of a purified philosophy; secondly, its full acceptance of the main body of our instinctive beliefs; and thirdly, its strenuous insistence upon the truth of scholastic realism [...]. So, instead of merely jeering at metaphysics, like other prope-positivists [...], the pragmaticist extracts from it a precious essence [...].
>
> EP 2:338–339; CP 5.423 [1905]

Peirce can be read as implicitly contrasting "ontological metaphysics", by which he presumably means metaphysics employing the a priori (intuitive) method, such as traditional "pre-critical", rationalist metaphysics, to his own scientific – epistemically sophisticated rather than purely ontological – metaphysics, which is closer to Kant's transcendental philosophy than contemporary metaphysical realism.[6] The passage quoted is not the only place where Peirce emphasizes the strong link between pragmati(ci)sm and scholastic realism (cf. CP 5.503–504, 8.208, 8.326), but it serves us in

[6] I am grateful to Tommi Vehkavaara for a conversation on this point, and related ones.

our sketch of a Peircean conception of metaphysics and its applications to modality. My way of "extracting" the "precious essence" of metaphysics may diverge from Peirce's own in crucial respects, but the important point is that pragmatism, far from being anti-metaphysical, allows and indeed encourages such an extraction.

3. Peirce's scholastic realism, transcendentally defended?

Peirce's statements about scholastic realism may be found in several important writings, from his seminal 1868 papers (EP 1, chs. 2–4) and the 1871 Berkeley review (CP 8.7–38; EP 1, ch. 5; W 2:462–487) up to his late writings on pragmaticism in and after 1905 (EP 2, chs. 24–28). He often describes his scholastic realism as "extreme" (CP 5.77n1, 5.470).[7]

Modal realism, realism about "real possibility", is a key element of Peirce's scholastic realism.[8] Defining "the scholastic doctrine of realism" as the view that "there are real objects that are general", Peirce argues that "the belief in this can hardly escape being accompanied by the acknowledgment that there are, besides, real *vagues*, and especially, real *possibilities*", because "possibility being the denial of a necessity, which is a kind of generality, is vague like any other contradiction of a general" (EP 2:354; CP 5.453 [1905]). Returning to his example of the hardness of a diamond, discussed in the early formulation of pragmatism as a method of "making our ideas clear" in the well-known 1878 paper, Peirce reflects:

> [T]he question is, not what did happen, but whether it would have been well to engage in any line of conduct whose successful issue depended upon whether that diamond would resist an attempt to scratch it, or whether all other logical means of determining how it ought to be classed *would* lead to the conclusion which [. . .] would be "the belief which alone could be the result of investigation carried *sufficiently far*." Pragmaticism makes the ultimate intellectual purport of what you please to consist in conceived conditional resolutions, or their substance; and therefore, the conditional propositions, with their hypothetical antecedents, in which such resolutions consist, being of the ultimate nature of meaning, must be capable of being true [. . .]. But that amounts to saying that possibility is sometimes of a real kind.
>
> EP 2:354; CP 5.453 [1905]

[7] See also, e.g., the following passages: CP 1.15–26, 3.93, 4.1ff., 5.59–65, 5.93–101, 5.312, 5.423, 5.430–433, 5.453ff., 5.502–504, 5.528, 8.208, 8.258, 8.266, and 8.326, as well as the relevant discussion in RLT.

[8] See, e.g., EP 2:35 (1898); EP 2:354–357 (1905); EP 2:450 (1908); CP 5.453–454, 5.457, 5.527, 6.485; on Peirce's progress, in 1896–97, toward the acknowledgment of real possibilities, see also CP 3.527, 8.308, as well as Fisch (1986, p. 194), and Houser (1998, p. xx).

The recognition of real possibility, Peirce observes, "is certainly indispensable to pragmaticism" (CP 5.527; cf. EP 2:357 [1905]). The case of the hard diamond is revisited in Peirce's oft-cited letter to Calderoni (c. 1905):

> I myself went too far in the direction of nominalism when I said that it was a mere question of the convenience of speech whether we say that a diamond is hard when it is not pressed upon, or whether we say that it is soft until it is pressed upon. I now say that experiment will prove that the diamond is hard, as a positive fact. That is, it is a real fact that it would resist pressure, which amounts to extreme scholastic realism. CP 8.208 [9]

According to Carl Hausman (1993, pp. 3–4), scholastic realism says that "there are repeatable conditions that are independent of mental acts and that function like rules for the ways particular things behave".[10] The contrast, clearly, is to nominalism, not idealism. Meaning – a pragmatic theory of which is a central context for the development of scholastic realism – depends on "*would-be's*", "patterns according to which occur the outcomes of actions and consequences relevant to the idea in question"; meanings are disclosed in "dispositional conditions, in habits, according to which the meaning or would-be could be expected to be exemplified if

[9] The passage continues: "I deny that pragmaticism as originally defined by me made the intellectual purport of symbols to consist in our conduct. On the contrary, I was most careful to say that it consists in our concept of what our conduct would be upon conceivable occasions." It is not easy to determine what exactly the relation between pragmati(ci)sm and scholastic realism is, though. As a logical maxim, pragmatism can hardly entail a metaphysical theory such as scholastic realism. Perhaps the relation is best construed as an *abductive* one: we arrive at scholastic realism as the only plausible hypothesis that might enable us, in accordance with the pragmatic maxim, to account for the meaning of rational (intellectual, scientific) concepts in terms of the conceivably practical bearings we may consider their objects to have. We might also say that the pragmatic maxim presupposes scholastic realism not as a purely logical principle but whenever the maxim is applied to any real concept. Again, I am grateful to Tommi Vehkavaara for this formulation.

[10] Hausman (1993, 1999) is one of the Peirce scholars who find scholastic realism absolutely central in Peirce's metaphysics and theory of meaning, indeed in his system as a whole. Thus, it will be useful for us to take a look at how Hausman – only as one example among the Peirce scholars who have been inspired by Peirce's views on realism – characterizes scholastic realism. He does not confine himself to discussing Peirce's scholastic realism but is interested in his "evolutionary realism" in a wider sense. Boler (2004, 2005) also sees scholastic realism as a part of a more general (and evolving) commitment to realism in Peirce. This paper will not deal with the controversy over the development of Peirce's views on realism vs. nominalism. For a now classic statement of Peirce's "progress", see Fisch (1986); for further discussion, cf. Hookway (1985, pp. 112–117), Michael (1988), and Boler (2005). Nor can I discuss Peirce's relations to his predecessors, such as the scholastics (see Boler, 1980, 2004; Mayorga, 2007).

the concept that articulates the meaning were put to the test" (1993, p. 7).[11] Peirce's postulation of repeatable conditions, rules, patterns, habits, dispositions, or "would-be's" is not a postulation of specific objects but of something that objects can exemplify or manifest.[12] These conditions are "regularities" that "render phenomena intelligible" (1993, p. 142). There is a teleological element in Peirce's dynamic, "developmental" generals: they are constantly "evolving", "tendencies that grow" (1993, p. 14; see pp. 26–27, 50–51). This distinguishes Peircean generals from traditional "fixed" universals (1993, p. 26), including Plato's Forms but also Aristotle's universals.[13]

In terms of the contemporary discourse on modality, Peirce is a modal realist, as he acknowledges "real possibilities – general modes of determination of existent particulars" (1993, p. 48). In his theory of meaning, it is crucial to distinguish *conceivable* practical bearings – something that *would* or *might* happen, if an object (e.g., a diamond) were subjected to certain experiential conditions (e.g., scratching), in order to find out whether a particular concept (e.g., hardness) applies to it or not – from what *actually* happens to any particular objects. Yet, although "possibility is sometimes of a real kind", Peirce cannot be understood as a Lewisian realist about "existing" possible worlds. He points out that philosophy deals with the "reality of potential being" in addition to the "reality of existence" (EP 2:35 [1898]). As in the case of universals, his picture of possibility is much more

[11] Hausman is here paraphrasing, in scholastically realist terms, the central ideas of "How to Make Our Ideas Clear" (EP 1, W 3). On Peirce's "would-be's" and potentialities as "powers" of things irreducible to their actualizations, see, e.g., CP 1.414, 1.420, 4.172, 5.77n1, 5.428, 5.436, 5.527–528; on the Aristotelian and medieval sources of these views, cf. Boler (2005, pp. 20–21). As already noted, Peirce later found his 1878 view of hardness (CP 5.403; EP 1:132 ff.) too nominalistic (Boler, 2004, p. 72; Hookway, 2000, pp. 52–56).

[12] Hausman even says that there is a Platonic element in Peirce's realism, insofar as the Peircean "generals" are "reals, independent, dynamic, ordering conditions that are not exhausted by, but are effective with respect to, sequences in which particular empirical consequences are encountered" (1993, p. 8). Definitely Peirce rejects standard Platonism in arguing that his real generals are not independently existing things, "separately existing Ideas", but rather "modes of being in things" (Boler, 2005, p. 18). As he says, "no great realist held that a *universal* was a thing" (CP 1.27n, also quoted by Boler). Existence is the mode of being of Secondness, while reality is the mode of being of Thirdness, and nominalism conflates these two (CP 5.503 [1905]; see Boler, 2004, pp. 68–69). Even familiar physical objects, on Boler's reading, are for Peirce "lawlike processes, systems, *constituted* by Firstness, Secondness, and Thirdness" (2004, p. 71). The structure of things must, with the Scholastics, be understood as analogous to the structure of thought (2004, p. 70). The notion of constitution here is, however, metaphysical in a rather traditional sense, not (at least not clearly) transcendental.

[13] See further Hausman (1993), ch. 4 passim.

dynamic than that of most contemporary authors.[14] He avoids, by means of his Thirdness and real generals, the game played by contemporary metaphysicians about whether to achieve ontological economy by postulating possible worlds and avoiding universals or, conversely, by postulating universals and avoiding unactualized possibilities. His real generals are able to do the job of both.[15]

As Hausman notes (1993, p. 165), real generals, real possibilities, and would-be's are intimately related to the "final opinion", the ideal end of scientific inquiry. Particular phenomena or objects, though intelligible as generals, never exhaust the latter. Scholastic realism – as well as synechism, the theory of continuity, also connected with it – is, for Peirce, a normative condition of thought, knowledge, intelligibility, and inquiry (1993, p. 168).[16] The final opinion need never be actualized. It is an ideal, regulative, normative notion, providing a reason for continuing inquiry when faced by resistance. (1993, p. 217.) If, Peirce says, "Truth consists in satisfaction", then "it cannot be any *actual* satisfaction, but must be the satisfaction

[14] Hausman (1993, p. 49) continues: "Thus, if something is not false or not known to be false, it is possible." This might strike a contemporary modal theorist as seriously misleading: aren't contingent falsehoods possibly true and contingent truths possibly false? Couldn't Peirce acknowledge this? Is this a problem for Peirce? Cf. CP 3.527 ("The Logic of Relatives") for Peirce's discussion of an epistemic definition of possibility. Indeed, a sharp distinction between possibility in a metaphysical sense and in an epistemic sense is foreign to Peirce, as it overlooks his way of seeing reality itself as epistemic – as the object of inquiry and, ultimately, of the final opinion. Furthermore, we should note that Peirce also has a "pure" notion of possibility, associated with Firstness, to be distinguished from laws, tendencies, or would-be's, which are cases of Thirdness. The latter, genuine "potentiality", is more fundamental than mere abstract pure possibility. Cf. Boler (2004, p. 72); see also CP 1.422. In Peircean evolutionary cosmology, there is a step from "undetermined and dimensionless potentiality to *determined* potentiality" (Houser 1992, p. xxxiii). On real possibilities, see also CP 4.547, 4.579–580. For Peirce's distinctions between various different notions of possibility, see, e.g., his "Notes on Metaphysics" (CP 6.371).

[15] This "game" covers much of the dialectic between, say, Armstrong and Lewis, in which the common purpose by all parties to the debate is to maintain maximal ontological economy. By accepting universals into his ontology, Armstrong thinks he has a sufficiently rich furniture in the actual world to yield truthmakers for truths about mere possibility, without postulating real possibilities, while Lewis claims that possible worlds and properties as classes (of *possibilia*) can, nominalistically, perform the job traditionally performed by universals. Famously, W.V. Quine was even more austere a metaphysician, eliminating both universals and modalities from his ontology, because both lack his – strictly nominalist – spatio-temporal criteria of identity. For these dialectics, see the essays collected in Kim and Sosa (1998).

[16] The Peircean view of truth, as emphasized by Misak (2004) and others, is that truth is what *would* be believed if inquiry were, or could be, continued indefinitely long, i.e., something upon which inquiry *would* not improve.

which *would* ultimately be found if the inquiry were pushed to its ultimate and indefeasible issue" (EP 2:450 [1908]).

An adequate conception of inquiry, understood as a process aiming at the settlement of belief, requires the notion of a final opinion, interpreted in terms of scholastic realism and the irreducible reality of possibilities, as *its* necessary condition for possibility – even if achieving the final opinion (truth) remains a mere hope. Generality is structurally present in the account of inquiry aiming at the fixing of a final opinion (cf. EP 1:88–91 [1871]). Since inquiry is actual, hence possible, its necessary condition, scholastic realism, must be satisfied (see EP 1:92 [1871]). Scholastic realism is needed to make sense of the very possibility of inquiry, insofar as inquiry is understood as aiming toward a final opinion whose object is "the real", with the hope that this will be achieved. Nominalism would destroy the possibility of inquiry and lead to utter chaos. Hence, Peirce argues for scholastic realism not just abductively but in a Kantian transcendental fashion,[17] examining the necessary conditions for the possibility of something we take for granted. Thus, his reflections sometimes mix transcendental and naturalized, abductive arguments.[18] His abductive de-

[17] Peirce, interestingly, points out an explicit connection between Kant and scholastic realism in the well-known passages of the 1871 Berkeley review discussing real generals and inquiry: "Indeed, what Kant called his Copernican step was precisely the passage from the nominalistic to the realistic view of reality. It was the essence of his philosophy to regard the real object as determined by the mind. That was nothing else than to consider every conception and intuition which enters necessarily into the experience of an object, and which is not transitory and accidental, as having objective validity." (EP 1:90–91.)

[18] In the passage just quoted (CP 5.430), Peirce talks about "experiential evidence", which of course may legitimately lead us to think that his argument is not transcendental at all – at least not purely a priori or apodictic. See Haack (1992) for a discussion of Peirce's defense of scholastic realism as an argument based on the possibility of science as genuine inquiry. For Haack, Peirce's scholastic realism is a piece of "scientific metaphysics" abductively defended, whereas I have sought to mix up Peirce's abductive and transcendental concerns in this regard (see Pihlström, 2003, ch. 3). A scholar more sensitive to transcendental construals of Peirce than Haack or Misak (among others) is Hookway; see his (2000, pp. 91ff., 106–107) for a discussion of the relevance of the rejection of nominalism to Peirce's pragmatic view of truth. Hookway's interpretation is not purely transcendental, though (2000, pp. 295–298). Esposito (2007, p. 13), in turn, explicitly reads Peirce's views on synechism as harboring transcendental arguments: "Simply put, if continuity in nature embodying not mere contiguity but relational generality was not all-encompassing, then representability would not be achievable, and if entities called signs could not represent then experimentation would be impossible and abductive inference would always be a mere wild guess. However, it is indisputable that science advances, our knowledge deepens, and that our intuitive abductions often reveal truths once we more clearly understand the significance of the models shaping them." Hence, synechism must be accepted as a necessary condition for the possibility of representability, abduction, and scientific progress. Let me note, further, that when referring to "transcendental" condi-

fense of scholastic realism can be seen as a naturalized transcendental argument, if we blur the dichotomy between transcendental and abductive arguments, and more generally between transcendental and naturalistic philosophy, including transcendental and naturalized, "scientific" metaphysics (Pihlström, 2003, ch. 3).

The Peircean account of modal realism is, then, again very different from the standard formulations, based on metaphysical realism, briefly described above, although in the end Peirce himself may also be too strongly tied to realism. Perhaps the Peircean philosopher ought to seek a middle way between metaphysical realism and full-blown, transcendentally idealist, traditional Kantianism? Here I have, however, only established (I think) that this particular case can be used to examine whether, or how, a transcendental-cum-pragmatic metaphysics is possible.[19]

Let me address one final worry. Hookway (2000) and others emphasize the distinction between transcendentally established principles and mere "hopes". Now, shouldn't we view modal (scholastic) realism itself as a mere regulative hope instead of a transcendentally defensible (constitutive) thesis? We can, and should, understand the final opinion as a mere hope: it need never be actualized, and we need not believe that it will. But in order for inquiry to be possible, we have to maintain that hope – as a transcendental constraint for inquiry. It seems that the (mere) hope that there is a final opinion, or that we will, in our inquiry, end up with a view not to be replaced by another (better) view, regarding some specific question, can *only* be maintained, if we are committed to the principle(s) of modal and scholastic realism. This hope, though a mere hope, requires "real possibility". It is important to make a distinction between hopes and transcendental principles, but it is equally important to inquire into the transcendental presuppositions of "mere hopes". The hope that there is a final opinion transcendentally presupposes scholastic (modal) realism, be-

tions, arguments, or considerations in a Peircean context I am not committing myself to Apel's (1981) to my taste too foundationalist and not genuinely fallibilist version of transcendental pragmatism (for my reasons for keeping the Apelian approach at a distance, see Pihlström, 2003, ch. 7). For an insightful exploration of transcendental argumentation in Peirce, in the context originally shaped by Apel and Habermas, see Cooke (2005).

[19] Let us note that I have a broader motivation for defending Peirce's scholastic realism. "Real generals", especially modalities, suitably interpreted, may be evoked to account for the notoriously problematic modal structure of transcendental reflection on the necessary conditions for the possibility of various given actualities (Pihlström, 2003, 2006). Insofar as the Peircean modalities can themselves be reconstructed along the lines of a transcendental metaphysics, a reflexive argumentative structure – but *not*, in my view, any vicious circularity – inevitably results.

cause generality cannot be reduced away from the final opinion. Thus, we ought to realize that the normative conditions for the possibility of inquiry may have metaphysical presuppositions.

These presuppositions are both pragmatic and transcendental. In pragmatism, no crude distinction between pragmatic and transcendental presuppositions must be drawn. Both can be seen as aspects of human ways of rendering the world we inhabit intelligible.[20]

4. Concluding remarks

Pragmatists, Peircean or not, should not reject metaphysics but reinterpret it in a pragmatically adequate manner. The notion of possibility is of crucial importance not only to the applications of the pragmatic maxim but to metaphysics in general, as an inquiry into what is possible (Lowe, 1998). A lot depends on how the notion of possibility is construed; I would urge that a Peircean realist about possibility (potentiality) should base her/his realism on Kantian transcendental considerations, instead of metaphysically realist assumptions about, say, individual essences or concretely existing possible worlds.

Peirce's scholastic realism suggests one way of reaffirming the metaphysical seriousness of pragmatism, without full commitment to metaphysical realism. Tensions remain, however. Can metaphysical realism in the end be avoided (Pihlström, 2003, ch. 3)? Is transcendental idealism or transcendental argumentation a proper method for the metaphysics of modalities, and does it really work? Should the transcendental conditions invoked here be understood as merely regulative instead of understanding them as constitutive, or how might this Kantian distinction be reinterpreted in the present Peircean context? Furthermore, should we speak of (constitutive or regulative) conditions for the possibility of inquiry in general, or rather of conditions for successful inquiry? A detailed treatment of these questions is beyond the scope of this paper.[21]

References

Allison, H. A. (2004). *Kant's Transcendental Idealism: An Interpretation and Defense.* Enlarged and Revised Edition. New Haven, CT and London: Yale University Press (1st ed. 1983).

[20] In Pihlström (2004), I have further argued that the distinction between hopes and transcendental principles must be softened, if one prefers William James's pragmatism to Peirce's.

[21] See, for further reflections, Pihlström (2003, 2006, 2007, 2009).

Apel, K.-O. (1981). *Charles S. Peirce: From Pragmatism to Pragmaticism*. Trans. J. M. Krois. Amherst: University of Massachusetts Press.

Armstrong, D. M. (1997). *A World of States of Affairs*. Cambridge: Cambridge University Press.

Armstrong, D. M. (2004). *Truth and Truthmakers*. Cambridge: Cambridge University Press.

Boler, J. (1980. "Peirce, Ockham and Scholastic Realism." *The Monist*, 63, 290–303.

Boler, J. (2004). "Peirce and Medieval Thought." In C. Misak (Ed.) *The Cambridge Companion to Peirce* (pp. 58–86). Cambridge: Cambridge University Press.

Boler, J. (2005). "Peirce on the Medievals: Realism, Power and Form." *Cognitio*, 6, 13–24.

Cooke, E. F. (2005). "Transcendental Hope: Peirce, Hookway, and Pihlström on the Conditions of Inquiry." *Transactions of the Charles S. Peirce Society*, 41, 651–674.

Esposito, J. L. (2007). "Synechism: The Keystone of Peirce's Metaphysics." In J. Queiro and R. Gudwin (Eds.) *Digital Encyclopedia of Charles S. Peirce.* Online: `http://www.digitalpeirce.fee.unicamp.br/p-synesp.htm` (accessed in April 2007).

Fisch, M. H. (1986). "Peirce's Progress from Nominalism toward Realism." In K. L. Ketner and C. J. W. Kloesel (Eds.) *Peirce, Semeiotic, and Pragmatism: Essays by Max H. Fisch*, Bloomington: Indiana University Press.

Forster, P. D. (1992). "Peirce and the Threat of Nominalism." *Transactions of the Charles S. Peirce Society*, 28, 691–724.

Haack, S. (1992). "'Extreme Scholastic Realism:' Its Relevance to Philosophy of Science Today." *Transactions of the Charles S. Peirce Society*, 28, 19–50.

Hausman, C. R. (1993). *Charles S. Peirce's Evolutionary Philosophy*. Cambridge: Cambridge University Press (paperback ed., 1997).

Hausman, C. R. (1999). "Evolutionary Realism and Charles Peirce's Pragmatism." In S. B. Rosenthal, C. R. Hausman, and D. R. Anderson (Eds.), *Classical American Pragmatism: Its Contemporary Vitality* (pp. 193-208). Urbana and Chicago: University of Illinois Press.

Hookway, C. (1985). *Peirce*. London and New York: Routledge.

Hookway, C. (2000). *Truth, Rationality, and Pragmatism: Themes from Peirce*. Oxford: Clarendon Press.

Houser, N. (1992). "Introduction." In EP 1, xix–xli.

Houser, N. (1998). "Introduction." In EP 2, xvii–xxxviii.

Kim, J. and Sosa, E. (Eds.) (1998) *Metaphysics: An Anthology*. Malden, MA and Oxford: Blackwell.

Kripke, S. (1980). *Naming and Necessity*. Oxford: Blackwell.

Leppäkoski, M. (2001). "The Transcendental Must." In Volker Gerhardt et al. (Eds.), *Kant und die Berliner Aufklärung* (Proceedings of the IX International Kant Congress, Berlin, 2000) (pp. 783–790). Berlin: de Gruyter, vol. 2.

Lewis, D. (1986). *On the Plurality of Worlds*. Oxford: Blackwell.

Lewis, D. (2001). *Papers on Metaphysics and Epistemology*. Cambridge: Cambridge University Press.

Loux, M. J. (2002). *Metaphysics: A Contemporary Introduction*, 2nd ed. London and New York: Routledge (1st ed. 1998).

Lowe, E. J. (1998). *The Possibility of Metaphysics: Substance, Identity and Time*. Oxford: Clarendon Press (paperback ed., 2001).

Mayorga, R. (2007). *From Realism to Realicism: The Metaphysics of Charles Sanders Peirce*. Lanham, MD: Lexington Books.

Michael, F. (1988). "Two Forms of Scholastic Realism in Peirce's Philosophy." *Transactions of the Charles S. Peirce Society*, 24, 317–348.

Misak, C. (2004). *Truth and the End of Inquiry*, rev. ed. Oxford: Oxford University Press (1st ed. 1991).

Pihlström, S. (1996). *Structuring the World: The Issue of Realism and the Nature of Ontological Problems in Classical and Contemporary Pragmatism*. Acta Philosophica Fennica 59. Helsinki: The Philosophical Society of Finland.

Pihlström, S. (2003). *Naturalizing the Transcendental: A Pragmatic View*. Amherst, NY.: Prometheus/Humanity Books.

Pihlström, S. (2004). "Peirce's Place in the Pragmatist Tradition." In C. Misak (Ed.), *The Cambridge Companion to Peirce*. Cambridge: Cambridge University Press.

Pihlström, S. (2006). "The Transcendental Method in Metaphysics." Presented at the conference, *The History of the Transcendental Turn*, London, UK, September 2006. Available online:
`http://www.helsinki.fi/filosofia/tutkijaseminaari/htm`

Pihlström, S. (2007). "Metaphysics with a Human Face: William James and the Prospects of Pragmatist Metaphysics." *William James Studies 2*. Available online: `http://williamjamesstudies.press.uiuc.edu/`

Pihlström, S. (2009). *Pragmatist Metaphysics: An Essay on the Ethical Grounds of Ontology*. London: Continuum.

Plantinga, A. (2003). *Essays on the Metaphysics of Modality*. M. Davidson (Ed.). Oxford and New York: Oxford University Press.

Putnam, H. (1990). *Realism with a Human Face*. J. Conant (Ed.). Cambridge, MA and London: Harvard University Press.

Stalnaker, R. C. (2003). *Ways a World Might Be: Metaphysical and Anti-Metaphysical Essays*. Oxford: Clarendon Press.

Toward a Transcendental Pragmatic Reconciliation of Analytic and Continental Philosophy

Jerold J. Abrams
Creighton University

1. Introduction

Richard Rorty in *Philosophy and the Mirror of Nature* (1979) draws on Thomas Kuhn's philosophy of scientific paradigm shifts in order to portray the history of philosophy as also subject to paradigm shifts. Rorty thinks that modern epistemology as representationalist and foundationalist is now an outmoded paradigm, which has been replaced by the new paradigm of pragmatism, and as part of that new paradigm Rorty presents his own unique philosophical perspective as "neopragmatism." This view of neopragmatism has the advantage of taking into account philosophers from outside classical pragmatism in order to show how they too revealed the old representationalist paradigm to be outdated, and how they too surpassed it. Three philosophers especially changed the course of epistemology in the twentieth century, three philosophers not always seen to be doing the same thing, mainly because they appear within three different traditions: John Dewey in American pragmatism, Ludwig Wittgenstein in analytic philosophy, and Martin Heidegger in Continental philosophy. Rorty highlights how each of these thinkers overcame the modern view of the mind as a detached spectator and replaced it with a new view of the individual as practically engaged within the world and the community of inquiry. Rorty's synthesis of these traditions is one of the major achievements of American philosophy in the second half of the twentieth century; and yet, for all of his synthesizing of the analytic, pragmatic, and Continental traditions in *Philosophy and the Mirror of Nature*, Rorty is hardly naïve about the philosophical and cultural obstacles facing such a synthesis. Two decades later, in *Truth and Progress*, Rorty even writes that the "two matrices" analytic and Continental philosophy "are very different indeed, and are very unlikely to blend with each other" (1998, p. 9). But, in the spirit of Rorty's own neopragmatism, and its stated aim to "keep the conversation going" in contemporary philosophy, these divided views may yet be reconciled. In fact, the engagement and disagreement between the traditions reveal at a transcendental and pragmatic level some level of unity expressible in the form of "we-saying." Not only must either side express its perspective about the other as an intersubjectively unified view, but either side must also recognize the other as always already intersubjectively unified with its own view. A fundamental condition for the possibility of dialogical engagement between Continental and analytic philosophy is an *a priori* recognition of an intersubjective unity between them.

2. The divide

Sometimes the divide between analytic and Continental philosophy is cast as if the two sides had neither a common origin nor a common developmental trajectory, a perception reinforced by their very different styles. But, in fact, the origins of both traditions can be traced more or less back to Kant, and their trajectories seem both to be more or less Hegelian and pragmatist. Many analytic philosophers extend Kant's project of analyzing propositional forms, like analytic vs. synthetic, and *a posteriori* vs. *a priori*, whereas many Continentals extend Kant's ideas on aesthetics and spontaneity to language. Analytic philosophers often hold that logical analysis is the best path to the truth, while Continentals tend to employ a more historically informed reconstruction of the development of various discussions. But despite these two diverging Kantian pictures of thought, both seem to follow respective paths toward a quite similar end in a nonrepresentationalist and instrumentalist view of mind, as Rorty rightly points out, as well as a transcendentally intersubjective and temporally extended view of the mind.

In the *Critique of Pure Reason* Kant advanced the transcendental unity of apperception (or the "I think") as the ultimate foundation of his philosophy: all thought must be unified for the subject. One can find intersubjective dimensions of Kant's thought, even in the *Critique*, and certainly in "Idea for a Universal History with a Cosmopolitan Purpose," but the major step forward in modern philosophy into intersubjectivity was taken by Hegel, who also thinks of his own philosophy as a logical development of Kant's thought. Analytic and Continental philosophers seem to travel this same path from the subject into the study of the language of thought, to arrive at intersubjectivity as the unity of thought, which results in a new view of the subject as intersubjectively shaped by and emerging within the community of inquiry. Hegel himself in his *Phenomenology of Spirit* highlights this developmental turn to intersubjectivity as central to the development of the mind: "What still lies ahead for consciousness is the experience of what Spirit is – this absolute substance which is the unity of the different independent self-consciousnesses, which, in their opposition, enjoy perfect freedom and independence: 'I' that is 'We' and 'We' that is 'I' "(Hegel, 1977, p. 110). Here Hegel means that Kant's "I" (as the ultimate groundwork of thought) is an important but ultimately illusory stage on the way to humanity seeing itself as "we" and "us," and Hegel uses a version of Kant's own transcendental argument (dialectic) to demonstrate that the "I" cannot even be posited except in the intersubjective social space of the "we." The entire debate over the schism between Continental and analytic philosophy also takes place within this same social space of "we-saying," despite what either side might portray as an irreconcilable difference.

Michel Foucault once said that Hegel with his dialectical philosophy circumscribed philosophy within a sphere which no future philosophy could ever go beyond: "We have to determine the extent to which our anti-Hegelianism is possibly one of his [Hegel's] tricks directed against us, at the end of which he stands, motionless, waiting for us" (Foucault, 1972, p. 235). The same might be said of the discussion over respective traditions today, for despite so many efforts to draw one tradition's bounds against the others, the major figures of either tradition all too often seem to be talking about the same Hegelian (and pragmatist) themes. And the point seems to be true even of Rorty who has done so much to bring the traditions together, for Rorty rightly highlights the unexpected commonality between Heidegger and Wittgenstein about nonrepresentationalism, only later to reaffirm their irreconcilable differences. But perhaps Rorty does not take the antirepresentationalism of the traditions far enough to see that each of the three major thinkers he examines already operates within the same logical and universal space of language which Hegel identifies as the very groundwork for any apparent division between traditions. Rorty is right that Heidegger, Dewey, and Wittgenstein shift paradigms from representationalism to instrumentalism, and from the subject to language, but that turn to language also contains a transcendental dimension of intersubjectivity which cannot be avoided by any rational creature, and which Heidegger lays bare, and which Dewey and Wittgenstein also approach in their respective philosophical projects. Heidegger in *Being and Time* emphasizes that "the world is always already the one that I share with others" (Heidegger, 1996, pp. 111–12), so that the "I" is always already within an intersubjective community of beings, while Wittgenstein in the *Philosophical Investigations* articulates a dialogical view of mind constantly using the first person plural pronoun "we." Of course, this "we" in Wittgenstein is not, strictly speaking, a Kantian transcendental unity (in the sense of an "I think"), but some contemporary philosophers like Jonathan Lear (1999) and Sebastian Gardner argue that Wittgenstein's "we" plays the intersubjective role of Kant's apperception insofar as it unifies the various forms of life (Gardner, 1999, p. 346).

Donald Davidson also follows through on this Wittgensteinian point in his essay "The Second Person," where he interprets Wittgenstein's claim that "meaning is like going up to someone" in specifically transcendental terms (Davidson, 2001, pp. 115, 121). All thought, Davidson argues, is necessarily directed from a first person (speaker) about an objective world toward a second person (hearer). Davidson calls this activity "triangulation," and finds it to be unified by a we-perspective. To communicate, *we* must know how to "go on" (in time) within the conversation (using the principle of charity). There is much here that resembles Hegel's view, but Davidson seems to resist the parallel, and instead seems to see his inquiry as moving more or less within a self-contained tradition, not free of the history of philosophy, but not exactly in contact with the Continent either. This approach is common to both sides of the divide: if one is working within a specified tradition, then other traditions need not be taken into account. Alternatively, sometimes a philosopher simply caricatures the other tradition, as in the case of John Searle's (almost Hegelian) view of "we-intentions" (Searle, 1998, pp. 119–120). Searle in *Mind, Language, and Society* argues that collective intentionality is "the foundation of all social activities" (Searle, 1998, p. 120), which would appear to be very Hegelian, except that Searle flatly rejects the relation, and even warns against philosophy's embrace of "some sort of overarching Hegelian World Spirit, some 'we' that floats around mysteriously above us individuals and of which we as individuals are just expressions" (Searle, 1998, p. 118). In point of fact, however, Searle's view is precisely Hegel's view, as is Davidson's, as is much of analytic philosophy today. But until recently, such acknowledgement has been thin at best.

So, a welcome contribution to the discussion has been Robert Brandom's book, *Making It Explicit*, which recognizes debts to Wittgenstein, pragmatism, and Hegel. In fact, Brandom even begins and ends his book with Hegelian analyses of we-saying. This we-saying begins, for all human beings, at a very local level, but ultimately points beyond locality to universality (Brandom, 1994, p. 643). Brandom writes:

> This thought suggests that we think of ourselves in broadest terms as the ones who say 'we.' It points to the one great Community comprising members of all particular communities – the Community of those who say 'we' with and to someone, whether the members of those different particular communities recognize each other or not.
>
> Brandom, 1994, p. 4

For Brandom, particular communities say "we," but the activity of we-saying is intrinsically expansive and inclusive, and as communities that say we develop over time, the individuals within those communities also develop a richer understanding of the unity of the "I" and the "we." Ultimately, according to Brandom (who here sounds very much like Peirce), the community of inquiry possesses no absolute boundaries, and indeed contains within it an impulse toward one great community inclusive of all individuals who can say we.

3. Toward a reconciliation: Peirce's "we"

Rorty in *Contingency, Irony, and Solidarity* also advances this idea of an expanding view of the cosmopolitan community unified through we-saying, which includes potentially all philosophical traditions and all cultures. But his view operates more or less at the social and political level of cosmopolitan liberalism. Rorty explains what he means with his own view of we-saying in just this political and cosmopolitan light: "It will mean something like 'we twentieth-century liberals' or 'we heirs to the historical contingencies which have created more and more cosmopolitan, more and more democratic institutions' " (Rorty, 1995, p. 196). The problem with this view is that intersubjective unity and recognition of a common social space seem to arise only contingently. Different traditions and social groups arise contingently through history and unify themselves according to their own respective narratives, but apparently nothing requires of them an ultimate recognition of a universal social space. But the structure of we-saying and the recognition of a universal social space unified by we-saying are not contingent dimensions of language. They are transcendental presuppositions of discourse, and therefore are also necessarily presupposed by analytic and Continental philosophers in any engagement over their apparent division.

Peirce throughout the development of his philosophy emphasizes this point about the logical priority of the potentially unlimited community of inquiry to any apparent social and cultural division. Already in his early essay "On a New List of Categories" (1867) Peirce follows Hegel in the *Phenomenology* by developing an intersubjective version of Kant's unity of apperception. Like Hegel, Peirce does not dissolve the "I" in favor of the "we," but instead recognizes that because all thought is in language (or in signs), the unity of experience must always already be intersubjective. Ultimately Peirce identifies this unity of experience and thought with the community of inquiry, which he also identifies as potentially unlimited in space and time, and therefore radically inclusive. But the community of inquiry which includes the various individuals who can say "I" must ultimately be unified through the intersubjective, first person plural "we," which extends across cultures to all those who can participate within the evolving community of inquiry. Inquirers do not so much unify experience for the "I think," in Kant's sense, but instead unify experience with one another within the community of inquiry, presupposing (prior to subjectivity) a unity with one another, which Peirce in the "New List" calls the "unity of consistency in interpretation," and which is expressed with the "constant use of the word '*we*' " ("The Grounds of the Validity of Logic," EP 1:81 [1869]). This "we" is not a ghostly form hovering over language, as Searle portrays that idea in Hegel. Rather, for Peirce, following Hegel, one always already finds oneself and cannot find oneself anywhere but within this social space. According to Peirce (1865), this unity of consistency with one another within the community is simply what humanity is: "This consistent unity since it belongs to all our judgments may be said to belong to us. Or rather since it belongs to the judgments of all mankind, we may be said to belong to it" ("On the Logic of Science," Harvard Lecture 1, W 1:167). Peirce in "Some Consequences of Four Incapacities" (1868) even claims that the way in which we view language must be reversed: "Accordingly, just as we say that a body is in motion, and not that motion is in a body, we ought to say that we are in thought and not that thoughts are in us" (EP 1:42, asterisk footnote). Furthermore, the "we" is necessarily extended in time, as Peirce writes in "Some Consequences of Four Incapacities".

> When we think, to what thought does that thought-sign which is ourself address itself? It may, through the medium of outward expression, which it reaches perhaps only after considerable internal development, come to address itself to the thought of another person. But whether this happens or not, it is always interpreted by a subsequent thought of our own. EP 1:38–9

Peirce again connects the unity of intersubjectivity with temporality in "What Pragmatism Is" (1905).

> Two things here are all-important to assure oneself of and to remember. The first is that a person is not absolutely an individual. His thoughts are what he is "saying to himself," that is, saying to that other self that is just coming into life in the flow of time. When one reasons, it is that critical self that one is trying to persuade; and all thought whatsoever is a sign, and is mostly of the nature of language. The second thing to remember is that the man's circle of society (however widely or narrowly this phrase may be understood) is a sort of loosely compacted person, in some respects of higher rank than the person of an individual organism. EP 2:338

This temporal dimension of the intersubjective community is thus extendable into the future, without limits.

4. Apel's pragmatic "we" and the reconciliation of the divide

The German pragmatist Karl-Otto Apel develops a Kantian and pragmatist project which he calls transcendental semiotics, and identifies apperception and the intersubjective "we" with Peirce's final opinion of inquiry in the long run. The final opinion of inquiry in the long run is a subjunctive conditional such that if free and open inquiry were to go on forever, then what inquirers *would* agree to in the long run would be the truth. Apel sees Peirce as replacing Kant's subjective unity of apperception with an intersubjective unity of the community of inquiry grounded in the long run. Apel writes that Peirce "has to replace Kant's ultimate presupposition and 'highest point,' namely, *the transcendental synthesis of apperception, by the postulate of an 'ultimate opinion'* " (Apel, 1980, p. 104). The ultimate "we," then, is the "we" at the end of the long run (for Apel).

There are, however, two basic problems with Apel's view. First, it is circular: the unity of thought in the present depends on the long run, which, in turn, depends on the unity of thought in present. Second, the long run as an epistemic ideal is problematic, as W.V.O. Quine points out in *Word and*

Object: "There is a faulty use of numerical analogy in speaking of a limit of theories, since the notion of limit depends on that of 'nearer than,' which is defined for numbers and not for theories." Quine adds that even if inquiry were to go on forever, science provides no reason why one theory might be the "*the* ideal result." Rather, "[i]t seems likelier, if only on account of symmetries or dualities, that countless alternative theories would be tied for first place" (Quine, 1960, p. 23). Rorty also rejects the long run for its lack of clarity: "The Peircian redefinition, however, uses a term – 'ideal' – which is just as fishy as 'corresponds.' To make it less fishy Peirce would have to answer the question 'How would we know that we were at the end of inquiry, as opposed to merely having gotten tired or unimaginative?' " (Rorty, 1982, p. 131).

Despite these problems, Apel's view may be reworked and Peirce's transcendental and future-oriented "we" may be maintained without dependence on the long run. This view may also be defended using Apel's concept of the performative contradiction, partly derived from Jaakko Hintikka's concept of an existential inconsistency: "The inconsistency (absurdity) of an existentially inconsistent statement can in a sense be said to be of *performatory* (performative) character. It depends on an act or 'performance,' namely on a certain person's act of uttering a sentence (or of otherwise making a statement)" (Hintikka, 1962, p. 12). For example, one says "I am not speaking," or writes "I am not writing," or says "We are not together in this dialogue." One's claim and the action of the claim stand in a contradictory relation.

Three performative dimensions of we-saying unavoidably appear in any discursive engagement, for example, that between analytic and Continental philosophers who stand in opposition. First, any individual must always already presuppose the unity of the intersubjective space of discourse as encompassing potentially all other speakers and hearers, and which is unified through the first person plural perspective of we-saying. Any attempt to exempt oneself from this space or exclude another speaker from this space within dialogue remains mired in a performative contradiction insofar as that individual must presuppose an underlying unity of intersubjectivity while attempting to divide it along social or cultural lines.

Second, anyone must presuppose the triadic logical relative structure of discourse and thought, as Peirce developed it, following August De Morgan's view of the logic of relations. Peirce finds thought to operate especially according to the triadic logical relative, such as "A gives B to C" (a logical relative with three subjects). Murray Murphey highlights the change from Peirce's early to his later non-relative logic, but perhaps overdraws the implications for the general Kantian project of the "New List." "Thus the 'New List' collapses entirely once the new logic is admitted" (Murphey, 1993, p. 153). Peirce's Aristotelian logic gives way to relative logic, but this new logic by no means forces a rejection of the Kantian and Hegelian idea of a transcendental "we" (see Abrams, 2004). All thoughts ultimately presuppose this performative structure: *A* says *B* to *C*, and to attempt to refute this presupposition is, again, to performatively contradict oneself. For that negation must also be uttered using the same form it seeks to undermine, namely, *A* says *B* to *C*, and in saying *B* to *C*, *A* also acknowledges the intersubjective unity of *A* and *C* as "we." One cannot refute the necessity of using a triadic logical relative except by using a triadic logical relative. As a note, this form is also the logical form of Davidson's structure of triangulation.

Third, anyone must presuppose a transcendental determination in time forward into the future. Any attempt to reject this presupposition must also simultaneously presuppose that one and another are going on in time even as the refutation against temporality is uttered. This triangular and temporal first person plural perspective is also potentially unlimited in space and time. If one attempts to draw a perimeter around the dialogue, one simultaneously and performatively says to those members beyond that presumed perimeter that they are not participants. Yet, in making that claim to them, a speaker is, yet again, including them at a fundamental level, as those who can understand the utterance of exclusion. The structure of we-saying is fundamentally unbounded in space and time.

This view may now be applied to the division between analytic and Continental philosophy. As Rorty rightly acknowledges, a strong cultural division exists and has existed for some time, so much so that some like even Rorty suggest that analytic and Continental philosophy are unlikely ever to be reconciled. Perhaps, culturally speaking, the two traditions will remain opposed for many years, but there is no reason for that, especially considering what Rorty already lays bare as their common antireprentationalism and instrumentalism, but, more importantly, their common view of the intersubjective unity of thought. While either side may attempt to draw a rational perimeter around its tradition or its practice or its form of life, against the other side, that very act itself presupposes an underlying intersubjective, triadic relative, and temporally extended unity between the two traditions. In sum, each is implicitly and transcendentally committed to the same basic philosophical groundwork, and any fundamental division, or claim to incommensurability, may be ruled out of hand.

5. Colapietro's pragmatic "we"

Once the unity of we-saying is established, the next step in developing the project of a transcendental "we" is to develop the *transcendent* dimension of the "we." Kant in the *Critique of Pure Reason* distinguishes the "transcendental" as *a priori* (e.g., the pure concepts of the understanding) from the "transcendent" as beyond all possible experience (e.g., the noumena), but here transcendent may also be understood as referring to a projected future which transcends the present state of the community of inquiry. Peirce rejected Kant's view of the transcendent noumena, but he also developed a view of the community as intrinsically transcendent, and conceived that transcendence itself to be transcendental insofar as all thought transcendentally flows forward into the future: the community of inquiry, unified through we-saying, transcendentally (unavoidably) projects itself into the future. Peirce placed this view of the community as projected into the potentially unlimited future at the center of his pragmatism, and emphasized as well that the community evolves over time.

More recently, Vincent Colapietro who draws extensively on Peirce has also advanced this view of the transcendent structure of the "we" in his essay "Testing Our Intuitions: Pragmatist Deconstruction of Our Cartesian Inheritance":

> Such a position does not commit us to doing what we have always done; nor does it collapse into an insular 'we,' an unwitting relativism. What we are *doing* commits us to what we have not yet done. Who we are, though rooted in who we have been, commits us to who we are not yet now. Such transcendence of what we are doing and who we have been is, while finite, real and potentially ennobling.

Against any relativistic picture of the intersubjective "we" such as may be found in Rorty's neopragmatism, Colapietro articulates the "we" in its more (originally) pragmatic spirit, as the "we" that not only unifies the community of inquiry, but also unifies the past of that community with what it is becoming in the future. As evolutionary creatures, human beings within the unlimited community of inquiry evolve always with some historical understanding and possess the means to direct the future of that community. Human beings are changing beings with a self-understanding grounded in an evolutionary past, which is unavoidably pointed forward toward potentially even greater changes. But even as the community transcends itself into the future, this transcendence will simultaneously be "our" transcendence. All future evolutionary self-transformation will be always already apperceptively and intersubjectively "ours," and "we" will be the ones who understand ourselves as having undertaken great changes to the community, whatever they may be.[1]

References

Abrams, J. (2004). "Peirce, Kant, and Apel on Transcendental Semiotics: The Unity of Apperception and the Deduction of the Categories of Signs." *Transactions of the Charles S. Peirce Society: A Quarterly Journal in American Philosophy*, 40(4), 627–677.

Apel, K.-O. (1980). *Towards a Transformation of Philosophy*. Trans. G. Adey and D. Frisby. London: Routledge & Kegan Paul.

Brandom, R. (1994). *Making It Explicit*. Cambridge: Harvard University Press.

Colapietro, V. "Testing Our 'Intuitions': Pragmatist Deconstruction of Our Cartesian Inheritance." *Commens: Virtual Center for Peirce Studies at the University of Helsinki*. `http://www.helsinki.fi/science/commens/papers/intuitions.pdf`.

Colapietro, V. (2007). "C.S. Peirce's Rhetorical Turn." *Transactions of the Charles S. Peirce Society*, 13(1), 15–62.

Davidson, D. (2001). *Subjective, Intersubjective, Objective*. New York: Oxford University Press.

Foucault, M. (1972). *The Archaeology of Knowledge and The Discourse on Language*. Trans. A. M. Sheridan Smith. New York: Pantheon.

Gardner, S. (1999). *Kant and the Critique of Pure Reason*. New York: Routledge.

Hegel, G. (1977). *Phenomenology of Spirit*. Trans. A.V. Miller. Oxford: Oxford University Press.

Heidegger, M. (1996). *Being and Time*. Trans. J. Staumbaugh. Albany: SUNY Press.

Hintikka, J. (1962). "Cogito, Ergo Sum: Inference or Performance?" *The Philosophical Review*, 71(1), 3–32 .

Kant, I. (1965). *Critique of Pure Reason*. Trans. N.K. Smith. New York: St. Martins Press.

Lear, J. (1999). *Open Minded*. Cambridge: Harvard University Press.

Murphey, M. (1993). *The Development of Peirce's Philosophy*. Indianapolis: Hackett Publishing.

Quine, W.V.O. (1960). *Word and Object*. Cambridge: MIT Press.

Rorty, R. (1979). *Philosophy and the Mirror of Nature*. Princeton: Princeton University Press.

[1] I am very grateful to Elizabeth F. Cooke, Sami Pihlström, Henrik Rydenfelt, and the participants of the "Peirce's Epistemology" session at the *Applying Peirce* conference at the University of Helsinki (June 13, 2007). I am also very grateful to Vincent Colapietro and an anonymous referee for valuable comments on an earlier draft of this essay.

Rorty, R. (1982). *Consequences of Pragmatism*. Minneapolis: University of Minnesota Press.

Rorty, R. (1995). *Contingency, Irony, and Solidarity*. Cambridge: Cambridge University Press.

Rorty, R. (1998). *Truth and Progress: Philosophical Papers*. Vol. 3. Cambridge: Cambridge University Press.

Searle, J. (1998). *Mind, Language, and Society.* New York: Basic Books.

Reflections on Practical Otherness: Peirce and Applied Sciences

Ivo Assad Ibri
Pontifical Catholic University of São Paulo

1. Introduction

By *practical otherness* I mean a special case of Peircean category of secondness given in the realm of phenomena of applied sciences, the kind of sciences that according to Peirce have practical ends. In general terms, the experience of otherness is one of the most important for the growth of knowledge being, at the same time, the phenomenological basis for a *relevance criterion* for the choice of the theory that can better represent some sort of phenomena.

An applied science like engineering, particularly when dealing with design and monitoring of physical objects, shows in its activities how *practical consequences* – the famous expression of the *pragmatist maxim* – can be understood totally based on the possibility of *practical otherness*. Furthermore, pragmatism is a way not only for reading the connection between theory and experience but, above all, for demanding an essential commitment between both. Peirce's theoretical system also furnishes the ground for reading indeterminacy as much in theories as in real objects. This *conceptual symmetry*, let me here adopt the expression, is in fact a consequence of the symmetry of Peircean categories, and established epistemologically by *Fallibilism* and ontologically by *Tychism*. This indeterminacy can be estimated with experimental data, and decisions can be taken despite the congenital uncertainty that rules all sciences.

Regarding the experiential ambience, it is important to remark that applied science has some advantage over theoretical sciences: its experimental field is entirely open to observation, as its objects need to work anyway. They are practical objects with practical ends and, being so, they continuously are tested by their users. Despite being designed by men under well-known theories and technology, they potentially keep, nevertheless, their *practical otherness*: the theory prediction must be harmonious with their observable performance or, otherwise, be denied by it. Their performance affects theories, and even *normal technology*, as extended from *normal science*, here and there deals with surprising facts, demanding an effort to guess what is going on with the possible disagreement between prediction and experimental data. Under the point of view of Semiotics, the practical scientist keeps a dialogue with the objects of design through the analysis of its performances. To call the interaction between theory and experience a *dialogue* is possible mainly due to Peirce's realism, reflected, of course, in pragmatism as a spreading rule for meaning, viz., surpassing the domain of mere subjectivity.

Let us take for granted that all the assumptions of Peirce's epistemology are deeply connected with his conception of science. This conception brings somehow an ethical commitment that cannot be surprising to anyone who is aware of his classification of sciences. The three steps of inquiry, namely, abduction, deduction and induction, will be effective as if they could work by themselves, if some ideal condition could be filled out. The main condition will be a sincere search for truth, free from other interests potentially strange to this aim. Science taken generally, therefore and consequently, shall have one basic aim, namely, to represent the best it can the universe of a dynamical and evolutionary reality. This being the case, no other goal should interfere in the science path throughout its main end, viz., to achieve truth.

2. Reflecting on Peirce's considerations of applied sciences

My concern here is to reflect on the following questions: would the epistemological dimension of science be free of that ethical commitment just mentioned in the latter item, as the three steps of inquiry seem to be indistinctly applied to any kind of object? In this case, could this application of the method of inquiry not be called a science? In other words, science would be such if only it really follows a sound ethical end? These interesting questions seem to require, first of all, what distinctions could be made between *Pure* and *Applied* Sciences, as the latter, given its own nature, could not obey that demand of being only a disinterested search for truth.

Other subsidiary questions will also appear along this investigation, such as 'could Applied Science be equivalent to Technology?' and 'what is the difference between Technology and Technique?' Such secondary questions regarding the main ones will deserve clarification in order to refer our reflection to a univocal terminology, despite the fact that they are far from a conceptual agreement among researchers.

2.1. The nexus with Peirce's pragmatism

On the one hand, Pragmatism, in its function of clarifying concepts, could be, we believe, the proper criterion to make the retro-mentioned concepts clear and distinct. On the other hand, the steps of inquiry, exactly as formulated by Peirce,[1] also seem to be an interesting basis for reflection. We know the complexity of the concept of Science in Peirce, not only for its conceptual scope, but also for its ethical dimension, for its bond with Esthetics, for the means through which it outlines itself under the logical forms of reasoning – in sum, for its dependence on the Normative Sciences – besides its interlacing with the Categories and with the fundamental concept of Community in his philosophy.

Conversely, given this complexity, which has certainly required much of Peirce's attention, it seems to me that he concentrated less on the clear formulation of the concept of Applied Science and even Technique. Only exemplarily, it's worth remembering that the word *technique* appears only twice in the eight volumes of the *Collected Papers*. The word technology, not once.[2] Certainly it had no highlighted meaning in his time, nor the same power and importance it acquired later or today. The rapid pace of post-war industrialization was a historical phenomenon Peirce did not experience the mass production of objects, directly linked to technological development, nor was it the object of his reflection. However, it was quite clear to him that the Applied Sciences' goal was to serve human needs. In Beverley Kent's classic work, there are interesting passages on the Practical Sciences in Peirce:

[1] As already mentioned, abduction, deduction and induction.

[2] According to Harper (2001), the term technology was coined in 1615, and it means "discourse or treatise on an art or the arts," from *Gk*. tekhnologia "systematic treatment of an art, craft, or technique," originally referring to grammar, from techno + logia. The meaning "science of the mechanical and industrial arts" is first recorded 1859. High technology attested from 1964; short form high-tech is from 1972. Tech as a short form of Technical College (Institute, etc.) is American English, attested from 1906.

> While the practical sciences do seek to discover truth, they differ from the heuretic sciences because their investigations are directed towards satisfying some definite human want. Kent, 1987, p. 82

and,

> Practical sciences seek to satisfy human desires. They take the systematic statement of discovery, supplement it where necessary, and make it available for application to areas in which it is expected to have some utility... Although he formulated a very considerable classification of the practical sciences, he regarded it as one of his failures.
> Kent, 1987, p. 131

Kent (1987, p. 189) furnishes a good synthesis of Peirce's considerations concerning the Applied or Practical Sciences:

The task of the third major division of the sciences is to discover truth for some defined human need, although the researchers themselves may not be involved in the practical application of their investigations. Peirce noted that this group of sciences attracts significantly more scholars than the previous groups. While these disciplines primarily involve reasoning and related operations, an enormous number of facts not previously assembled, must be collected also. These facts concern either the want that is waiting to be satisfied or the physical means for its implementation. Although they are bound to make their own observations and amass their own data, the practical scientists are quite dependent on the discoveries of the heuretic science.

There is, in Peirce's thought, a care for distinguishing Heuretic Sciences from Applied or Practical ones, and, on certain occasions, he seems to cherish a kind of disdain for the latter, in such a manner that their *vital ends* characterize a channeling of the research for the solution of man's current problems (see Hookway 2002, pp. 21–22, 228). Unlike these interests, Pure Science ought to be based, according to Peirce, on the instinctive impulse toward the truth, freed from the practical character of its results. Concerning this aspect, we will comment on it in the conclusion of this paper.

From an epistemological point of view, we will point out further on the utmost importance of these practical purposes in Applied Sciences for human needs, especially regarding the speed of incorporation of new theoretical models and diffusion of knowledge.

It is important that we give, here, a more accurate and detailed definition of Applied Sciences, Technology and Technique, for these concepts are, oftentimes, deemed alike.

It seems proper to say that Practical or Applied Sciences, doubtlessly directed to human needs, involve the research of theoretical models and the retroanalysis of experimental data and, for this very reason, constitute reflexive intellectual urging in the Peircean pragmatic sense, which, as we know, cannot be confined merely to the realm of particular objects. Concerning this issue, it is worth referring to two classical passages of Peirce's Pragmatism:

> Action wants an end, and that the end must be something of a general description, then the spirit of the maxim itself, which is that we must look to the upshot of our concepts in order rightly to apprehend them, would direct us towards something different from practical facts, namely, to general ideas, as the true interpreters of our thought. CP 5.3

and,

> Pragmatism is a correct doctrine only in so far as it is recognized that material action is the mere husk of ideas... But the end of thought is action only in so far as the end of action is another thought.
> CP 8.272

The expression *practical consequences*, present in the Pragmatism maxim embodies, in light of this reflexivity concept, the need for the *continuum* to configure itself as *discontinuity* for a subsequent return to its genuine eidetic realm. Well then, seen from this vertex, *Practical* will mean passing through the discontinuous, where the otherness required for the improvement and growth of the representation effectively lies.[3]

It is also interesting to point out that this passage through the discontinuous is the manner through which the theoretical sphere *appears*, that is, has phenomenologically experienceable consequences. The semiotic dialogue, needed for the establishment of semiosis, i.e., of the cognitive function, requires the *practical* as experienceable aiming at the universal validation of the theoretical instance.

Technology, in turn, can be considered, parodying the Kuhnian concept of Normal Science, as a Normal Applied Science, that is, that activity that, through a technique, puts into practice theoretical models that have already been tested or parametrically reformulated in a reflexive manner from experience.[4] Lastly, Technique would comprise all practical proceedings that enable technological knowledge in the form of the creation of

[3] In Ibri (2001) I considered this point in detail.

[4] It is left for us to clarify what constitutes experience in technology. We will return to this question.

objects. Technology and technique differ: while the former is theoretical-practical knowledge, the latter is confined solely to practical knowledge. Technological activity possesses theoretical models for the reading of experience and, thus, can always see it under a more general view, shaping its conduct in light of these models. Technical activity is the upshot of successful practices and, for this very reason, possesses a reduced power of generalization. When its habits are broken by failure, it can hardly mobilize resources for a reflexive analysis; all it can do is simply exclude that failed case from the list of successful samples it has and which it always seeks to imitate.

Technique accomplishes; technology plans such accomplishment and knows how to justify it in light of already tested theoretical-practical models. Applied Science solves the problems brought by technological practice in its normal activity, proposing new interpretants to be tested.

2.2 What, after all, is experience in applied sciences?

According to Peirce, as we know, Applied Sciences have practical ends, which are to produce objects for human utilization. Its ground, according to him, is in the Heuretic Sciences or Sciences of Discovery. In Civil Engineering, for example, the last theoretical basis of part of its models is to be found in Rational Mechanics, the general science of the equilibrium of solid systems.

As Applied Sciences, such as engineering particularly, aim at producing objects for human purposes, and since such objects once built are submitted, not to the experience imposed by those who have conceived it, but by those who will use them, we may say that the experimental field of these sciences is constituted by the performance of the objects it creates. The verification of the truth of its theories is not constituted by experimental results only, but by performances. The objects will *speak* for themselves, when inquired by a technological activity to monitor their performance. However, not only so: those who utilize them *will tell* whether they do or do not serve their purpose. It is worth mentioning that this objectual field is, due to its very nature, *public*. Nevertheless, it must be highlighted that it will not be of any interest for the retro-analysis of the Practical Sciences all that, out this human testimony, refer solely to variables that effectively concern market sciences. This retro-analysis, of an exclusively epistemological nature, aims at proposing new theoretical-practical models – or reparameterizing old ones – thus endowing technology with new efficient procedures.

We may say that Applied Sciences are, for the reasons stated, intensely dialoguing, evidently semiotic, demarcating its growth and learning in this circulation of signs that causes the intense and pragmatically reflexive interaction among its particular and general instances. We ought to bear in mind that the truth of the theories that are practical in character is made patent in a much faster pace than that of the merely Speculative Sciences or those without practical purposes: in the latter, often, the experimental field is extremely complex and burdensome, and many theories remain, for years, strongly hypothetical, due to the difficulty of their experimental verification.

In the realm of technology, the conception of a new object will begin with a project. But what is a project? It is, in fact, the most genuine semiotic kind of knowledge in its '*esse in futuro*', namely, in its predictive expression. We could say that a project is a virtual object described according to laws that will rule the real object in the future. Keeping its general symbolic character, it bears the icon of its replica as Secondness in the form of a hypoicon. The designer has high hopes for his project and knows that it will only be possible if the laws provided in it according to the best theories, represent, in an approximately true manner, on the one hand, the laws that rule the behavior of the material components, and, on the other, those that rule the performance of the object that will be built. Incidentally, one must decide many times during project design, which theories must be chosen among those available for each case. There is, here, evidently, a tacit realism adopted by the designer. From this Realism depends all the possible justification of the prediction success. This is a key point among Peirce's arguments in favor of his Realism: the conditions for the future representability of the sign in relation to its object lie, simply, on the reality of the *continua* of Thirdness, viz., on the hypothesis of a realism of the laws. It is not only the case of adopting a theoretical stance here, but to answer factually for such stance, once the objects of the Applied Sciences are right here and will be, in their most genuine Secondness, in their *practical otherness*, as a *consequence* of how it has been represented. Furthermore, we believe such conditions to be valid not only for the project of a bridge but also for a piece of furniture, for a machine or for medicines.

We must consider, then, this potential *continuum* of the insistence of the object against the set of presuppositions with which we conceived it. The generalized and generalizing evidence of Thirdness that rules it, typical of Applied Sciences, is in fact the most plausible justification of the naturally regulating Realism of the scientists' expectations.

The object, once made, though it might have been according to the project, will be judged in light of three basic parameters: its structural performance, directly related to its safety, its durability and functionality. Such parameters constitute the continuity of the phenomenical field, according to laws in Applied Sciences, and will be, according to their performance, permanently defying a theoretical retro-analysis. Much to the contrary, in a Science of Nature, especially those whose objects are difficult to access experimentally, it is important to notice that such objects are not apt to directly affect our human conduct.

There is a field of pragmatic meaning in Applied Sciences within which a semiotic dialogue is drawn between the interpretants of the scientist, of the users of the object, and of the objects themselves – these *interpret* the actions they will be submitted to, according to the laws that rule them. The users are, in turn, those who will *interpret* the efficacy of the purposes those objects ought to serve. Both, objects and users, constitute the *practical otherness* with which the scientist will have to permanently confront himself. Practical otherness is forcibly experimented as the upshot of the Applied Sciences activity. In non-applied sciences it is presupposed as the necessary theoretical requirement for the logical truth of theories – the otherness of its objects will only be able to manifest itself as the investigation proceeds.

We do not deem it proper to consider this tacit realism assumed by Applied Sciences as naïve. It is not the case of a scientist who, unconscious of the vicissitudes of philosophical skepticism, would assume a metaphysics of the universals without any criticism since, while inquiring on a natural object, would not even think how impossible it is to infer the need of the space-time continuum for the properties he has discovered. On the contrary, he believes that he will be submitted to the semiotic criticism of a future *practical* otherness coming from the performance of the object and the judgment of its users, concerning the efficacy of the purpose.

One may think that, once the objects have been devised by means of projects, they somehow impose their form, along with their behavior and according to laws and targets, such that the general instance is only in the sphere of language, characterizing the most common kind of nominalism. Much to the contrary, since practical otherness imposes, as we have mentioned before, a constant dialogue with the object of these sciences, characterized by the continuous reflexive activity of retro-analysis, the scientist expects his actions – through technology and technique – to be efficient according to laws which rule the conduct of the objects. *Tense* Secondness, so to speak, needs to be represented so that its impending *brute force* is overcome by mediation. Such *tension* is immediately reflected in the Thirdness of Science: a mistake in the diagnosis, be it, for instance, medical in nature, or concerning the real safety state of a civil engineering structure, may cause the most undesirable consequences. Here, the *telling* has an ethical commitment with the *doing*. And such responsibility can only be undertaken in light of a Realism that allows the efficiency of the semiotic dialogue of the physician with the symptoms of the body of the patient, or of the engineer with the symptoms of a structure. In both, behind the indexes of factuality, there must be *real* symbols that mediate the conduct of the object, making that dialogue possible. The hope of the scientist is, always, that the object of his investigation also *speaks* his language. In fact, such hope only seems to consummate itself under the hypothesis of Realism.

2.3. The implicit fallibilism in applied sciences

Besides the mistaken supposition that the practice of the Applied Sciences is nominalistic, it would be natural, also, to think that the objects must behave *without deviation* in relation to what a project proclaims. Let us not forget, however, the *tense* practical otherness constituted by the performance of the objects, many times far removed from what was thought of it. In civil engineering, for example, the theoretical models for design are probabilistic or semi-probabilistic, owing to the probabilistic behavior of the materials, structure and actions that affect it. Structures are designed by adopting the so-called *safety* ratios whose purpose is to minimize the risks of a possible, although scarcely probable, incidence of random variables in simultaneous combination with rare events. Besides this evident admission of chance acting in the sphere of the object, there is, in these models, the implicit acceptance that human action, be it during the project design, or in the making of the objects envisaged, may fail, due to the inadequacy of the immediate object to the dynamic one, characterizing the project, thus, as a bad representamen of the real object.

For this very reason, many of these structures, after having been built, are permanently monitored, in a manner of confrontation of the theoretical premises that have guided the design with the real behavior of the object.

Exemplarily, it can be mentioned that large structures conceived with new theoretical premises are frequently monitored through highly precise electronic and mechanical instrumentation. The theoretical curves of the predicted structure behavior, based on the premises adopted by the project, are confronted with the experimental data of displacements and deformations obtained through the instruments. In an applied way, this is what Peirce means by the *esse in futuro* of the theories: the confrontation of the prediction with experience as a validation criterion of these very theories.

As an analysis criterion, when the theoretical curves are very close to the experimental ones, one may conclude that the structure was correctly built, according to the project, and, mainly, the theoretical premises represent the real behavior parameters. What is worth noticing is that the differences between the theoretical and experimental curves, despite the fact that they indicate the same tendency of behavior, and this is enough to support the interpretants of the monitoring process, are due to chance factors that affect the real object, thus undeterminable in the ideality of the theoretical model. The awareness of scientific fallibility is able to accept the natural and expected dispersion of experimental results. For no other reason, Fallibilism, under an epistemic bias, and Chance, through an Ontological one, are correlate concepts.

3. Conclusion

The semiotic dialogue with the designed object is only possible if general logical structures guide its performance. In this case, the common language between sign and object is constituted by general systems of relations: on the one hand, theories; on the other, laws, in a form of necessary acknowledgment of Peirce's Realism, as mentioned before. Thirdness needs to be symmetrical, and under this hypothesis, it is feasible to explain the reason for the affection of theoretical symbols by experimental indexes. I believe that Realism finds itself in a more comfortable logical situation to justify why the last word is given to the particular, when it comes to validate, or not, the general.

As aforementioned, the fact that an object has the *geometrical form* predicted in the design does not mean that it possesses the same *logical form* of that project. Parametric variables associated to a proper dispersion of the used material will influence in the structure behavior, as well. Major discrepancies can and often occur. The performance of the object will show its practical otherness, its Secondness, which will allow the recalibration of the parameters or refinement of the models. The continuum of the future performance will show, or not, the correction of the new adopted model, in a process of improvement of the interpretants of that science.

As all sciences, applied ones grow and assimilate new knowledge thanks to the anomalies of behavior. In the occurrence of unexpected behavior of the object, and even in accidents with harmful consequences, opportunities for great learning arise. Area-scientists seek plausible explanations in processes involving the raising of hypotheses, which must be tested for confirmation. All kinds of research need a theoretical model as a criterion for relevance. That is why every research ought to start with Abduction.[5] Applied Sciences evolve under the same reasoning processes that guide Heuretic Sciences, according to the nomenclature bequeathed by Peirce, and, as abductions are abundant and extremely necessary in Applied Sciences, it seems to us that they should also be reconsidered under their tremendous heuretic power.

For this reason, some questions that demand reflection posit themselves. All the supposed inferiority of Applied Sciences – in relation to Heuretic Sciences – lies, it seems to us, on the meaning of the word *practical*, still carrying the stigma of *useful* – a *practical* end would be a *utilitarian* end – while, as a matter of fact, practical ought to mean *experienceable*, in such a manner that one may consider the maxim of Pragmatism as a valid rule for meaning also within Applied Sciences, in tune with Peirce's criticism of the improper appropriation of this maxim by the utilitarianism.

Yet, to us, the question seems to be an ethical and not an epistemological one. What to do with knowledge and how to be faithful to the truth of the facts to the detriment of interests foreign to Science itself, whether practical or not, is a problem concerning what conduct to adopt in light of certain values one considers communitarily admirable, free from sectarian interests. From this point of view, it seems false to us to impose a connate distance between Heuretic and Practical or Applied Sciences, regarding its logical structure and the sound ethicity of its ends. To condition scientific investigation, regardless of its nature, whether theoretical or practical, to the purposes intended, reveals an interference of power instances foreign to scientific procedures, misrepresenting them as such.

Under this prism, the philosophy of Peirce enhances a rereading of the misunderstandings of our culture, of our relation with Nature, of our anthropocentric tradition, which stimulates asymmetric, dualistic stances, whether from the point of view of knowledge or from an ethical vertex. Reforming our worldview should imply, pragmatically speaking, reforming our conduct, and, thus, judging Practical Sciences under their potential

[5] Abduction is emphasized as the starting point of every inquiry in connection with deduction and induction in Ibri (2006).

nature for epistemic discovery, distilling, from scientific activity, those decisions that are ethical in character.

The recent awareness in the community of man concerning the need to save our Planet, as a vital undeferrable goal, has provoked, along with it, reflections on the aggression of our civilization to Nature, an awareness of this asymmetry of rights to which, for centuries, we have related. Would not this asymmetry have a conceptual debt with anthropocentric philosophies, and with what Peirce named an *ethics of greed*? In this vital mission, it is clear that one cannot do without Applied Sciences and their twin sisters, Technology and Technique. I believe that philosophy owes them better epistemic justice, aware, also, of the necessary separation between *knowledge* and *uses of* knowledge, between the meaning of power as a verb, and the meaning of power as a noun.

References

Harper, D. (2001). *Online Etymology Dictionary*. Retrieved May, 7, 2007, from `http://www.etymonline.com`

Hookway, C. (2002). *Truth, Rationality and Pragmatism – Themes from Peirce*. Oxford: Clarendon Press.

Ibri, I. A. (2001). *Sobre a incerteza*. Trans/Form/Ação, 23, (Marília, SP: EDUNESP), pp. 97–104.

Ibri, I. A. (2006). "The Heuristic Exclusivity of Abduction in Peirce's Philosophy." In R. Fabbrichesi & S. Marietti (Eds.), *Semiotics and Philosophy in C. S. Peirce*. Cambridge: Cambridge Scholars Press.

Kent, B. (1987). *Logic and the Classification of Sciences*. Kingston and Montreal: McGill-Queen's University Press.

Problems in Applying Peirce in Social Sciences

Erkki Kilpinen
University of Helsinki

1. Introduction

A curious paradox inheres in Charles Peirce's relation to the social sciences. He is one of the most social of classical philosophers, if not the most social, one who can go so far as to claim that "individualism and falsity are one and the same" (CP 5.402 n2 [1893]) or that "logic is rooted in the social principle" (CP 2.654 [1878]). However, the science that de facto studies human beings' social relations, sociology, has remained an unmapped area in Peirce's otherwise so all-embracing purview of human intellectual endeavours. As his reputation has spread in recent years, it has reached also sociology, and today some sociologists are turning to him in search for theoretical inspiration. However, as he never said anything substantial about this discipline,[1] he is also a very Delphic guide in this domain, one whose pieces of advice demand a great deal of elucidation. I begin with a brief demonstration of how Peirce's very scarce sociological observations allow contradictory interpretations. After this, I give a quick resume of how his thought has so far been applied to sociology, and then, in the main part of this paper, I put forward my own opinion about how it could be used in dealing with the *conceptual foundations* of sociology and other social sciences. In particular, I wish to show that Peirce's philosophy has some new things to say in regard to the hoary question of what human rationality is

[1] All rules have their exceptions. Peirce was familiar with the work of his contemporary compatriot sociologists, Lester Ward and Franklin Giddings, reviewed it, and in personal correspondence with the two also touched on substantial issues. Peirce also held Ward in high intellectual esteem.

all about. I take the same course that the history of sociology has originally taken, by first taking critical issue, with the help of Peirce, with neoclassical economics, and then show how this *Auseinandersetzung* can yield conclusions that are also of relevance for theoretical sociology and its problem of rationality. In further likeness with the history of sociology (cf. Joas, 1996, ch. 1), I use the general interpretation of human action as the catalyst with which the relations between the various social sciences are to be sorted out.

As the relations between various sciences were of special interest to Peirce, it is understandable that he sometimes mentions sociology. However, the occasions when he looks behind this name and tries to see what this field of study is all about are rare. In a brief sketch for a history of science, *From Copernicus to Newton* (MS 1337), he presents one of those enumerative "orders of science" that he was fond of, and enumerates a part of it as follows:

> Still more special combinations or structures are communities or societies of conscious beings especially men; and sociology must be reckoned as the seventh order of science. It has two main branches, the first relating to conduct in general, the second to intercommunication. The first branch includes ethics, theology, politics and law. The second branch includes the theory of art and sciences of language.
>
> HP 1:148

This arouses ambivalent feelings in a reader who is familiar with theoretical problems in sociology. Peirce's conception appears at first glance deceptively modern, with communication, politics, law and language as objects for sociological study. On the other hand, his expression "communities or societies of conscious beings, especially men" reminds a modern reader also of something else, about the unproblematic manner in which the entomologist Edward O. Wilson (1975) drew parallels between human societies and other kinds of societies in his suggested synthesis for sociobiology. Precisely those sociologists who would welcome language, communication and politics as themes would be abhorred by the idea of comparing human societies with those populated by non-humans.

Accordingly, brief summaries like this do not suffice to make clear where Peirce's ideas are of relevance for social disciplines and where they are not. There is a body of literature that previously has tried to answer this question. Within that literature, some have used Peirce for substantial purposes, some have approached him more from a meta-theoretical viewpoint, and as I now turn to that literature, I divide it into three thematic groups. As I see things, Peirce has previously been applied to sociology and social theory[2] from three different viewpoints:

(i) as a counter-example to modernism;

(ii) as a theorist of the human self; and

(iii) as a realist counter-example to critical realism.

Let us take a look at these viewpoints in closer detail.

2. Some previous attempts to apply Peirce in sociology and social theory

(i) Peirce as a counter-example to modernism

"We have never been modern," is the famous slogan of Bruno Latour (1993), the French sociologist of science and a sort of semiotician in his own right. Those social scientists and philosophers, who take inspiration from Peirce while considering modernity, maintain that though we have been modern, this was not any foredoomed cultural fate. An alternative has been available all the time during the course of modernity, and Peirce's philosophy is one example of it. This is the leading idea in the social treatises by the Midwest sociologist Eugene Halton (1995; Rochberg-Halton, 1986) – and philosophers and historians of ideas like Hoopes (1989; 1998), Deely (1994; 2000), Neville (1992) and Ochs (1993) are other relevant names. At their best, these works show sophisticated sociological insight. However, what they actually manage to contribute to is that field of study, for which even English-speaking scholars often use its German name, *Zeitdiagnose*, diagnosis of one's own time. When the German sociologist Ulrich

[2] In choosing examples for closer inspection, I use awareness of semiotics as a criterion, and thus leave out some earlier treatments of Peirce in sociology. The first systematic sociological discussion of Peirce apparently occurs in the radical dissident sociologist C. Wright Mills's 1942 dissertation, posthumously published as *Sociology and Pragmatism: The Higher Learning in America* (Oxford University Press paperback edition, 1966). That work testifies to Mills's intellectual precocity, but its interpretation of Peirce follows the footsteps of the 1930s logical positivists, and thus misses semiotics. A generation later, J. D. Lewis and R. L. Smith rely heavily on Peirce in their *American Sociology and Pragmatism* (1980), but are not able to distinguish between semiology and semiotics, and accordingly drift onto false tracks. Jürgen Habermas's *Knowledge and Human Interests* (originally of 1968; new English translation 1987) I would classify as a philosophical rather than as a sociological work, although its sociological influence has been considerable. Habermas has since then admitted that lack of knowledge about semiotics made him give an excessively positivistic depiction of Peirce in that work.

Beck (1986/1992) some twenty years ago became internationally famous by claiming that modern society is essentially a *risk society*, he was making a diagnosis of our time, and quite an apt one, many people would say. As for Peirce, he sometimes exercised *Zeitdiagnose* himself, as he lamented, for example, how political economy seems to legitimize universal selfishness, the opinion expressed in his famous essay "Evolutionary Love" (1893; republished in CP 6.287-317 and EP 1:352-371).

However, while most sociologists would agree that *Zeitdiagnose* is a genuine part of sociological theorizing, few would take it as a central or the most important part. For another thing, it needs to be pointed out already at this early stage that those negative opinions that Peirce brings out in "Evolutionary Love" are not his final word about political economy or economics. On other occasions, he said something beyond mere ideology, something that has even analytic value. The above 'anti-modernist' body of literature shows close faithfulness to Peirce, but does not quite take modernity as a fait accompli (cf. Mazlish, 1989). Peirce may be a counter-example to modernism, but this does not yet tell what social-scientific relevance his philosophy may have.

(ii) Peirce as a theorist of the human self

Two famous sociologists, Norbert Wiley (1994) and Margaret Archer (2003) have used Peirce in an attempt to enrich current sociological theory with his ideas, drawing particularly on his notion of the human self. Self or subjectivity is a very hotly debated theme in sociology, so it is no wonder that even Peirce's rather brief and scattered remarks about it have stirred some interest. His conception of the 'self,' however, is not of any ordinary variety; it is semiotically constituted, in other words, mediated by signs, and this has escaped these authors, despite the fact that Wiley's book is entitled *The Semiotic Self* (1994).

Wiley, however, has committed a tragicomic blunder. He has managed to pinpoint the one and only non-semiotic part in Peirce's literary corpus, those earliest (early 1860s) extant manuscripts that were published for the first time in the first volume of the *Writings* edition (1982). In them Peirce uses an expression consisting of pronouns, *I – It – Thou*. Wiley thinks, as is prima facie understandable, that these terms refer to Peirce's self-theory, as other pragmatist philosophers use such pronouns in that sense, like William James (1890) and George Herbert Mead (1934) do with their *I/Me* distinction.[3] But it is not so; those passages were written while Peirce was just beginning to outline his semiotic theory (and his theory of the self), and their intended purpose is *logical*. In them Peirce is performing his famous feat, reducing Kant's twelve-term table of categories to his own basic three, those which later on assumed the laconic names, "firstness", "secondness" and "thirdness" (cf. Esposito, 1980). Accordingly, the tuistic expression, i.e., usage of I/you terms, later on completely vanishes from Peirce's usage, after it has performed its ancillary work (cf. Habermas, 1995). In his mature philosophy he does discuss the human self, but not by using tuistic expressions or ideas.

As Archer (2003) draws on Wiley's (1994) preceding work, these errors multiply further. The two authors argue to opposite effects, however, so that Wiley proposes a unification of the self-theories of Peirce and Mead, whereas Archer wishes to purge sociological theory of the detrimental effects of Mead's influence (as she thinks), and attempts to use Peirce's self-theory as a neutralizer. She thinks that Mead's self-theory is excessively social, but Peirce's is free of that fault, so that "The Peircian 'Me', as the personal conscience which is regularly consulted, is thus very different from Mead's 'Me', as 'the generalized other' " (Archer, 2003, p. 73). I have discussed Peirce's and Mead's respective self-concepts and argued that they amount to more or less the same thing, so that Peirce also does recognize the presence and importance of the generalized other. The only difference is that "man's circle of society [as] a sort of loosely compacted person" (Peirce CP 5.421 [1905]) is not as laconic an expression as Mead's "generalized other"; but it does refer to the same phenomenon (Kilpinen, 2002). As for Archer, her search for an irreducible, non-social core in the human self cannot receive support from Peirce's side, because his unshakable position is that "all thought is in signs" including also thoughts about one's self; they are mediated by signs. In fact, this is just the same idea that is behind Mead's *I/Me* distinction, the idea that one can *know* one's self only *as mediated*, as a 'me'. (For a more detailed criticism of Archer in this respect, see Gronow, 2008.)

(iii) *Peirce as a counter-example to critical realism*

The Copenhagen sociologist Margareta Bertilsson (2004) uses Peirce's philosophy to assess critically the theoretical movement that in current so-

[3] The *I – Thou* distinction in Martin Buber's philosophy of theology is yet another well known example of such a division in self-theories.

cial science is known as critical realism. This movement, originating in the work of the philosopher Roy Bhaskar (1979) and carried on by various followers, has been dissatisfied with the dominating interpretive approaches to social science proliferating today, and has searched for an alternative, in both sociology and economics. Most interestingly, as Bertilsson shows in her article *The Elementary Forms of Pragmatism* (2004, see also Bertilsson, 2009), critical realists have in their project even appropriated some ideas from Peirce, particularly his idea about abduction as the third basic mode of logical inference (Bertilsson, 2004, pp. 385–6.). This, however, is not as welcome as it might seem at first blush, as Peirce and the critical realists understand the character of scientific (and human) inquiry differently, though this is not quite obvious at first sight. As Bertilsson maintains (pp. 385–6), the critical realists' conception of inquiry is an impoverished and more schematic version in comparison with that of Peirce's, all things considered.

I support Bertilsson's argument that critical realism is not realist (or critical) enough, if evaluated by Peirce's criteria. But if so, then her argument can be strengthened by pointing out that abduction is not even the only mode of truth-advancing logical inference that Peirce has introduced. His conception of 'theorematic deduction' (see below) takes the idea of truth-advancement even further. Bertilsson also maintains (p. 388 fn. 2) that "Peirce made the 'linguistic turn' well in advance of both Wittgenstein and the post-modernists,", but strictly speaking this is not true, and does not advance the Peircean case in social sciences. Richard Rorty (1982) already took Peirce as a forerunner of the linguistic turn and simultaneously committed the error of not seeing (Bertilsson is ambivalent on this) that linguistics and Peirce's semiotics are at completely different levels of generality, so that linguistic affairs, important though they are, constitute only a tiny sub-domain in the problem field of semiotics. There is a turn in Peirce's development, but it is of semiotic nature (Bergman, 2004), and it constitutes a more comprehensive meaning-theoretic upheaval than any linguistic turn (for a similar point concerning pragmatism in general see Hildebrand 2004).

In sum, what seems to hinder the advancement of Peircean ideas in social sciences is that the thoroughly semiotic character of his philosophy has not been realized. In what follows, I try to avoid that error and argue where Peirce's social-scientific relevance actually lies. I think that it lies in his new, process conception of action, and in his new conception about the role of rationality therein, a conception that is more dynamic than previous alternatives. Moreover, I think that the best course to approach Peirce is to begin in such a problem field where he *has* said something substantial, and this, so far as social sciences are concerned, is not sociology but economics.

3. Peirce on the problem field of social science

In the early 1890s, having lost his job at the U.S. Coast and Geodetic Survey, Peirce tried to concentrate on philosophy and drafted various plans for works to be published. The most gigantic of them was no doubt an intended 12-volume series, *Principles of Philosophy, or Logic, Physics and Psychics, Considered as a Unity, in the Light of the Nineteenth Century*, for which he printed an advertising prospectus in 1893. The eighth planned volume was intended to treat "Continuity in the Psychological and Moral Sciences", or the social sciences, as we would say today, and its contents Peirce sketched in a telegram-like staccato language as follows:

> Mathematical economics. Precisely similar considerations supposed by utilitarians to determine individual action. But, this being granted, Marshall and Walras's theorem leads to a mathematical demonstration of free will. Refutation of the theory of motives. The true psychology of action expounded. HP 2:1115 [1893]

I propose that the best course in trying to deconstruct this list of topics, which despite its brevity titillates a social scientist's imagination, is to begin from the end, "the true psychology of action". The reason to take that course is that Peirce has, if not quite expounded, at least made clear what such a psychology would be like.

He expressed his opinion in a review on a new edition of Wilhelm Wundt's *Principles of Physiological Psychology*. The following words do not paraphrase merely Wundt's position, but what Peirce takes to be a sensible attitude toward mental phenomena *überhaupt*, namely that "the whole function of thinking consists in the regulation of conduct" (CP 8.199 [1905]). This phrase should alert Peirce scholars, because it comes close to repeating his position from some three decades before, namely that "the whole function of thought is to produce habits of action", as the idea was expressed in his seminal essay, "How to Make Our Ideas Clear" (1878; W 3:265). This impression is not deceptive, because in an alternative draft for the review in question, Peirce goes on to elaborate his above agreement with Wundt's psychology by saying that

> Endeavouring to sum up the results of this elaborate investigation so far as they concern psychology in such imperfect fashion as they can be

> reduced to one simple sentence, we may say that Wundt finds that the function of our thinking-organ lies in its regulation of motor reactions. Now this is neither more nor less than the substance of pragmatism in the dress of psychology. The original definition of pragmatism put it in the form of maxim: 'Consider what effects that might conceivably have practical bearings you conceive the object of your conception to have. Then, your conception of those effects is THE WHOLE of your conception of the object.' What is that than to say that the sole function of thought is to regulate motor reactions? CP 8.201 n. 3 [1905]

Here we have it, namely the answer with which Peirce keeps his promise of 1893, about showing what the "true psychology of action" would be like. Such a psychology, where thought regulates motor reactions and motor conduct, apparently is a true psychology of action or something close enough. While Peirce, in keeping with Wundt's original problematic refers to motor reactions and their regulation, these do not make up the whole story, so that we can talk about action in an advanced, rather than merely behavioural sense. In the paraphrase that I quoted first, Peirce said that "the whole function of thinking consists in the regulation of conduct". Conduct expresses a more advanced sense of action than mere motor reactions, so that we are entitled to conclude that we are dealing with Peirce's psychology of action, or theory of action, in a comprehensive and serious sense. There is also reason to speak about it explicitly as Peirce's theory, because though it apparently assumes its psychological framework from Wundt, it has also a characteristically Peircean kernel. Above, he speaks about "the substance of pragmatism in a dress of psychology", and the substance of pragmatism is Peirce's own doubt/belief theory of inquiry, originally put forward in 1877–8. This is the logical and rational kernel in the theory of action, whose descriptive psychological outlines Peirce appropriates from Wundt and other late nineteenth century theorists.

The theory of action belongs to the tools of the trade in the various social sciences; they all deal with human doings rather than people as such. We are making some headway in relating Peirce's thought to that prevailing in social sciences, but we are not there yet. One thing to which Peirce scholarship has not given sufficient attention is that he right from the beginning maintained that his doubt/belief theory of inquiry also had general action-theoretic relevance; it was not purely a contribution to scientific methodology, though this was its main purpose. "Everybody uses the scientific method about a great many things, and only ceases to use it when he does not know how to apply it", Peirce said while introducing that theory of inquiry (EP 1:120), meaning that version of the scientific method that he himself was explaining in the article in question, "The Fixation of Belief" (1877). In the concluding paragraph of the second article, "How to Make Our Ideas Clear" (1878), he said, moreover, that "We have, hitherto, not [yet] crossed the threshold of scientific logic" (EP 1:141). Now, as Peirce's announced purpose was to spell out the logic of science in that series of articles, the following conclusion suggests itself. The first two writings, "The Fixation of Belief" and "How to Make Our Ideas Clear", together make up what might be called a *Prolegomena* for the true logic of science. In them, Peirce discusses human inquiry in general, rather than its explicitly scientific sub-variant, and if this interpretation holds water, I suggest further that those two writings express also Peirce's conception of action, considered from its rational side (or logical, as was his preferred expression).

Before going further, there is still something in Peirce's relation to Wundt that pertains to our present problem. Peirce held Wundt in high esteem (cf. HP 2:891 [c. 1901])[4] and even credits him for having first shown, in the 1860s, "that every train of thought is essentially inferential in character" (CN 1:37 [1869]). This is an important idea, because the inferential character of human thought later on came to be one of the cornerstones in Peirce's own philosophy. Accordingly, we can pose the following question: if every train of thought is essentially inferential in character, what then does the human mind do, when it infers?

Peirce's answer to this question is prima facie surprising, if expressed in a laconic manner: the human mind does not actually 'draw' its inferences. In order to see what this means, recall what he said above about thought's role in regard to motor action and conduct: it *regulates* them, rather than, say, produces them or brings them about. The idea of regulation is not confined to this task. Above, Peirce was perhaps unnecessary generous to his predecessor Wundt, by calling him the sole inventor of the idea that thought is essentially inferential. Rather, the truth is that Peirce brought to fruition Wundt's original idea. Namely, his mature position is (cf. Murphey, 1961, pp. 359–60) that though every train of thought is *potentially* inferential, it does not have to be so actually. Peirce is famous for maintaining that logical reasoning takes place by means of self-control – in this it resembles ethics and is related to it – so that according to him a logical reasoner does not so much 'draw' his or her inferences. He or she

[4] Peirce appreciated Wundt as a scientist rather than as a philosopher. See the 1905 review in its entirety.

rather *receives* 'inferential candidates,' in the stream of mental associations (CP 7.443-4f. [1893]), and out of these (s)he by means of self-control, by deciding whether to accept the association as a conclusion or not, makes genuine conclusions. "A logical reasoner is a reasoner who exercises great self-control in his intellectual operations", is Peirce's well-known position (EP 2:200–1 [1903]). The underlying idea is a bit like that of a gardener cultivating her flowers (cf. EP 1:354 [1893]). A gardener begins with great many seedlings, of which only a small minority will eventually flourish. Out of those seedlings, the gardener selects the most promising ones, nurtures them actively, and picks out of the ground and destroys the less promising ones. In this way she eventually produces a beautiful flower-bed, and I submit that the model in Peirce's theory of reasoning is similar: a small minority of continuously flowing mental associations are eventually accepted as logical conclusions, and the procedure in doing this is precisely that of exercising self-control, as Peirce liked to say. "'Autonomy' is just a fancy word for 'self-control' " maintains Daniel Dennett (1995, p. 366) today, and Peirce would have approved of this expression. I presume, though I cannot demonstrate it in the space available, that his endorsement of this idea might stem from his youthful reading experience of Friedrich Schiller's *Aesthetic Letters* (1795), where Schiller's position is that the "voice [of morality] is merely inhibitory" (p. 179 in the 1967 edition).

Here we have reached a point at which to take stock. Peirce's idea about logical inferences as self-controlled operations provides us with the basics of his theory of rationality. This idea of rationality is the skeleton in his more general psychology of action, or theory of action, to follow social scientists' parlance. And this, in turn, provides us with a tool of analysis, because theories of action, as I said above, belong to the tools of trade in social sciences. This enables us to return to the agenda that Peirce had set for himself in 1893, to explain what "Continuity in the Psychological and Moral Sciences" would be all about.

4. Peirce and economics

Peirce's agenda, it will be recalled, contained an explicit reference to economics. It is now possible to juxtapose those two references to that science that Peirce made in 1893, the one in "Evolutionary Love", the other in his advertising prospectus. In the first place, his prima facie very negative opinion in the former about political economy as a *Gospel of Greed* (EP 1:355–6) turns out to be sarcastic. Peirce tells later, in 1906 or so, that he had on purpose made "as much fun as politeness would allow" of such writers who undertake to address the issue of human welfare, a question for which Peirce considered political economists "particularly unfit" (CP 6.517 [c. 1906]).

If so, does not then Peirce's more neutral expression in his advertising prospectus express his position correctly? In it he takes the mathematical economics of Marshall and Walras as a fait accompli, and at first glance seems to have only minor reservations about its close relation to utilitarianism. Even this, however, is not the final truth. The reason is that Peirce elsewhere expresses regret about "political economy" having turned into "economics" (NEM 4:62 [c. 1902]) – that is to say, about its turning from a general social science into a more limited mathematical analysis of wealth. Accordingly, his opinion about the achievement of Marshall and Walras is ambivalent. While systematizing economics by means of mathematical methods – a feat with which Peirce would have no quarrel[5] – they have also considerably narrowed its scope.[6]

I suggest that we should take a last look at "Evolutionary Love" in order to find a way out of this dilemma. There Peirce says, in connection with his critical discussion about political economy, that "the study of [its] doctrines, themselves true, will often temporarily encourage generalizations extremely false, as the study of physics has encouraged necessitarianism" (EP 1:354 [1893]). The clue-word is Peirce's characteristic expression "necessitarianism".

This curiously Peircean term is yet another of those that have not so far received sufficient attention by Peirce scholars. Even in advanced literature it has too often been taken merely as a synonym expression for "determinism." In some cases, as in the quotation above, it can pass as such. I argue, however, that this in fact is only one of its sub-meanings, and that the term's pertinence extends further. In the first place, if Peirce means merely determinism, why doesn't he say so? It was a going English

[5] Peirce was familiar with mathematical economics, as one of his half-serious hobbies from early on was to analyse economic theorems by means of differential calculus (e.g., W 3:173–176 [1874]). He was also well-read in economics, aware, for example, about the work of Antoine Cournot (1801-77), who in histories of economics is represented as the 'missing link' between classical and neoclassical economics (the economics of Marshall and Walras, for instance), but known only by very few during his lifetime (Schumpeter, 1954; on Peirce's familiarity with Cournot, see Eisele, 1957/1979 p. 59; 1974/1979).

[6] It is at this juncture that theoretical room is being made for a new general social science, sociology (Clarke, 1982; Mazlish, 1989). About that development see also Hodgson (2001; 2004).

term at the time, used also by him.[7] That this meaning cannot be the crucial term's whole meaning comes out from a retrospective personal remark that Peirce once makes.

He tells that he originally, in his teens, "was a young necessitarian of the most odious type" (MS 958:42 [c. 1892]), but then had the good fortune of receiving Friedrich Schiller's aforementioned *Aesthetic Letters* (1795) as a gift, and that reading experience cured him of that vice. *Aesthetic Letters* cannot cure anyone of determinism, because that theme is nowhere mentioned in the book. It deals with moral philosophy, and more than once tells critically that "*Utility* is the great idol of our age, to which all powers are in thrall and to which all talent must pay homage," as is Schiller's expression in his second letter, third section (p. 7 in the 1967 edition; original emphasis). My interpretation accordingly is that the mature Peirce faults his own earlier self for having been a young utilitarian, not for having been a young determinist. But if so, what then do utilitarian thought and determinism have in common, because there indisputably are cases where Peirce's pet term "necessitarianism" refers to the latter meaning?[8] They share a common, exclusively deductive logical framework. Regarding the position to which Peirce refers as 'necessitarianism,' and to its supporter as, a 'necessitarian' I propose and submit for Peirce scholars to consider that *a 'necessitarian' is such a person who in his or her logic exclusively relies on necessary reasoning.*

Necessary reasoning refers in the first place to deductive reasoning in the ordinary sense of the term, and it is established knowledge within Peirce scholarship that his logical armature extends further than this. "Deduction is the only necessary reasoning", is his expression in his 1903 Harvard lectures on Pragmatism, and he adds immediately that it "is the reasoning of mathematics" (EP 2:205). A brief moment later he elaborates this by saying that "all necessary reasoning, whether it be good or bad, is of the nature of mathematical reasoning", and adds provocatively that "I declare that all necessary reasoning, be it the merest verbiage of the theologians, so far as there is any semblance of necessity in it, is mathematical reasoning" (EP 2:206).

This polemic assertion can be explicated by referring to the two different tasks that Peirce has explicitly set for logical analysis: its "security

[7] One of William James's important early essays was *The Dilemma of Determinism* (1884) which Peirce said "struck" him (Peirce to James 3/18/1897; CP 8.306).

[8] Peirce's *Reply to the Necessitarians* (CP 6.588-618 [1892]) is a case where 'necessitarianism' and 'determinism' are used interchangeably.

and uberty," (EP 2:463–4 [1913]). Necessary reasoning is strong in security, but weak in uberty, in the ability to yield new knowledge and information, which according to Peirce also belongs to the tasks of reasoning. He expresses the idea, in regard to empirical science and human individuals' ordinary involvements with material reality, as follows:

> All that necessary reasoning can do is to keep an initial hypothesis consistent with itself, it cannot prove any matter of fact. [...] The world of possibilities in which necessary reasoning holds a solitary sway, is a world of generals. [...] The world of existencies to which truth is related, and in which necessary reasoning is out of place, is the world of individuals. CN 2:151 [1897]

Whereas necessary reasoning (deduction) is strong in security, its non-necessary counterparts (abduction in particular) are strong in uberty, in the *advancement* of human knowledge. As I said above, knowledge about Peircean abduction, the 'third' mode of logical inference, has of late reached also the social sciences. What instead has not yet reached that universe of discourse is that abduction does not exhaust what he has to say about truth-advancing (ampliative) logical inference. Peirce scholars know, but other people less so, about his position that "our ordinary reasonings, [even] so far as they are deductive, are not, in the main, such syllogisms as the books have taught, but are just such inferences that are particularly dealt with in this new branch of logic" (CN 2:132 [1896]). By "this new branch of logic" Peirce refers to his own invention, the "logic of relatives," as he called it. Its consideration qua logical theory can be left to the professionals of that discipline, but its consequences demand also other people's attention. On its basis, Peirce reaches a conclusion that there are *two* modes of deduction, namely its 'corollarial' and 'theorematic' variants, the former answering to the traditional idea of deduction, the latter being its more general and dynamic counterpart. Namely, theorematic deduction is also able to suggest new truths, not merely to preserve the truth of its premises, as is the case with the ordinary corollarial variant. Why not then make such use of this distinction as Peirce himself suggests, as he says that this "is a matter of extreme importance for the theory of cognition" (NEM 4:56 [c. 1902])?

5. Conclusion: Knowledge-advancing use of reason as Peirce's implicit legacy for social sciences

Regarding cognition, Peirce's distinction in the first place suggests that the domain of the ampliative use of human reason in his conception is even wider than most people have hitherto assumed. It is safe to say that he finds truth-advancement or knowledge-advancement even more important than the corroboration of putative knowledge, or the context of justification, to follow Popperian parlance.

Regarding our theme, the theory of action considered from a social-scientific viewpoint, Peirce's position is, we recall, that the whole function of thought is to produce habits of action. If so, we may ask how thought produces them when it operates in the ampliative mode, the mode that turns out to be more significant than ever. Here I take a shortcut and refer to results already achieved by other Peirce scholars (Hintikka, 2007; Pietarinen, 2003; 2006). Hintikka (2007, p. 47) provides an answer to the above question, by paraphrasing Peirce's position to be that the aim of scientific abduction is to "recommend a course of action". To this, I add that this holds not only for scientific abduction but also for abductions performed during everyday life.[9] But the actual point is, as Hintikka adds immediately, that "such recommendation can scarcely mean a preference for one particular action in one particular kind of situation, but presumably means a policy recommendation" (ibid.).

If so, this provides us with ingredients for an answer to the question: where does Peirce's relevance for social sciences actually lie? The model of rationality that has prevailed in these sciences, making its first entrée with neoclassical economics on which also Peirce commented, has been what is known as the theory of rational choice. Some have called it the "default mode" of social theorizing in its entirety (Wagner, 2000) – or at least of its theory of rationality. That theory typically operates by means of necessary reasoning, to express the matter in Peirce's terms. If we take the upshot of Peirce's ampliative theory of rationality to be that it yields 'policy recommendations', this means that it proffers a more general notion, in a positive sense, of rationality. Rational choice still has a task to perform, but only an ancillary task. It finishes the job whose main part is in reason's production

[9] Peirce's well known position is that "Not the smallest advance can be made in knowledge beyond the stage of vacant staring, without making an abduction at every step" (HP 2:900 [1901]). Early in his article, Hintikka (2007) says that "all our science and indeed our whole life depends on ampliative reasoning" (p. 40).

of 'policy recommendations' it singles out a particular deed to be done in terms of some of those policies. Peirce is aware of the existence and practical importance of rational choice, as he says that "Balancing reasons *pro* and *con* is the natural procedure of every man. No man can avoid doing so continually" (EP 2:78 [1901]). However, as he adds immediately that "reason is nothing but man's natural way of thinking, carefully and consistently observed" (ibid.), I take this to suggest the following interpretation. A competent agent does make choices in the course of action, but (s)he takes them in stride, in the midst of an already ongoing action process, not while sitting pretty and pondering!

And with this hypothetical conclusion we have found a viewpoint from which Peirce's thought may turn out to be of relevance for the social sciences. Early in this article, I expressed reservations about the views of the sociologist Margaret Archer (2003), but that disagreement is of minor importance. She has my full support when it comes to the program that she calls "resisting colonization", namely the colonization that rational choice theory (with neoclassical economics implicitly in the background) exercises toward other social sciences and their theoretical assumptions. The collection *Rational Choice Theory* (2000), edited by Archer and Jonathan Tritter, is devoted to explicating and criticizing this tendency in the social sciences, in sociology in particular, and to critically questioning rational choice theory.

It is dubitable, however, whether its arguments are able to convert many (or any) of the uncritical supporters of that theory. Certain assertions, e.g. that rational choice theory does not take social normativity into account (at least not sufficiently) (Archer, 2000), or that it ignores emotions at the expense of rationality (Williams, 2000), are formally to the point. To all this, however, a supporter of the theory apparently has an answer ready: even supposing the importance of all that, a thought-out social theory in any case needs to include an explicitly rational component, and if this is admitted, isn't then the notion of rational choice our only choice?

It is *not* our only choice, Peirce's theory of rationality – in the language of social scientists – enables us to assert. And as I said above, it enables one to assert this in a positive sense, without doing away with the idea of rational choice (let alone with the idea of rationality itself) and replacing it by some other notion. There is such a phenomenon as choice, which does have a task to perform, but in a wide perspective that task is nonetheless rather pedestrian. In rational choice theory the subject is confined to draw on that information that he or she already has. Whence did it ever come to his possession in the first place? This is a question that the theory of rational choice has to leave untreated (or address in a mystifying manner), but some people would find that very question more important. Peirce's ampliative theory of reason, on the other hand, incorporates that question as one of its basic tasks. It treats all humans as inquirers and assumes that the continuous enlarging of our stock of knowledge belongs to the human condition. Peirce's dynamic theory, furthermore, goes much better together with the sociological understanding of action, where action is taken as "reflexive monitoring of conduct in the day-to-day continuity of social life" – as Anthony Giddens (1984, pp. 43–44) has put it – than with those so-called 'action'-models that economic theory relies on. But in this respect the situation is again such that we need not do away with them completely. By drawing on Peirce's ampliative theory of rationality sociology will be able to resist colonization from the side of economics, without resorting to nihilistic attempts to deny the validity of the latter altogether.

References

Archer, M. & Tritter, J. Q. (Eds.) (2000) *Rational Choice Theory: Resisting Colonization*. London & New York: Routledge.

Archer, M. (2000). "Homo Economicus, Homo Sociologicus and Homo Sentiens." In M. Archer & J. Q. Tritter (Eds.), *Rational Choice Theory: Resisting Colonization* (pp. 36-56). London & New York: Routledge.

Archer, M. (2003). *Structure, Agency and the Internal Conversation*. Cambridge: Cambridge University Press.

Beck, U. (1992 [1986]). *Risk Society: Toward a New Modernity*. London: SAGE.

Bergman, M. (2004). *Fields of Signification: Explorations in Charles S. Peirce's Theory of Signs.* Philosophical Studies from the University of Helsinki 6. University of Helsinki.

Bertilsson, T. M. (2004). "The Elementary Forms of Pragmatism: On Different Types of Abduction." *European Journal of Social Theory*, 7(3), 371–389. Also published as 'Pragmatism Rediscovered: The Relevance of Peirce for Social Science' in P. Baert & B. S. Turner (Eds.), *Pragmatism and European Social Theory* (pp. 69–93). Oxford: Bardwell Press.

Bertilsson, T. M. (2009). *Peirce's Theory of Inquiry and Beyond: Towards a Social Reconstruction of Science Theory.* Frankfurt am Main: Peter Lang.

Bhaskar, R. (1979). *The Possibility of Naturalism: A Philosophical Critique of the Contemporary Human Sciences.* Hassocks, UK: Harvester Press.

Clarke, S. (1982). *Marx, Marginalism and Modern Sociology: From Adam Smith to Max Weber.* London & Basingstoke: Macmillan.

Deely, J. (1994). *New Beginnings : Early Modern Philosophy and Postmodern Thought.* Toronto, Buffalo, London: University of Toronto Press.

Deely, J. (2001). *Four Ages of Understanding.* Toronto, Buffalo, London: University of Toronto Press.

Dennett, D. C. (1995). *Darwin's Dangerous Idea: Evolution and the Meanings of Life.* New York: Simon & Schuster.

Eisele, C. (1957). "The Correspondence with Simon Newcomb." Chapter 5 (pp. 52–93) in Eisele (1979).

Eisele, C. (1974). "Charles S. Peirce and the Mathematics of Economics." Chapter 24 (pp. 251–254) in Eisele (1979).

Eisele, C. (1979). *Studies in the Scientific and Mathematical Philosophy of Charles S. Peirce.* R. M. Martin (Ed.). The Hague, Paris, New York: Mouton.

Esposito, J. (1980). *Evolutionary Metaphysics: The Development of Peirce's Theory of Categories.* Athens, OH: Ohio University Press.

Giddens, A. (1984). *The Constitution of Society: Outline of the Theory of Structuration.* Cambridge: Polity Press.

Gronow, A. (2008). "The Over – or the Undersocialized Conception of Man? Practice Theory and the Problem of Intersubjectivity." *Sociology*, 42(2), 243–259.

Habermas, J. (1987 [1968]). *Knowledge and Human Interests.* New English translation of the second, enlarged edition (1973). Cambridge: Polity Press.

Habermas, J. (1995). "Peirce and Communication." In K. L. Ketner (Ed.), *Peirce and Contemporary Thought* (pp. 243–266). New York: Fordham University Press.

Halton, E. (1995). *Bereft of Reason: On the Decline of Social Thought and Prospects for Its Renewal.* Chicago & London: University of Chicago Press.

Hildebrand, D. (2004). "Avoiding Wrong Turns: A Philippic Against the Linguistification of Pragmatism." In E. L. Khalil (Ed.), *Dewey, Pragmatism, and Economic Methodology* (pp. 73–86). London & New York: Routledge.

Hintikka, J. (2007). "Abduction – Inference, Conjecture, or an Answer to a Question?" Chapter. 2 in Hintikka's collection of essays, *Socratic Epistemology* (pp. 38–60). Cambridge: Cambridge University Press. (Originally published as 'What Is Abduction?' in *Transactions of the Charles S. Peirce Society*, 1998).

Hodgson, G. M. (2001). *How Economics Forgot History: The problem of historical specificity in social science.* London & New York: Routledge.

Hodgson, G. M. (2004). *The Evolution of Institutional Economics: Agency, structure and Darwinism in American Institutionalism.* London & New York: Routledge.

Hoopes, J. (1989). *Consciousness in New England: From Puritanism and Ideas to Psychoanalysis and Semiotic.* Baltimore & London: Johns Hopkins University Press.

Hoopes, J. (1998). *Community Denied: The Wrong Turn of Pragmatic Liberalism.* Ithaca: Cornell University Press.

James, W. (1950 [1890]). *The Principles of Psychology, I–II.* New York: Dover. (Also available, in three volumes, in the critical Harvard edition, The Works of

William James [Cambridge, MA & London, England: Harvard University Press], 1981).

James, W. (1897 [1884]). *The Dilemma of Determinism. In James's collection of essays The Will to Believe and Other Essays in Popular Philosophy* (pp. 145–183). New York, London, Bombay: Longmans Green & Co. (The collection appears in the 1979 volume of the Works edition).

Joas, H. (1996, [1992]). *The Creativity of Action.* Cambridge: Polity Press.

Kilpinen, E. (2002). "A Neglected Classic Vindicated: The Place of George Herbert Mead in the General Tradition of Semiotics." *Semiotica*, 142(1/4), 1–30.

Latour, B. (1993). *We Have Never Been Modern*. New York: Harvester Wheatsheaf.

Lewis, J. D. & Smith, R. L. (1980). *American Sociology and Pragmatism: Mead, Chicago Sociology and Symbolic Interaction.* Chicago: University of Chicago Press.

Mazlish, B. (1989). *A New Science: The Breakdown of Connections and the Birth of Sociology.* New York & Oxford: Oxford University Press.

Mead, G. H. (1934). *Mind, Self and Society, from the Standpoint of a Social Behaviorist.* C. W. Morris (Ed.). Chicago: University of Chicago Press.

Mills, C. W. (1966). *Sociology and Pragmatism: The Higher Learning in America.* I. L. Horowitz (Ed.). New York & Oxford: Oxford University Press.

Murphey, M. G. (1961 [1993]). *The Development of Peirce's Philosophy.* Cambridge, MA: Harvard University Press. (With a new introduction and appendix, Indianapolis: Hackett).

Neville, R. (1992). *The Highroad Around Modernism.* Albany: State University of New York Press.

Ochs, P. (1993). "Charles Sanders Peirce." In D. R. Griffin et al., *Founders of Constructive Postmodern Philosophy*. Albany: State University of New York Press.

Pietarinen, A.-V. (2003). "Peirce's game-theoretic ideas in logic." *Semiotica*, 144(1/4), 33–47.

Pietarinen, A.-V. (2006). *Signs of Logic: Peircean Themes on the Philosophy of Language, Games, and Communication.* Dordrecht: Springer.

Robin, R. S. (1967). *Annotated Catalogue of the Papers of Charles S. Peirce.* Amherst: University of Massachusetts Press.

Rochberg-Halton, E. (1986). *Meaning and Modernity: Social Theory in the Pragmatic Attitude.* Chicago & London: University of Chicago Press.

Rorty, R. (1982). *Consequences of Pragmatism: Essays 1972–1980.* Brighton: Harvester Press.

Schiller, F. (1967 [1795]). *On the Aesthetic Education of Man In a Series of Letters.* English and German Facing. E. M. Wilkinson & L. A. Willoughby (Eds., trans.). Oxford: Clarendon Press.

Schumpeter, J. (1954). *History of Economic Analysis.* London: Allen & Unwin.

Wagner, P. (2000). "The Bird in Hand: Rational Choice – The Default Mode of Social Theorizing." In M. Archer & J. Q. Tritter (Eds.), *Rational Choice Theory: Resisting Colonization* (pp. 19–35). London & New York: Routledge.

Wiley, N. (1994). *The Semiotic Self.* Cambridge: Polity Press.

Williams, S. (2000). "Is rational choice theory 'unreasonable'? The neglected emotions." In M. Archer & J. Q. Tritter (Eds.), *Rational Choice Theory: Resisting Colonization.* (pp. 57–72). London & New York: Routledge.

Wilson, E. O. (1975). *Sociobiology: The New Synthesis.* Cambridge, MA: The Belknap Press of Harvard University Press.

Peirce and Pragmatist Democratic Theory

Robert B. Talisse
Vanderbilt University

1. Introduction

The revival of pragmatism has brought renewed enthusiasm for John Dewey's conception of democracy as a "way of life".[1] In this paper, I shall present a case for thinking that there is a decidedly Peircean brand of pragmatist democratic theory which is superior to Deweyan democracy. The argument proceeds in three steps. First I sketch the basic contours of Deweyan democracy. Then I argue that later Rawlsian insights concerning the fact of reasonable pluralism render the Deweyan model of "democracy as a way of life" unacceptable as an ideal for contemporary democratic societies. Finally, I sketch a view of democracy based in Peirce's social epistemology and argue that it is not vulnerable to the later Rawlsian arguments which undermine the Deweyan view.

One result of this paper is that pragmatists who want to theorize democracy must abandon Dewey. Another is that there is a non-Deweyan option available to the pragmatist. Of course, this is not sufficient in itself to demonstrate that pragmatists who theorize democracy must adopt the Peircean view I shall sketch; another non-Deweyan but self-avowedly pragmatist view of democracy has been proposed, namely, Richard Posner's "everyday pragmatist" (Rawls, 2003, p. 50) view of democracy. According to Posner, democracy is best understood as a "competitive power

[1] It is increasingly difficult to pick up a work of mainstream contemporary democratic theory that does not make at least a passing positive reference to Dewey. See, for example, Nussbaum (2007), Bohman (2007), Dworkin (2006), Sandel (2005), Stout (2004), MacGilvray (2004), Richardson (2002), Sunstein (2001), Shapiro (2001), Young (2000).

struggle among members of a political elite... for the electoral support of the masses" (2003, p. 130). Though I cannot argue the point here, Posner's view is vulnerable to serious objections and is in any case not really a *pragmatist* option at all.[2] If this is correct, then it is safe to conclude that, if the arguments in this paper go through, pragmatists who want to theorize democracy must be Peirceans.

2. What Deweyan democracy is

The core of Deweyan democracy can be stated as follows. Deweyan democracy is *substantive* rather than proceduralist, *communicative* rather than aggregative, and *deep* rather than statist. I shall take these contrasts in order. Deweyan democracy is *substantive* insofar as it rejects any attempt to separate politics and deeper normative concerns. More precisely, Dewey held that the democratic political order is essentially a *moral* order, and, further, he held that democratic participation is an essential constituent of the good life and a necessary constituent for a "truly human way of living" (LW 11:218).[3] Of course, democratic theorists differ over the question of what democratic participation consists in. Dewey rejects the idea that it consists simply in processes of voting, campaigning, canvassing, lobbying, and petitioning in service of one's individual preferences; that is, Dewey held democratic participation is essentially *communicative*, it consists in the willingness of citizens to engage in activity by which they may "convince and be convinced by reason" (MW 10:404) and come to realize "values prized in common" (LW 13:71).[4] Importantly, Dewey thought that such communicative processes were fit to direct not simply the basic structure of government, but the whole of social association. In fact, Dewey held famously that democracy is a "way of life" (LW 13:155) rather than a kind of state or a collection of political institutions (LW 2:325). On Dewey's view, democracy is a mode of social organization that "must affect all modes of human association, the family, the school, industry, religion" (LW 2:325).

[2] I argue against Posner in Talisse (2005) and Talisse (2007, ch. 5).

[3] Standard references to John Dewey's work are to the critical edition, *The Collected Works of John Dewey*, with the following abbreviations: EW = Early Works, MW = Middle Works, LW = Later Works. See the bibliography. Cf. Campbell, "Participation in a community is essential to a fulfilled human existence because such participation makes possible a more diversified and enriching experience for all members" (1998, 24). See also Campbell (2005) and Saito (2006).

[4] According to Dewey, the "heart and guarantee of democracy is in free gatherings of neighbors on the street corner to discuss back and forth what is read in uncensored news of the day" (LW 14:227).

In this way, Deweyan democracy is *deep*. It is meant to reach into and affect the whole of our lives, both individual and collective; it provides a social ideal of human flourishing or the good life, what Dewey called "growth" (MW 12:181).

Deweyan democracy is therefore a species of *perfectionism*. As he sees the self as inherently social, and the good as a matter of self-realization, Dewey held that "Democracy and the one, ultimate, ethical ideal of humanity are [...] synonyms" (EW 1:248).[5] However, unlike other forms of perfectionism, which hold that the project of forming citizens' dispositions is a task only or primarily for the state, Dewey's perfectionism is, like his conception of democracy, *deep*; that is, on the Deweyan view, the perfectionist project of realizing human flourishing is a task for *all* modes of social association (LW 2:325). Consequently, Dewey held that "The struggle for democracy has to be maintained on as many fronts as culture has aspects: political, economic, international, educational, scientific and artistic, and religious" (LW 13:186). He saw the task of democracy to be that of "making our own politics, industry, education, our culture generally, a servant and an evolving manifestation of democratic ideals" (LW 13:197). For Dewey, then, *all* social associations should be aimed at the realization of his distinctive vision of human flourishing.

3. An objection to Deweyan democracy

John Rawls's idea of the "fact of reasonable pluralism" (Rawls, 1996, p. 36) is at this point so well known among political theorists that it does not require extended comment. Basically the idea is this: There is no single comprehensive philosophical, religious, or moral doctrine upon which reason, even at its best, converges. That is to say, there is a set of defensible and reasonable comprehensive moral ideals such that each ideal is fully consistent with the best exercise of reason but inconsistent with other members of the set. Consequently, despite "our conscious attempt to reason with each other" (1996, p. 55), agreement at the level of fundamental moral, religious and philosophical issues is elusive. Importantly, Rawls contends

[5] On the social self, Dewey holds that "The idea that individuals are born separate and isolated and are brought into society only through some artificial device is a pure myth"; he continues, "No one is born except in dependence on others... The human being is an individual because of and in relation to others" (LW 7:227). Dewey also holds that "society and individuals are correlative, organic, to one another" (MW 12:187). Contemporary Deweyan democrats maintain this commitment (see Boisvert, 1998, pp. 54f.; Green, 1999, p. 6; Stuhr, 1998, p. 85; Fesmire, 2003, p. 11; Colapietro, 2006, p. 25).

that reasonable pluralism "is not a mere historical condition that may soon pass away" (1996, p. 36), but "the long-run outcome of the work of human reason under enduring free institutions" (1996, p. 129). The very liberties secured in a constitutional democracy give rise to reasonable pluralism.

The fact of reasonable pluralism entails the corresponding "fact of oppression" (1996, p. 36). If reasonable pluralism is "the inevitable outcome of free human reason," then "a continuing shared understanding on one comprehensive religious, philosophical, or moral doctrine can be maintained only by the oppressive use of state power" (1996, p. 36). To simplify: Where minds are free, pluralism prevails; where pluralism does not prevail, minds are not free.

When the facts of reasonable pluralism and oppression are considered in light of the core democratic commitment – which we shall call the Legitimacy Principle – that the exercise of coercive political power is legitimate only if it is justifiable, at least in principle, "to every last individual" (Waldron, 1993, p. 37), the result is that any political order which is premised upon the truth of a single comprehensive doctrine – even a perfectly reasonable and democratic one – is oppressive. It is oppressive because it coerces reasonable citizens in the service of a comprehensive moral, philosophical, or religious ideal that they could reasonably reject. Accordingly, Rawls draws the radical conclusion that "no comprehensive doctrine is appropriate as a political conception for a constitutional regime" (1996, p. 135). Therefore, if by "community" we mean "a special kind of association, one united by a comprehensive doctrine," a "well-ordered democratic society" cannot be a community (1996, p. 40).

However, it is clear that Deweyan democracy is committed to the claim that proper democracy is a community in this Rawlsian sense. That is, Deweyan democrats envision a political world in which "all modes of human association" (LW 2:325) are organized around Dewey's comprehensive moral doctrine. As Dewey's comprehensive doctrine is a species of perfectionism, he naturally sees democracy as an ongoing, and never completed, project of cooperatively and experimentally realizing his view of human flourishing.[6] Accordingly, Deweyan democrats see proper democracy as a matter not simply of how a society or group makes its collective decisions, but rather of *what it decides*. The Deweyan thought is that, in a proper democracy, collective decision should increasingly reflect a social commitment to principles, policies, and institutions that further Deweyan growth;

[6] Dewey describes human flourishing as a condition in which each individual "feels [the community's] success as his success, and its failure as his failure" (MW 9:18).

consequently, the degree to which a given society is *not* directed towards the realization of Deweyan flourishing is the degree to which that society is failing at democracy.

This point deserves emphasis. To repeat: The Deweyan view is that human association of any kind is properly – that is, *democratically* – organized only when it are directed towards the realization of "growth" as understood by Dewey. Accordingly, any association that seems to *not* be so directed is failing at democracy. Consequently, whether a given mode of social association is democratic is, according to the Deweyan, a matter of *what policies it enacts* rather than *how it makes its collective decisions*. This perhaps explains why the literature on Deweyan democracy is so laden with institutional and personal prescriptions which, in many cases, curiously take the form of *commands*.

An exhaustive examination of the Deweyan democracy literature cannot be attempted here, so I will limit myself to only a few Dewey scholars. Describing Deweyan democracy as "the culture of a whole society in which experience is engaged in its power of fulfillment of life through cooperation and communication," Thomas Alexander claims that "*if democracy is to have a future*, it must embrace an understanding of the deepest needs of human beings and the means of fulfilling them" (1998, p. 17, my emphasis). John Stuhr claims that Deweyan democracy presents a "demand" for "different personal conduct and far-reaching cultural reconstruction – deep changes in habits of thought and action, patterns of association and interaction, and personal and public values" (2003, p. 55). Stuhr concludes that "we must each seek to expand democracy [...]. We must realize in thought and action that democracy is a personal way of individual life [...], and we must rededicate our lives to its realization – now" (2003, p. 64). Finally, James Goulinlock describes Deweyan democracy as a "more or less specific ordering of personal dispositions and modes of conduct that would be operative in all forms of interpersonal experience"; he continues that "Political democracy, *when it is real*, is but an instance of this more generic form of life" (1999, p. 235; my emphasis).

The problem with all of this is that the commitments constitutive of the Deweyan democratic ideal – which for these theorists comprise the *sine qua non* of democracy itself – can be reasonably rejected. Insofar as the Deweyan democrat seeks to reconstruct the whole of society in the image of her own philosophical commitments, she seeks to create social and political institutions that are explicitly designed to cultivate norms and realize civic ideals that her fellow citizens could (and in fact do) reasonably reject. Hence Deweyan democracy is an ideal that must deny the fact of reasonable pluralism; it must deny that non-Deweyans could be reasonable. For this reason Deweyan democracy is oppressive in Rawls's sense. Accordingly, Deweyan democracy is an inappropriate ideal for contemporary democratic societies.

In response, Deweyans might appeal to the hackneyed injunction to dismiss "problems of philosophers" and attend only to the "problems of men" (MW 10:46); they will claim that the concept of reasonable pluralism is an artifice of a philosophical approach that is not properly attuned to real-life conditions, and conclude from this that the objection I have raised cuts no ice.

But the fact of reasonable pluralism is a markedly evident aspect of modern life. One finds in newspapers and magazines, on television programs, on blogs and list-servs, and in the public square proponents of reasonable moral and political views that differ fundamentally from, and are opposed to, the commitments that are presupposed by Deweyan democracy. Moreover, all of the most pressing moral and political controversies of the day feature a plurality of reasonable positions formulated in terms of a wide variety of reasonable moral doctrines. With regard to any persistent moral dilemma, one can find compelling arguments on *many* sides of the issue. To dismiss the fact of reasonable pluralism is to retreat from our actual experience of our social and political world.

To put the matter somewhat differently, Deweyans hold that it is a *necessary* condition for a social order's being properly democratic that all of its institutions, policies, and norms aim at promoting growth. And yet many democratic citizens reject the idea that "growth itself is the only moral 'end' " (MW 12:81). In fact, many hold that growth is not even a coherent moral idea. Consequently, many would reject the idea that, in order to be democratic, all of society must aim at promoting growth. Of course, Deweyans regard such citizens as mistaken, perhaps in the grip of an obsolete moral view. And maybe the Deweyans are correct in their assessment. But the question is not about the correctness of Dewey's moral philosophy. Rather, the question is whether any reasonably rejectable moral doctrine, such as Dewey's, should be publically authoritative in a society of equals who are reasonably morally divided. The answer is clearly no. A community or government violates the equality of citizens when it coerces them on the basis of a moral doctrine that they can reasonably reject. And this is precisely what the Deweyan ideal prescribes. Far from being a solution to democracy's ills, Deweyan democracy exacerbates them.

Since Deweyans are committed to the idea that the worth of a philosophical view is to be judged according to the depth of its connection with real-life problems and conditions, I take the argument that Deweyan democracy cannot countenance the fact of reasonable pluralism to be especially damaging. The upshot of the argument I have deployed is that Deweyan democracy fails *on its own terms*; it must reject a salient trait of current experience. Consequently, we should bid farewell to Deweyan democracy. Pragmatists who want to theorize democracy must look elsewhere.

4. A Peircean alternative

The very idea of a Peircean conception of democracy may seem strained. Yet, as I have argued elsewhere at length (Talisse, 2003; 2007), Peirce's essay on "The Fixation of Belief" can be read as ultimately promoting a social epistemology according to which norms of proper inquiry entail democratic political norms. To see this, consider the core of Peirce's epistemology, which can be summarized as follows:

1. To believe that *p* is to hold that *p* is true.[7]
2. To hold that *p* is true is to hold that *p* "is a belief that cannot be improved upon, a belief that would forever meet the challenges of reason, argument, and evidence" (Misak, 2000, p. 49).
3. To hold that a belief would meet such challenges is to commit to the project of *justifying* one's belief, what Peirce called "inquiry."
4. The project of squaring one's beliefs with reasons and evidence is an ongoing *social* endeavor that requires participation in a "community of inquiry".

An epistemic argument for democracy follows intuitively from these components: one should endorse a democratic political order because only in a democracy can one live up to one's epistemic commitments. That is, if being a believer commits one to the project of justification, and if the project of justification commits one to the social enterprise of examining, exchanging, testing, and challenging reasons, then one can satisfy one's commitments qua believer only within a political context in which it is possible to be an inquirer. Inquiry requires that characteristically democratic

[7] Cf. Wiggins, (1998); Haack, (1998, p. 8).

norms obtain; in order to inquire, there must be norms of equality, free speech, a freedom of information, open debate, protected dissent, access to decision-making institutions, and so on. Moreover, since the project of justification involves testing one's beliefs against the broadest possible pool of reasons, experiences, and considerations, inquiry requires more radically democratic norms, such as participation, inclusion, and recognition.

Additionally, the Peircean argument carries a number of institutional entailments. If inquiry is to commence, the formal infrastructure of democracy must be in place, including a constitution, courts, accountable bodies of representation, regular elections, and a free press. Also, there must be a system of public schooling designed to equip students in the epistemic habits necessary for inquiry, and institutions of distributive justice to eliminate as far as possible material obstructions to democratic citizenship. In addition, democracy might also require special provisions for the preservation of public spaces, the creation of forums for citizen deliberation, and the like.[8]

Insofar as it begins from a view of what it is to believe and inquire *properly*, we can say that Peircean democracy is *substantive*. Furthermore, as it sees democratic politics as involving social processes of reason-exchanging, Peircean democracy is *communicative*. Given that it endorses social institutions that aim to enable proper inquiry among citizens, we can say that Peircean democracy is *deep*.

In these respects, Peircean democracy might seem very closely allied with Deweyan democracy. However, there is a crucial difference. Whereas on the Deweyan view the democratic order is justified in terms of an overarching moral ideal, the Peircean view relies upon no substantive *moral* vision. The Peircean justifies democratic institutions and norms strictly in terms of a set of substantive *epistemic* commitments. It says that *no matter what one believes* about the good life, the nature of the self, the meaning of human existence, or the value of community, one has reason to support a robust democratic political order of the sort described above simply in virtue of the fact that one holds beliefs.

Since the Peircean conception of democracy does not contain a doctrine about "the one, ultimate, ethical ideal of humanity" (EW 1:248), it can duly acknowledge the fact of reasonable pluralism. Peircean democrats can recognize that there are many distinct and epistemically responsible moral vi-

[8] I'm thinking here of the kinds of policies endorsed by Cass Sunstein to ensure deliberation among persons of different opinions (see Sunstein, 1996; 2001; 2003; Ackerman and Fishkin, 2004).

sions that are compatible with democratic politics. Accordingly, Peirceans understand that questions of how our schools, workplaces, and churches should be organized, what our communities should look like, and what constitutes good citizenship are *not* questions that can be settled by appealing to democratic theory as such; they are instead questions to be pursued experimentally and discursively *within* a democratic politics. What counts for Peirceans is not the proximity of a given democratic outcome to a substantive moral vision of the ideal society, but rather whether the outcome is the result of properly democratic processes of reason exchange.

By drawing upon decidedly *epistemic commitments*, the Peircean view avoids the dilemma between substance and pluralism occasioned by Deweyan democracy. The Peircean pragmatist does not propose a moral ideal for all of society, but rather an analysis of proper *epistemic* practice. The Peircean then recommends a political order in which disputes between conflicting moral visions can be conducted in an epistemically responsible way. Hence the Peircean pragmatist offers a far more modest politics than the Deweyan. Whereas Dewey thought that getting democracy right meant getting the whole of moral philosophy right, the Peircean leaves open the dialectical space for substantive disagreements about deep moral and social questions within democracy. In this way, Peircean democracy is substantive and deep, but not hostile to the pluralism of substantive moral doctrines.

Someone might object to the distinction I have invoked between moral and epistemic commitments. The objection has it that just as Deweyans expect everyone to converge upon a common substantive moral vision, Peirceans expect everyone to adopt a single (pragmatist) epistemology. The objection continues that Peircean epistemology is at least as controversial as any moral philosophy; and so both the Deweyan and the Peircean views commit the same error of denying reasonable pluralism. Deweyan democracy denies it at the level of moral commitments, and Peircean democracy denies it at the level of epistemic commitments.

This objection is mistaken. The epistemic commitments that lie at the core of Peircean democracy do not constitute a comprehensive epistemology in their own right, but rather state a set of principles that are consistent with any well-developed epistemology. Internalists, externalists, foundationalists, coherentists, and so on all agree that beliefs aim at truth, and that when we believe, we take ourselves to be responding to reasons, argument, and evidence. Accordingly, the four Peircean commitments identified above represent an attempt to make explicit the epistemology that is implicit in our existing epistemic practice. They are the commitments we have in virtue of the very fact that we are believers; they are not *optional*. Furthermore, since contestation itself presupposes norms of reason-responsiveness and truth-aiming, the Peircean commitments are not reasonably contestable.

5. Conclusion

If the argument of the above section succeeds, Peirceans and Deweyans are *not* in the same boat. The substantive moral ideal that drives the Deweyan program is, indeed, reasonably rejectable; hence Deweyan democracy would permit coercion on the basis of a reasonably rejectable moral ideal and thus runs afoul of pluralism. The Peircean epistemic commitments, by contrast, are robust enough to support a case for democratic politics, but are nonetheless modest enough to recognize the legitimacy of deep disputes over fundamental moral ideas. Hence the Peircean can offer what the Deweyan cannot, namely, a substantive conception of democracy that is consistent with a due appreciation of the reasonable pluralism of comprehensive moral ideals. But that is not all. The Peircean view does more than simply accommodate reasonable pluralism. Importantly, the Peircean view also makes available to pragmatist democratic theorists a kind of reason that can be offered in support of the progressive agenda typically favored by pragmatists which does not presuppose a controversial moral ideal. To be specific, the Peircean can offer *epistemological* reasons to support more aggressive policies of distributive justice, or fundamental reforms of the news media which need not appeal to "growth," but only to the prerequisites of proper epistemic activity. For unlike "growth," the ideal of promoting epistemic responsibility amongst a population of democratic citizens is not reasonably rejectable.

I indicated at the beginning of this paper that there is reason to think that other purportedly pragmatist conceptions of democracy are nonviable. Consequently, pragmatists who want to theorize democracy should be Peirceans.

References

Ackerman, B. and Fishkin, J. (2004). *Deliberation Day*. New Haven: Yale University Press.

Alexander, T. (1998). "The Art of Life: Dewey's Aesthetics." In L. Hickman (Ed.), *Reading Dewey* (pp. 1–22). Indianapolis: Indiana University Press.

Bohman, J. (2007). *Democracy Across Borders*. Cambridge: MIT Press.

Boisvert, R. (1998). *John Dewey: Rethinking our Time*. Albany: SUNY Press.

Campbell, J. (1998). "Dewey's Conception of Community." In L. Hickman (Ed.), *Reading Dewey*. Indianapolis: Indiana University Press.

Campbell, J. (2005). "Community, conflict, and Reconciliation." *Journal of Speculative Philosophy*, 19(4), 187–200.

Colapietro, V. (2006). "Democracy as a Moral Ideal." *Kettering Review*, 24(3), 21–31.

Dewey, J. (1969–1991). *The Collected Works of John Dewey: The Early Works, The Middle Works, The Later Works*. 37 vols. Jo Ann Boydston (Ed.) Illinois: Southern Illinois University Press.

Dworkin, R. (2006). *Is Democracy Possible Here?* Princeton: Princeton University Press.

Fesmire, S. (2003). *John Dewey and Moral Imagination*. Indianapolis: Indiana University Press.

Gouinlock, J. (1999). "Dewey: Creative Intelligence and Emergent Reality." In S. Rosenthal, C. Hausman, and D. Anderson (Eds.), *Classical American Philosophy: Its Contemporary Vitality*. Urbana: University of Illinois Press.

Green, J. (1999). *Deep Democracy*. Landham: Rowman and Littlefield.

Haack, S. (1998). *Manifesto of a Passionate Moderate*. Chicago: University of Chicago Press.

MacGilvray, E. (2004). *Reconstructing Public Reason*. Cambridge: Harvard University Press.

Misak, C. (2000). *Truth, Politics, Morality*. New York: Routledge.

Nussbaum, M. (2007). *The Clash Within*. Cambridge: Harvard University Press.

Rawls, J. (1996). *Political Liberalism*. New York: Columbia University Press.

Richardson, H. (2002). *Democratic Autonomy*. New York: Oxford University Press.

Saito, N. (2006). "Perfectionism and the Love of *Humanity*." *Journal of Speculative Philosophy*, 20(2), 93–105.

Sandel, M. (2005). *Public Philosophy*. Cambridge: Harvard University Press.

Shapiro, I. (2001). *Democratic Justice*. New Haven: Yale University Press.

Stout, J. (2004). *Democracy and Tradition*. New Jersey: Princeton University Press.

Stuhr, J. (1998). "Dewey's Social and Political Philosophy." In L. Hickman (Ed.), *Reading Dewey* (pp. 82–99). Indianapolis: Indiana University Press.

Stuhr, J. (2003). *Pragmatism, Postmodernism, and the Future of Philosophy*. New York: Routledge.

Sunstein, C. (1996). *Democracy and Problem of Free Speech*. New York: Free Press.

Sunstein, C. (2001). *Republic.com*. New Jersey: Princeton University Press.

Sunstein, C. (2003). *Why Societies Need Dissent*. Cambridge: Harvard University Press.

Talisse, R. B. (2003). “Towards a Peircean Politics of Inquiry” *Transactions of the Charles S. Peirce Society*, 40(1), 21–38.

Talisse, R. B.(2005). “Deliberative Democracy Defended.” *Res Publica*, 11(2), 185–199.

Talisse, R. B. (2007). *A Pragmatist Philosophy of Democracy*. New York: Routledge.

Waldron, J. (1993). *Liberal Rights*. Cambridge: Cambridge University Press.

Wiggins, D. (1998). “C. S. Peirce: Belief, Truth, and Going From the Known to the Unknown.” *Canadian Journal of Philosophy*, supp. vol.

Young, I. M. (2000). *Inclusion and Democracy*. New York: Oxford University Press.

PART II

Peirce's Revolutionary Concept of Rhetoric

James Jakób Liszka
University of Alaska Anchorage

1. Introduction

In an earlier work, I attempted to show that Peirce's critical logic – that is, his theory of inference – was ultimately dependent upon his universal rhetoric, that is, his theory of inquiry (Liszka, 1996, pp. 75–77). Since the validity of the three principal types of inference – abduction, deduction, and induction – rested on the validity of its leading principles (CP 2.463), and all three leading principles required appeal to an indefinite community and practice of inquiry, then a universal rhetoric explicating the features of inquiry was essential.

In a subsequent work, I provided a historical context for Peirce's new rhetoric (Liszka, 2000). Going against a trend beginning with Descartes, Peirce joined together what had been sundered by the modernist tradition, namely, logic and rhetoric – but, in the process, revolutionized the notion of rhetoric as the logic of inquiry and, thereby, transformed the role and understanding of rhetoric generally. Whereas Descartes's method was intuitionist, subjective, deductive, and could be exercised in an inner monologue independent of a community of investigators, Peirce's methodeutic was experimental, public, dialogic, and required a community of inquiry to succeed. Inquiry was part of logic, rhetoric was formulated as the study of inquiry, and inquiry itself was thought of as a way of life, bound by certain sentiments, norms, and appropriate processes of communication. Pure reason or pure logic alone was not enough to discover knowledge; it required the effort of a historical community of inquirers, cooperating in the right sort of community.

Ignoring Peirce's work altogether, the separation of logic and rhetoric became particularly sharp among Russell and the positivists, who thought formal logic alone was the vehicle by which we could account for scientific knowledge, and had removed rhetoric to the warehouse of indifference. But as that strategy for a formal language of logic began to fail, philosophers of science, beginning with Popper, and continuing with Kuhn and Larry Laudan, began to appreciate what Peirce had already discovered many years previously – namely, that there had to be attention to the process of inquiry and not just the formal character of inference. The evolutionary, historical, and developmental practice of scientific inquiry had to be taken into account to understand how science worked. As "the highest and most living branch of logic" (CP 2.333), rhetoric as a theory of inquiry completed and comprehended a formal theory of inference; but, thereby, Peirce had transformed the role of rhetoric from simply prudential advice on how to communicate effectively to how to render signs sufficiently effective to be scientifically successful, in the broadest sense of the term.

What I hope to do in this paper is to clarify and expand this previous work, with the help of a wide range of scholarly perspectives on Peirce's third branch of semeiotic, in order to give a more cogent account of what is truly Peirce's revolutionary concept of rhetoric (see Bird, 1959; Johnson, 1968; Braun, 1977; 1981; Michael, 1977; Lyne, 1978; 1980; Fisch, 1978; Krois, 1981; Kevelson, 1984; Savan, 1988; Perreiah, 1989; Bybee, 1991; Johansen, 1993; Santaella-Braga, 1999; Bergman, 2000; 2009; Colapietro, 2007). In doing so, I also want to show why formal or speculative rhetoric – more than any other branch of semeiotic – points to the importance of taking up the study of ethics, as the second of Peirce's triad of normative sciences.

2. The dependence of critical logic on formal rhetoric

There is a simple and elegant line of argument in the body of Peirce's work that shows the dependence of critical logic on formal rhetoric, that is, the dependence of a theory of inference upon a theory of inquiry. The validity of the three principal types of inference – abduction, deduction, and induction – depends on the validity of their leading principles (CP 2.463). The ultimate leading principle of induction is that such a method, "if steadily adhered to, would at length lead to an indefinite approximation to the truth, or, at least, would assure the reasoner of ultimately attaining as close an approach to the truth as he can, in any way, be assured of attaining" (CP 2.204, see also CP 1.93). The ultimate leading principle of abduction is that the human mind is so akin to the order of things that in a finite number of guesses it will light upon correct hypotheses (CP 5.172–3). Given enough minds, effort, and time, inquirers generally will hit upon the truth. The ultimate leading principle of deduction is that if a particular logical principle is valid, then in no analogous case will it lead to a false conclusion from true premises (CP 2.204, 2.267, 4.477; W 4:246). Thus, all three leading principles of inference appeal to an indefinite community of inquiry, not just formally, but as a real, historical community of inquirers, engaged in the practice of inquiry.

> The very idea of probability and of reasoning rests on the assumption that this number [of inferences] is indefinitely great... logicality inexorably requires that our interests shall *not* be limited. They must not stop at our own fate, but must embrace the whole community. This community, again, must not be limited... Logic is rooted in the social principle. CP 2.654

Formal rhetoric or methodeutic has the critical goal of showing how reliable methods of inferencing (deduction, different forms of induction, and logics of discovery) are comprehended within the larger framework of the *practice* of scientific inquiry.

3. The roles of rhetoric

Formal or speculative rhetoric is principally about inquiry, and inquiry requires not only a reliable method of reasoning, but a community of inquiry, as well as a community of right-minded inquirers. “The most vital factors in the method of modern science have not been the following of this or that logical prescription – although these have had their value too,” says Peirce, but, on the one hand, “moral factors”, such as the love of truth and, on the other, the recognition of science’s social and public character, particularly with respect to the “solidarity of its efforts” (CP 7.87).

The latter role for rhetoric is a traditional and consistent one. It is often characterized – from ancient times to modern – as a study of the most effective means of communication to create solidarity in a community, and to move the community or an audience to a certain course of action. Certainly for Aristotle this is true of political oratory (1952, 1358b). Cicero emphasizes the importance of rhetoric in moving us toward an understanding of the common good (1960, I.ii.3). Francis Bacon makes this clear: “the duty and office of Rhetoric is to apply Reason to Imagination for the better moving of the will” (1892, III, p. 409). Similarly, as Kenneth Burke noted, "the classical principles of persuasion are put to the task *of inducing co-operation in beings that by nature respond to symbols*" (1950, pp. 22, 43). As Peirce says in this regard, "Every proposition has its practical aspect. If it means anything it will, on some possible occasion, determine the conduct of the person who accepts it. Without speaking of its acceptance, every proposition whatsoever, although it has no real existence but only a *being represented*, causes practical, even physical, facts. All that is made evident by the study which I call *speculative rhetoric*" (NEM 4:291). Indeed, several of Peirce's many definitions of formal or speculative rhetoric are consonant with this general role for rhetoric: the power of symbols to appeal to a mind (CP 4.116, CP 1.559, CP 1.444); the conditions for the intelligibility of symbols (MS 340:34, MS 774:9-11, W 1:175); the clarity of ideas (MS L 75, MS 322:12); the study of the transmission of ideas (CP 1.445, CP 2.93); the study of the consequences of accepting beliefs (NEM 4:291); and how to render signs effective (MS 774:2). As Vincent Colapietro summarizes it, for Peirce, speculative rhetoric is about "the power of signs to move agents and to change the habits so integral to their agency" (2007, p. 19).

To provide a better understanding of Peirce's formal or speculative rhetoric, we might indeed frame it in a manner similar to the classic divisions in Aristotle – an account with which Peirce was likely familiar (see CP 2.553, CP 2.554, CP 2.11). As is well known, Aristotle divided the modes of persuasion into *ethos*, or by testimony through the character of the person; *pathos*, or by means of putting the audience to the right frame of mind; and, *logos*, that is, by argument. *Logos*, in turn, divided into invention, style, and arrangement (1952, 1356a). However, to apply this framework to Peirce's notion of rhetoric, we need to transpose these roles. Peirce's concept of rhetoric is more about a cooperative process of inquiry than an orator attempting to persuade an audience, and so requires adjustment accordingly. In this sense, the audience is not a passive listener to an argument, but invited to join a community of inquiry. *Ethos*, then, is more broadly concerned with both the character of the inquirer and the character of the community of inquiry; *pathos* is not concerned so much with affecting the emotions and sentiment of an audience, but cultivating the proper sentiments in inquirers, conducive to inquiry. *Logos* plays a similar role in Peirce as it does in classic rhetoric, but it is refined in the sense that it has to do with the principal types of inferences developed in critical logic that are conducive to the *scientific* attainment of truth. Peirce's formal rhetoric appears to be the proper use of those inferences in inquiry, as stated in several definitions: the ordering and arranging of inquiries (MS 478, MS 452:9;

CP 3.430, CP 2.106–110); the study of the general conditions under which a problem presents itself for solution (CP 3.430); how truth must be properly investigated (MS 320:27, MS 606:15; CP 1.191); the management and economy of testing hypotheses (MS L 75).

One thing that strikingly distinguishes Peirce's formal or speculative rhetoric from more traditional theories is its incorporation of a strong historical and evolutionary dimension. This, I would argue, is the result of the very nature of inquiry which is inter-generational and, also, of Peirce's convergence theory of truth – which is inherently a historical and evolutionary process. Thus, Peirce defines formal rhetoric also as the study of the growth of Reason (NEM 4:30-31); the science of the general laws of a symbol's relation to other systems of symbols (W 1:258); the evolution of thought (CP 2.108, CP 2.111); the advancement of knowledge (MS 449:56); the influence of ideas (NEM 4:31); and a concern with systematic and architectonic matters (MS 346:3; CP 4.116).

Putting all this together, we can say the role of formal rhetoric is to articulate the *ethos, pathos, and logos* of inquiry, understood as a purposive, evolving, and historical process. In this regard, as Vincent Colapietro notes, formal or speculative rhetoric focuses on thick descriptions of actual practices (2007, p. 19). As such, Peirce's rhetoric is not only concerned with the effective use of scientific inference in the *practice* of inquiry, but also the analysis of the essential features of the practice of inquiry, such as the constitution of a community that is optimal for inquiry, including its normative ideals, the epistemological virtues of inquirers, and the proper sentiments requisite for good successful inquiry. In general, formal rhetoric should be the study of inquiry, understood as a practice involving a method of reasoning, embedded in a certain kind of community with certain kinds of norms and presuppositions; as cultivating certain sentiments and virtues in practitioners; as privileging certain forms of communicative practices, and as involving a historical identity and purpose. If this account has merit, it shows why Peirce's formal or speculative rhetoric logically leads to the second normative science – ethics – much more clearly than Peirce's grammar or critical logic.

4. The *pathos* of inquirers

Precisely because of his perspective on formal rhetoric and his holistic approach to inquiry, Peirce, I believe, is one of the earliest philosophers of science to recognize the importance of the cultivation of certain sentiments and feelings in inquirers, as fundamental to the process of inquiry (see

Liszka, 1996, pp. 86 ff). Christopher Hookway makes this clear: "Peirce claims that sentiment has an ineliminable role in reflective deliberation and scientific inquiry" (1997, p. 201). What is most important for the *pathos* of inquirers is the establishment of a genuine sentiment toward inquiry:

> I ... put forward three sentiments, namely, interest in an indefinite community, recognition of the possibility of this interest being made supreme, and hope in the unlimited continuance of intellectual activity, as indispensable requirements of logic. CP 2.655

These sentiments express an attitude toward continuing inter-generational inquiry. This is well developed by Peirce in his notion of "evolutionary love". Evolutionary love is more or less an expression of the sentiment consequent to Lamarckian forms of evolution. This, according to Peirce, is a form of evolution likely more explanatory of development experienced at the cultural level in human affairs than the tychistic, Darwinian form of evolution, which better models biological evolution (CP 1.103–109). The core of Lamarckian evolution is the power of agents for habit-taking and habit-change (CP 6.300). The ability to select, retain, and "pass-on" fruitful habits catalyzes cultural evolution – the obvious example being rapid advances in technology, as witnessed in history. However, the impulse to pass on what is beneficial is, from a certain standpoint, rather puzzling, since it involves benefits to unknown future generations, which the present generation will never see. Thus, the act is a form of altruism, and there is no particular reason why such habits must be shared or transmitted:

> the individual strives to produce that which he himself cannot hope to enjoy. One generation collects premises in order that a distant generation may discover what they mean. When a problem comes before the scientific world, a hundred men immediately set all their energies to work upon it. One contributes this, another that. Another company, standing upon the shoulders of the first, strike a little higher, until at last the parapet is attained. CP 7.87

> A problem started today may not reach any scientific solution for generations. The man who begins the inquiry does not expect to learn, in this life, what conclusion it is to which his labors are tending. Strictly speaking, the inquiry never will be completely closed. Even without any logical method at all, the gradual accumulation of knowledge might probably ultimately bring a sufficient solution. Consequently, the object of a logical method is to bring about more speedily and at less expense the result which is destined, in any case, ultimately to be reached, but which, even with the best logic, will not probably come in our day. CP 7.185

Whence this altruistic impulse? This is the puzzle that "evolutionary love" attempts to explain. However, no matter what the explanation, inquiry cannot succeed without it.

5. The *ethos* of inquiry

Whereas the *pathos* of inquiry concerns the sorts of sentiments that must be present for successful inquiry, the *ethos* of inquiry concerns the sort of character inquirers must have to be good inquirers, but also the character of the community of inquiry which will allow optimal research results.

5.1 The ethos of communities of inquiry

In "The Fixation of Belief", Peirce focuses on some of the normative features of different types of communities of inquiry. In this well-known article for *Popular Science Monthly*, Peirce articulates some of the basic methods of inquiry, and explains why the method most closely associated with science is the optimal one. Based on our understanding of such communities, the method of authority, for example, will generally speaking engender an *ethos* that favors strong hierarchies, emphasizes the virtues of obedience and loyalty, discourages curiosity, cultivates a trust toward any authority, and stresses top-down, asymmetrical communicative practices (CP 5.381–2). The purpose of such communities of inquiry is really not truth but the legitimization of those in authority. This could result in general stability, but certainly uniformity of thought (CP 1.60).

The method of tenacity engenders an isolated community, xenophobic and fearful of new ideas. Its forms of communication, like the method of authority, must be highly censorious to maintain its purpose of comfort and stability (CP 5.378). The apriori method is a form of intellectual dogmatism; it is a form of authoritarianism disguised as reason. Its goal is often to legitimize beliefs one tends already to believe by framing them as natural and universal (CP 5.383). Only science communities have the purpose of the inquiry into truth, and even though stability is not its purpose, ironically stability is the more likely result if truth is the purpose. The method of authority might lead to the convergence of belief quite quickly and for large numbers, but Peirce's point is to stress that the corresponding practices of inquiry of such a type ultimately yield inherently unstable results.

The so-called scientific method, on the other hand, engenders an ethos contrary to these other methods of fixing belief. Science requires a community that is open to beliefs; it relies on something independent of authority and independent of inquirers by which to measure the veracity of beliefs; it requires an opportunity to criticize and evaluate beliefs, and obligates those who assert beliefs to publicly accessible demonstration of those beliefs. In genuine scientific inquiry, the purpose is the truth for its own sake (CP 1.44, 5.384).

> Science is to mean for us a mode of life whose single animating purpose is to find out the real truth, which pursues this purpose by a well-considered method, founded on thorough acquaintance with such scientific results already ascertained by others as may be available, and which seeks coöperation in the hope that the truth may be found, if not by any of the actual inquirers, yet ultimately by those who come after them and who shall make use of their results. CP 7.54

Even though the primary purpose of scientific inquiry is truth, indirectly the result is the fixation of belief and, ironically, with more success in the long run than those methods that have it as their direct purpose.

In addition to the *ethos* of the community, there is a certain *ethos* of inquirers as well, who must have the right sort of epistemological virtues and sentiments. First, scientists should not be corrupted in their purpose, which is the purpose of truth, by ulterior motives, such as money, or even particular moral beliefs. If scientists use inquiry to make money, or to prove a specific moral belief, they have already corrupted the process of inquiry (CP 1.619, 1.642). "A scientific man must be single-minded and sincere with himself. Otherwise, his love of truth will melt away, at once. He can, therefore, hardly be otherwise than an honest, fair-minded man" (CP 1.49). The scientist must have humility: "he is keenly aware of his own ignorance, and knows that personally he can make but small steps in discovery" (CP 8.136). Honesty itself is essential to scientific practice.

5.2 Privileging certain forms of communication

Inquiry also requires proper paradigms of communication. Peirce's theory of communication has been studied by a number of thinkers, most notably by Johansen (1993); Liszka (1996); Santaella-Braga (1999); and Bergman (2000, 2009). Bergman, in particular, makes it clear that the study of communication ought to be considered part of Peirce's rhetoric (2000, p. 247).

However, rather than revisiting the whole of Peirce's theory of communication, I would like to point out how Peirce's theory of assertion in particular generates certain kinds of normative claims that align with his account of communities of inquiry, and in a manner that is consistent with Jürgen Habermas's universal pragmatics and Robert Brandom's notion of normative pragmatics. Inquiry requires making assertions, and commentators on Peirce's theory of assertion have noted that his account anticipates speech act theory in many respects (see Brock, 1981; see CP 2.333). In his brief account, Peirce makes clear the normative structure of assertion:

> An assertion belongs to the class of phenomena like going before a notary and making an affidavit, executing a deed, signing a note, of which the essence is that one voluntarily puts oneself into a situation in which penalties will be incurred unless some proposition is true.
>
> CP 8.313

For Habermas, a whole kind of normative pragmatics falls out of discursive practices such as assertion. Any assertion implicitly entails four validity claims which can be made against the assertor: the claim of truth, the claim of intelligibility, the claim of sincerity (that is, does the assertor believe what she says), and the claim of rightfulness (does the assertor have the authority to make such an assertion) (Habermas, 1990, pp. 57 ff; see Johansen, 1993, pp. 303 ff; Liszka, 1996, p. 138 n. 30). In effect, these are exactly the sort of normative claims one would make and be expected to make against fellow inquirers. Communities of authority, tenacity, and the like, inhibit or forbid one or more of these types of claims.

However, some Peirce scholars, Cheryl Misak in particular, have attempted to show some fundamental differences between Habermas's universal pragmatics and Peirce's rhetoric in this regard (see Misak, 2000, pp. 35–47). I believe it is not so much the difference in the ultimate types of norms each thinker promotes, as it is in the method by which those norms are justified. However, if the universal pragmatics of Habermas is not in line with Peirce's thinking, I think it is much easier to note at least a strong similarity with Robert Brandom's notion of normative pragmatics. In any case, a similar point, which is consistent with Peirce's general outlook on essential communicative practices for genuine inquiry, is reached by both thinkers. In engaging in assertion practices, for example, Brandom claims that one implicitly has certain deontic commitments, such as standing accountable and providing evidence for what is asserted, and the audience has certain corresponding entitlements in this respect (2000, pp. 194 ff), exactly the claims Peirce makes in the passage cited above. These types of language practices are, according to Brandom, something that emerges as a particular constellation in cultural processes (2000, p. 33). Brandom recognizes what he calls Hegel's pragmatism, that is, the view that conceptual activity is translated in practice, specifically in the *normative* features of related social practices (2000, p. 34). Citing kinship with Dewey in this respect, he seems unfamiliar with an even stronger kinship with Peirce's thought on this matter (2000, p. 34).

6. The *logos* of inquiry

Just as *logos* in classical rhetorical theory is concerned with persuasion by means of a well-formulated argument, so the *logos* of Peirce's theory of inquiry is concerned with the application of the methods of inference, developed through the labor of his critical logic, to the practical matter of inquiry. For the scientist, the real workhorse and the most manifest dimension of inquiry is *logos* in this sense, although inquiry cannot accomplish its purpose – yet alone begin – without a proper community of inquiry, and inquirers without the proper virtues and sentiments.

In an earlier article, I proposed that a critical dimension of Peirce's formal or speculative rhetoric had to do with the application of his theory of scientific inference, developed in the critical logic, to the matter of practical inquiry (Liszka, 2000). This captured several of the many definitions which Peirce gave of speculative rhetoric, including the ordering and arranging of inquiries (MS 478, MS 452:9; CP 3.430, CP 2.106–10); the study of the general conditions under which a problem presents itself for solution (CP 3.430); how truth must be properly investigated (MS 320:27, MS 606:15; CP 1.191); and the management and economy of testing hypotheses (MS L 75). In order to show that this was the role of speculative rhetoric, I suggested that these functions, so described, could be roughly patterned – in a more abstract way – after the different functions of Cicero's classic division of rhetoric into invention, arrangement, memory, elocution, and delivery, or, perhaps Aristotle's more condensed version of invention, style, and arrangement (Liszka, 2000, pp. 465 ff; see Cicero, 1960, I.9; Aristotle, 1952, Bk. III.1), which I summarize here.

Cicero defines invention as "the discovery of valid or seemingly valid arguments to render one's cause plausible" (1960, I.9). The obvious counterpart to invention in Peirce is abduction: "methodeutic has a special interest in abduction", and may concern "abduction alone" (MSL75, Draft D, 329). In this regard, the purpose of methodeutic is "to develop the principles which are to guide us in the invention of proofs, those which are to govern the general course of an investigation, and those which determine what problems shall engage our energies.(MS L 75, Memoir 27, Draft D, 279). It determines whether a hypothesis should be the first among the justifiable hypotheses to be considered (MS L 75 Memoir13, Draft E, 164). Because it is concerned with what problems an inquiry should invest in, and which hypotheses should be considered for testing, invention is a problem of economics. "The economics of research," Peirce says, is, so far as logic is concerned, "the leading doctrine with reference to the art of discovery" (MS L 75, Memoir 27, Draft D, 330). Part of the purpose of the economy of research is to determine those areas of investigation which prove the most profitable, relative to the value for science (MS L 75, Memoir 28, 388). Most of Peirce's work in this area is done in 1879 (CP 7.139-157), and it is also outlined in his Carnegie grant application in 1902.

In classical rhetoric, style or elocution concerns the manner in which an argument is delivered. Cicero defines it as "the fitting of the proper language to the invented matter" (1960, I.9). For Peirce, this focuses on the clarity of ideas – also emphasized in the rhetorical tradition of Campbell and Whately, in which he was tutored as a young man (see Brent, 1993, p. 38; MS 774; see Campbell, 1823, Bk. II, chap. vi; Whately, 1855, Part III, chap. 1). Clear and distinct ideas are also, of course, a focus of Descartes's methodology and the Port Royal Logic, and the target in "How to Make Our Ideas Clear". Peirce clearly considers this topic part of his methodeutic (MS L 75, Memoir 32, 391). Of course, for Peirce, the clarity of ideas is best expressed by the pragmatic maxim. There are two functions of pragmatism in this regard: the riddance of all unclear ideas, and help in rendering clear ones distinct (CP 5.206). As Peirce articulates it in his famous *Popular Science Monthly* article, the pragmatic method emphasizes that the understanding of a concept is achieved through the systematic conception of its practical or ultimate interpretants; and in science that means articulating a hypothesis, by deduction, in terms of its testable, experimental consequences (CP 7.220). Indeed, some of Peirce's definitions of his formal rhetoric connote this aspect of it: "the science of the essential conditions under which a sign may determine an interpretant sign of itself and of whatever it signifies, or may, as a sign bring about a physical result" (MS 774:5); or, "the doctrine of the general conditions of the reference of symbols and other signs to the interpretants which they determine" (CP 2.93; MS 793:20).

Arrangement, as an important aspect of classical rhetoric, is understood by Cicero as the distribution of arguments in the proper order (1960, I. 9). In Peirce, this could be understood as the proper ordering and interrelation of the three principal types of inferences: abduction, deduction, and induction. Peirce cautions readers that "abduction... is the first step of scientific reasoning, as induction is the concluding step. Nothing has so much contributed to present chaotic or erroneous ideas of the logic of science as failure to distinguish the essentially different characters of different elements of scientific reasoning ..." (CP 7.218). Abduction, as the process of reasoning concerned with invention or the discovery of a hypothesis based on surprising observations, is followed by deduction – "that which is to be done with the hypothesis is to trace out its consequences by deduction" – which is then followed by an induction: "to compare them [the consequences] with the results of experiment by induction, and to discard the hypothesis, and try another, as soon as the first has been refuted; as it presumably will be. How long it will be before we light upon the hypothesis which shall resist all tests we cannot tell; but we hope we shall do so, at last" (CP 7.220). It should also be mentioned that for Peirce, arrangement could also be reflective of Peirce's notion of architectonic, that is, the systematic organization of accumulated concepts and knowledge, including the proper ordering and classification of the sciences themselves (MSL75, Memoir 31, 391; see Liszka, 2000, p. 466).

To emphasize the rhetorical flavor of these matters, it is interesting to point out a parallel here with Whately's recommendation concerning the proper arrangement of the ordinary argumentative composition – realizing, of course, that Whately is one of Peirce's mentors in logic and rhetoric: clear statement of thesis, discovery of proofs for it, the proper ordering and arrangement of those proofs, critical judgment of the thesis on the basis of those proofs (see 1855, pp. 35 ff). In other words, a good composition, like the good proof of a hypothesis, involves the proper organization of elocution, invention and arrangement.

7. Rhetoric, purpose, and convergence to the truth

Inquiry is a real, historical, evolving, and purposive process. The last and most comprehensive aspect of formal rhetoric addresses this teleological dimension of inquiry. In addition to the normative dimensions of the process of inquiry, this aspect of inquiry also points toward the second of the normative sciences, ethics, as well as the third of the normative sciences, aesthetics. This is the case since these normative sciences in particular concern the nature of purposes and ends. In the context of the rhetoric of scientific writing, Peirce defines the traditional sense of rhetoric as "the doctrine of the adaptation of the forms of expression of a writing to the accomplishment of its purpose" (CN 3:180). This is a striking parallel to Campbell's definition of rhetoric as "that art or talent by which the discourse is adapted to its end" (1776, p. 28). In many ways, if modified, this could serve as a good definition of the broadest aspect of his formal rhetoric: "the doctrine of the adaptation of inquiry to the accomplishment of its purpose." As Peirce argues in many places, the purpose of inquiry is truth; that truth is the end of inquiry: "by the true is meant that at which inquiry aims" (CP 5.557). Taken in these terms, formal rhetoric becomes the study of how best to adapt inquiry to achieve truth.

It would appear that in order to do formal rhetoric, we would need to understand the nature of truth in order to adapt the practice of inquiry accordingly. Yet, Peirce famously defines truth as "the predestined result to which sufficient inquiry would ultimately lead" (CP 5.494); or, elsewhere that "the opinion which is fated to be ultimately agreed to by all who investigate, is what we mean by the truth ..." (CP 5.407). It is not so much that something is true because inquirers agree to agree that it is, but because each would, through a sufficient process of inquiry, come to the same conclusion. "Let any two minds investigate any question independently and if they carry the process far enough they will come to an agreement which no further investigation will disturb" (W 3:17). Indeed, Peirce insists that if steadily persisted in, induction will cause someone's conclusion "to converge to the truth as its limit" (CP 7.110), or "in the long run produce a convergence (though irregular) to the truth" (CP 2.775).

However, all of this results in apparent circularity. The purpose of inquiry is the attainment of truth, yet truth is defined as the final result of inquiry. This generates a paradox similar to Meno's dilemma: the purpose of inquiry is to know, yet if we do not know, how can we inquire? We know not where to begin, nor do we know when we have reached the end, even if we came across it quite by accident, not knowing it, we would not recognize it.

Peirce's solution to this paradox, and one that helps to inform the whole of his theory of inference, as well as his theory of inquiry, is found in his theory of errors (see Mayo, 1996, pp. 412 ff). In his astronomical work, Peirce learned very clearly the importance of the method of least squares in finding the line of best fit among clusters of reported observations for stars. Most reported observations clustered into the bell-shaped Gaussian curve. This allowed the recognition of a central tendency in those observations, which by the method of least squares predicted the likely position of the star. The theory of errors becomes a model of inquiry precisely because it solves Meno's paradox. The theory of errors argues that we know primarily by means of error production; by taking the Socratic stance, that everyone is ignorant, we can infer the likely answer by considering the history of our errors. In trying to find the truth, sufficiently long inquiries will begin to converge. But it is important that inquiry proceed in order to produce these errors – so the process must be open and inclusive – but it must also be self-corrective, so that truth eventually converges in the process. As Wilfrid Sellars argues, "empirical knowledge, like its sophisticated extension science, is rational, not because it has a foundation, but because it is a self-correcting enterprise which can put any claim in jeopardy, though not *all* at once" (Sellars, 1956, p. 300). In this case, there is a selection of hypotheses based on least error, that is, a selection of the optimal hypothesis. Thus, Peirce's convergence theory of truth fits well with a corresponding theory of inquiry:

> All our knowledge of the laws of nature is analogous to knowledge of the future, inasmuch as there is no direct way in which the laws can become known to us. We here proceed by experimentation. That is to say, we guess out the laws bit by bit. We ask, What if we were to vary our procedure a little? Would the result be the same? We try it. If we are on the wrong track, an emphatic negative soon gets put upon the guess, and so our conceptions gradually get nearer and nearer right. The improvements of our inventions are made in the same manner. The theory of natural selection is that nature proceeds by similar experimentation to adapt a stock of animals or plants precisely to its environment, and to keep it in adaptation to the slowly changing environment. CP 2.86

Peirce's speculative rhetoric gives us a strong reminder of the importance of Socrates's most famous dictum, made in a final plea to his fellow citizens: "a life without inquiry is not worth living".

References

Aristotle (1952). *The Rhetoric. The Works of Aristotle*, vol. XI. W. D. Ross (Ed.) (W. Rhys Roberts trans.). Oxford: Clarendon Press.

Bacon, F. (1892). *The Advancement of Learning.* G. Bettany (Ed.). London: Ward, Lock, Bowden.

Bergman, M. (2000). "Reflections on the Role of the Communicative Sign in Semeiotic." *Transactions of the Charles S. Peirce Society*, 36(2), 225–254.

Bergman, M. (2009). *Peirce's Philosophy of Communication*. New York: Continuum.

Bird, O. (1959). "Peirce's Theory of Methodology." *Philosophy of Science*, 26, 187–200.

Brandom, R. (2000). *Articulating Reasons*. Cambridge, MA: Harvard University Press.

Braun, J. (1981). "The Speculative Rhetoric of Charles Sanders Peirce." *Philosophy and Rhetoric*, 14, 1–15.

Brent, J. (1993). *Charles Sanders Peirce: A life*. Bloomington, IN: Indiana University Press.

Brock, J. (1981). "An Introduction to Peirce's Theory of Speech Acts." *Transactions of the Charles S. Peirce Society,* 17(4), 319–326.

Burke, K. (1950). *A Rhetoric of Motives*. New York: Prentice Hall.

Campbell, G. (1823). *The Philosophy of Rhetoric*. Boston: Charles Ewer.

Cicero. (1960). *De Inventione*. (H. Hubbel trans.). Cambridge, MA: Harvard University Press.

Colapietro, V. (2007). "C.S. Peirce's Rhetorical Turn." *Transactions of the Charles S. Peirce Society*, 43(1), 16–52.

Habermas, J. (1990). *Moral Consciousness and Communicative Action.* (C. Lenhardt and S. Nicholsen trans.). Cambridge, MA: MIT Press.

Hookway, C. (1997). "Sentiment and Self Control." In J. Brunning & P. Forster (Eds.), *The Rule of Reason* (pp. 201–222). Toronto: University of Toronto Press.

Johansen, J. (1993). *Dialogic Semiosis: An Essay on Signs and Meaning.* Bloomington, IN: Indiana University Press.

Johnson, H. (1968). *The Speculative Rhetoric of Charles Sanders Peirce.* Unpublished Master's Thesis, University of Florida.

Kevelson, R. (1984). "C. S. Peirce's Speculative Rhetoric." *Philosophy and Rhetoric* 17(1), 16–29.

Krois, J. (1981). "Peirce's Speculative Rhetoric and the Problem of Natural Law." *Philosophy and Rhetoric*, 14, 16–30.

Liszka, J. (1996). *A General Introduction to the Semeiotic of Charles S. Peirce*. Bloomington, IN: Indiana University Press.

Liszka, J. (2000). "Peirce's New Rhetoric." *Transactions of the Charles S. Peirce Society*, 36(4), 439–476.

Lyne, J. (1978). *C.S. Peirce on Rhetoric and Communication.* Unpublished Ph.D. Dissertation, University of Wisconsin.

Lyne, J. (1980). "Rhetoric and Semiotic in C.S. Peirce." *The Quarterly Journal of Speech*, 66, 155–68.

Mayo, D. (1996). *Error and the Growth of Experimental Knowledge.* Chicago: University of Chicago Press.

Michael, E. (1977). "A Note on the Roots of Peirce's Division of Logic into Three Branches." *Notre Dame Journal of Formal Logic*, 18, 639–640.

Misak, C. (2000). *Truth, Politics, Morality: Pragmatism and Deliberation.* New York: Routledge.

Santaella-Braga, L. (1999). "Methodeutics, the Liveliest Branch of Semiotics." *Semiotica*, 124(3/4), 377–395.

Savan, D. (1988). "Peirce and the Trivium." *Cruzeiro Semiotico*, 8, 50–56.

Sellars, W. (1956). "Empiricism and the Philosophy of Mind." In Herbert Feigl & Michael Scriven (Eds.), *Minnesota Studies in the Philosophy of Science*, vol. 1 (pp. 253–329). Minneapolis, MN: University of Minnesota Press.

Whately, R.(1846). *Elements of Rhetoric* (7th ed.). D. Ehninger (Ed.). Carbondale, IL: Southern Illinois University Press.

Evolution, Pragmatism, and Rhetoric: Exploring the Origin and Loci of Meaning

Vincent Colapietro
The Pennsylvania State University

1. Introduction

C. S. Peirce bemoaned "the merciless way that words have to expect when they fall into literary clutches" (EP 2:334). In my hands, his texts have once again fallen into such clutches, at any rate, ones that he would judge to be closer the hands of a *litterateur* than those of a scientist. I intend to be not so much merciful as cherishing, thereby hoping to show that litterateurs and rhetoricians need not be abusive in their handling of the words of others, especially the texts of philosophers. And it is to Peirce's own words, recalled here partly for a polemical purpose, that I most want to call your attention. This purpose is, at least, doubly polemical, for my intention is to read Peirce somewhat against the grain of even his most astute interpreters but also against himself. In reading Peirce to some extent against himself, however, I desire to aid him in achieving one of his deepest aspirations – the daunting challenge of articulating a truly general theory of signs. The constructive goal underlying this polemical purpose, however, is to trace out more fully a trajectory inherent in Peirce's theory of signs, a trajectory bearing directly on the scope of this theory. The culmination of Peirce's semeiotic in a truly comprehensive understanding of speculative rhetoric is often compromised by attending too exclusively to methodeutic as the culminating branch of Peircean semeiotic. The evolution of his own reflections on signs, moreover, is intimately connected to his commitment to evolution. That is, his doctrine of signs is, to a remarkable degree, of a piece with his commitment to evolution. Constructively, then, my task is to highlight these all too often neglected aspects of Peirce's mature position. The evolution of Peirce's semeiotic toward a truly comprehensive vision of rhetoric and the articulation of this theory from an evolutionary point of view define the topics of my concern.

2. Instituting a theory of signs: preliminary considerations

In "A Sketch of Logical Critics", a manuscript most likely composed in August of 1911, Peirce posed a rhetorical question:

> Would it not, at any rate, in the present state of science, be good scientific policy, for those who have both a talent and passion for eliciting the truth about such matters, to institute a cooperative cenoscopic attack upon the nature, properties, and varieties of Signs, in the spirit of twentieth-century science? EP 2:462

He immediately added:

> For my part, although I have had sundry universal propositions concerning Signs under anxious advisement for many years, I have been unable to satisfy myself as to a single one of them... This is not because of any definite reason for hesitation, but simply that having been unable to urge my argument upon any mind but my cautious self, I cannot help having a vague question whether a fresh intelligence, uncramped by long dwelling on the same questions, might not start objects that have escaped my fagged understanding on account of their very obviousness, just as in my fatigue I very frequently think I have mislaid some familiar instrument or utensil and lose the better part of an hour searching for it and finally discover it very prominently placed just where it always was and ought to be, but where the very absence of any feature to which I am not accustomed has preventing its attracting my attention.

These are virtually "paper doubts", but not fully so. Here too Peirce's own words are instructive: "I think it most likely that my doubts about all universal predications concerning signs are mostly quite gratuitous, but still my having no second person to whom to appeal as to the reasonableness of my doubts prevents their being laid to rest." You and I are among those to whom Peirce in such writings is appealing. In explicitly addressing the Reader in the second person (sometimes going so far say as to entitle this person as "Your Honor"), he is deliberately addressing "a real person, with all the instincts of which we human beings are so sublimely and so responsibly endowed" (EP 2:464). In "What Pragmatism Is", Peirce stresses: "Among the things which the reader, as a rational person, does not doubt, is that he not merely has habits, but also can exert a measure of self-control over his future actions..." (EP 2:337).

The importance of this to the original formulation and especially the eventual refinement of his pragmatic position cannot be exaggerated: "Now the theory of Pragmaticism was originally based, as anyone will see who examines the papers of November 1877 and January 1878 [i.e., "the Fixation of Belief" and "How to Make Our Ideas Clear"], upon the study of that experience of the phenomena of self-control which is common to all grown men and women; and it seems evident that to some extent, at least, it must always be so based" (EP 2:348). The pragmatic clarification of meaning and the experimental fixation of belief are the results of the conscientious efforts of deliberate agents possessing a contrite sense of their ineradicable fallibility. It is based, above all else, on our experience of error (more fully, that of having error forced on our attention, but also having at least on occasion the experience of being able to correct our mistakes, i.e., modify our habits so that they are more finely and fully attuned with those of the cosmos itself).

The shaping of intellectual character, at the heart of which is intellectual conscience,[1] is arguably bound up with the articulation of Peircean pragmatism. The proof of pragmaticism thus must be rhetorical as well as logical, one facilitating the *identification* with a certain form of community as well as exhibiting the unsuspected implications of our unavoidable acknowledgments (Colapietro, 2007). It is conceivably aimed at the reshaping of intellectual character, not solely the winning of cognitive assent. In this connection, the references to the effects upon persons are not "sops to Cerberus". The famous text in Peirce's private correspondence in which this metaphor appears needs to be set alongside other ones, not least of all:

> In coming to Speculative Rhetoric, after the main conceptions of logic have been well settled, there can be no serious objection to relaxing the severity of our rule of excluding psychological matter, observations of how we think, and the like. The regulation has served its end; why should it be allowed now to hamper our endeavors to make methodeutic practically useful? But while the justice of this must be admitted, it is also to be borne in mind that there is a purely logical doctrine

[1] It is certainly significant that one of Peirce's most important manuscripts, filling six notebooks and running to over 400 pages, is titled: "Reason's Conscience: A Practical Treatise on the Theory of Discovery; Wherein logic is conceived as Semeiotic" (MS 693).

> of how discovery must take place, which, however great or little is its importance, it is my plain task and duty here to explore. In addition to this, there may be a psychological account of the matter, of the utmost importance and ever so extensive. With this, it is not my business to meddle, although I may here and there make such use of it as I can in aid of my own doctrine. CP 2.102

But methodeutic as a branch of semeiotic is the achievement of an autonomous agent striving, within the context of inquiry, to exert the necessary level of intellectual control over the use of signs and, of pivotal importance, the formulation, elaboration, and testing of hypotheses. In speculative grammar, a truly general conception of semiosis is derived by means of abstraction; in speculative rhetoric, a distinctively normative understanding of sign-use is obtained through recontextualization (taking sign-use in all of the contexts in which it is observable, not only in those that are paradigmatic or, at least, plausible instances of experimental inquiry).

This suggests that speculative rhetoric, rather than methodeutic, is the better name for the third branch of Peircean semeiotic. Within an intricate mapping of the divisions of speculative rhetoric, Peirce suggests, as one of the leading divisions of this branch of semeiotic (its most vital and important branch), this trichotomy: a rhetoric of fine arts, that of practical persuasion, and that of scientific discourse ("Ideas, Stray or Stolen, about Scientific Writing"; EP 2:329). The least developed part of Peirce's semeiotic might just be the most important part. It is *neither* identifiable with methodeutic (methodeutic being but a part of a part of one of the main subdivisions of speculative or philosophical rhetoric) *nor* possible (let alone useful) to do so, except insofar as this branch concerns itself with the deliberate cultivation of logical interpretants in any sphere of sign-use (above all, *ultimate* logical interpretants – i.e., habits of imagining, questioning, and acting in various other ways). It is the branch of semeiotic most directly concerned with the evolution of interpretants. One important implication of this pragmaticist doctrine regarding the ultimate interpretant is this: The question of meaning turns out to be one concerning the history – or evolution – of interpretants, ultimately the ongoing generation of ever more flexible, nuanced, and attuned habits. The historicist and evolutionary cast of Peirce's semeiotic is, even at this late date, inadequately appreciated by many readers who are otherwise informed and insightful (Colapietro, 2004b).

3. An evolving theory and a thoroughgoing evolutionism

Peirce's reflections on signs manifest an evolving character. Moreover, they are more intimately connected with his carefully articulated accounts of evolution than many readers seem to notice (see, however, Short, 2007). It is, therefore, remarkable that Peirce's theory of evolution has not been used more fully by his expositors to illuminate his understanding of the interpretant, in particular, the complex processes by which interpretants are actually generated in such paradigmatic instances of anthroposemiosis as ordinary conversations, scientific investigations, moral deliberations, and artistic innovations. A number of commentators, including John Dewey in his review of the *Collected Papers* and Philip Wiener in *Evolution and the Founders of Pragmatism*, have indeed highlighted the fact Peirce's conception of logic is evolutionary (see, e.g., Alborn, 1989). In addition, some have been emphatic in claiming that Peirce viewed natural processes from a logical perspective as much as logical practices from an evolutionary viewpoint. While biological mutations are depicted by him as, in effect, random guesses having, at best, an uncertain future, the intense competition among scientific hypotheses to secure a niche for themselves in an environment full of predators and other antagonists is cast in an evolutionary light. So, on the one hand, Peirce insists, "the logic of evolution and of life need not be supposed to be of that wooden kind that absolutely constrains a given conclusion. The logic may be that of the inductive or hypothetic inference" (CP 6.218). On the other, he suggests: "The evolutionary theory in general throws great light upon history and especially the history of science – both its public history and the account of its development in an individual intellect" (CP 1.103). Thus, it seems no less accurate to assert that Peirce sought to explain evolution in terms of his logical conceptions than that he endeavored to illuminate logic (or semeiotic) in terms of evolutionary ideas (Burks, 1997).

This might however appear to be (to recall one of Peirce's most vivid metaphors) a case of two drunks trying to hold each up. Recall that he uses this trope in reference to anyone who proposes to explain the mutual dependency of logic and psychology (CP 8.167). But we can appeal to Peirce as underwriting our position concerning evolution and logic: "After all, any analogy, however fanciful, which serves to focus attention upon matters which might otherwise escape observation is valuable" (CP 3.370). And who can convincingly deny that the analogy of evolution invites us to discern what we might otherwise easily overlook? Is it even the case that this analogy is *utterly* fanciful, especially since it is so unquestionably fruitful? Finally, is not the idea of growth, with which Peirce virtually identifies evolution (see, e.g., CP 1.174), itself capable of indefinite growth and, in addition, is not the cultivation of the growth of this idea, especially in the teeth of positions rendering life, mind, and consciousness completely inexplicable and cosmologically anomalous, worthy of our cherishing concern? Is not Peirce's vision of the cosmos one in which growth, including the growth of signs (especially symbols) and, thus, the growth of mind (indeed, the evolution of semiosis into mentality), is rendered not only central but also explicable? Peirce is explicit on most of these points:

> The idea of growth – the stately tree springing from the tiny seed – was the key that Aristotle brought to be tried upon this intricate grim lock. In such trials he came upon those wonderful conceptions... This idea of Aristotle's has proved marvelously fecund; and in truth it is the only idea covering quite the whole area of cenoscopy that has shown any marked uberosity [security versus uberty (rich suggestiveness)]. Many and many a century is likely to sink in Time's flood, and be buried in the mud of Lethe, before the achievements of the nineteenth [century] shall get matched. But of all those achievements, the greatest in the eye of reason, that to bringing to light the supremacy of the element of *Growth*, was, after all, nothing but a special *application* of Aristotle's pure vision. EP 2:373; emphasis added

It is hardly an exaggeration, then, to say that all of Peirce's efforts were directed toward facilitating the *growth* of meaning, knowledge, and understanding.

Although these points are almost certainly familiar to most readers of Peirce, their implications, not least of all their implications for *how* to carry forward the study of semiosis, are not likely appreciated by every student of Peirce's writings. But, just as Peirce's texts must be read in an evolutionary light, so Darwin's might be interpreted from a Peircean perspective. Doing so allows us to bring into sharp focus not only questions of rhetoric, above all, those pertaining to the rhetoric of science, but also questions about some of the most important rhetorical dimensions of Peirce's own philosophical authorship. The least complete, but most vital, part of Peirce's semeiotic (his speculative rhetoric) is arguably the one in which metaphors drawn from evolutionary biology have their least problematic, most promising applications.

In a perceptive review of the first six volumes of the *Collected Papers*, John Dewey noted: "Peirce lived when the idea of evolution was uppermost in the mind of his generation. He *applied* it everywhere. But to him it meant, whether in the universe of nature, of science or of society, continual growth in the direction of interrelations, of what he called continuity" (LW 11:482–3; emphasis added). Dewey is especially perceptive in connecting Peirce's evolutionism with his synechism (or doctrine of continuity), an insight honoring the principle of continuity itself. For it connects what otherwise might seem to be disparate or disjoined. Dewey is also surprisingly appreciative of the fact that, given Peirce's concern with the generality of our shared practices, far more than with the uniqueness of our individual experiences, Peirce, precisely as a pragmatist, captured what James failed to appreciate. Shared human practices are irreducibly *general* modes of purposive exertion. In Dewey's judgment, at least, Peirce was *more of a pragmatist* than James precisely because of Peirce's characteristic emphasis on the generality of human practices and because such practices are *general* (LW 11:483).

As a younger man, Peirce went so far as to assert: "indeed, my opinion is only Darwinism analyzed, generalized, and brought into the realm of Ontology" (W 4:552). "This Darwinian principle is plainly capable of great generalization. Wherever there are large numbers of objects having a tendency to retain certain characters unaltered, this tendency, however, not being absolute being giving room for chance variations... there will be a gradual tendency to change in directions of departure from them" (Wiener, 1965, p. 81). But the first of these assertions, the one in which Peirce identifies his position as "only Darwinism" modified in several respects, needs to be carefully handled.

The main reason for this is that, while Peirce was a thoroughgoing evolutionist, he was only a half-hearted Darwinian. The nature and source of his reservations regarding Darwin's theory of evolution are matters of dispute. Too often, however, too much is made of Peirce's philosophical and even theological objections to Darwin's views, too little of the strictly scientific character of his misgivings. I, however, simply note these reservations. In Freudian terms, one might say that Peirce's mature position toward the Darwinian perspective was one of achieved ambivalence (Segal, 1992). He arrived at a nuanced, critical, yet appreciative attitude toward Darwin. In this, he proved himself to be able to throw off the influence of one of the most commanding thinkers in the early stage of his intellectual development (the close friend of his father and scientific tutor of Charles – Louis Agassiz).[2]

[2] After his return from Louisiana (a scientific expedition including the recently graduated Peirce), Agassiz would debate with Asa Gray at Harvard about Darwinian evolution. For illuminating, informative accounts of this controversy, see Wilson (1967), also Russett (1976).

But it is other facets of Peirce's preoccupation with growth that I want to consider here. While *methodeutic* captures Peirce's focal preoccupation with offering a normative account of objective inquiry, in the context of an evolutionary cosmology, speculative rhetoric conveys the still largely unrealized potential of his philosophical imagination, inasmuch as this imagination is evident in his vision of a thoroughly generalized conception of rhetoric (see, however, Bird, 1959; also Santaella, 1999, esp. pp. 388–90). According to Peirce, "the woof and warp of all thought and all research is symbols, and the life of thought and science is the life inherent in symbols" (CP 2.220). Symbols cannot function apart from other modes of signification, so a detailed, nuanced, and comprehensive account of the various modes of signification is required for doing justice to scientific investigation (or objective inquiry). However, the execution of this task requires unblinking recognition of the vital character, the irrepressible life, inherent in our experimental practices (see, e.g., CP 1.234–5). But, from Peirce's perspective, the very forms of living beings grow (not just those organisms themselves): by complex processes involving chance and catastrophe, compulsive attractions and alluring radiance, fierce struggle and cherishing concern, the forms of life themselves evolve.

The title of Darwin's book, *Origin of Species*, implicitly embodied a revolution, since it manifestly implied (contra the dominant tradition in Western ontology) that species have an origin in history. The very forms of being and thus intelligibility are irreducibly historical or temporal. I take this to mean (among countless other things) that Peirce's evolution is relevant to his semeiotic. The application of Peirce's understanding of evolution to his own doctrine of signs enhances the applicability of this doctrine, for it renders his semeiotic more flexible, adaptable, and fecund than it otherwise would be. It is however easy to misunderstand the ideal of applicability, one bound up with the insistence upon generality (cf. Wittgenstein, 1958, pp. 17–8). Indeed, the generality of this theory is practically established by the applicability of the definitions and distinctions to domains beyond those for which they were principally crafted. But the ordinary understanding of applicability is likely to endorse what might be called a theoreticist conception of practice, wherein the validity or the justification of a practice awaits the arguments and verdicts of theory. But, from a consistently pragmaticist perspective, our practices are justified in the same manner as our lives. From this angle, theory is not undertaken for the sake of practice any more than practice appeals to a theory for its justification or foundation. Rather, theory is itself a form of practice or, more accurately, a widely extended family of historically *evolved* practices. Our theoretical practices are, like all other ones, justified (insofar as they are truly justified) *practically*. Self-subsistent grounds are as superfluous here as are self-warranting cognitions, ahistoric foundations as irrelevant in this context as foundational intuitions. The ultimate appeal can only be to the fluency, efficacy, intensity, and disclosures reclaimed, in the face of inevitable crises, by improvisational actors caught up in historical dramas of an essentially contested character (see Gallie, 1964). Of course, such an ultimate appeal can never be anything more than a provisional appeal: it can never be ultimate. The historical emergence of experimental intelligence is, in one sense, contemporaneous with certain complex forms of animal life yet, in a more narrow sense, coextensive with a self-consciously *deliberative* approach to those experiential impasses by which mindful agents are thrown into doubt and confusion.

The *continuity* between the forms of intelligence displayed in everyday life and those exhibited in paradigmatically scientific investigations needs to be stressed, but not to the point where certain salient differences are effaced. The abiding relevance of Peirce's sentimental conservativism is likely, especially among intellectuals, to be ignored or dismissed. So much depends upon virtually unquestioning allegiance to traditions of civility, tolerance, and affection.

We craft a general theory of signs *for a purpose*. Peirce was a convinced pragmaticist *in* even his seemingly most formal elaboration of semeiotic topics. This means, in part, that the governing purposes are of the utmost importance to identify and assess in reference to any development within his semeiotic theory. It also means that theories are not formulated prior to practice and, only then, applied. If we are Peirceans, we do not so much *apply* a theory of signs ready-made to a domain of practice as we articulate from within this domain a more nuanced, flexible, and experimental self-understanding of our participation in this practice (a participation not infrequently involving a sense of identification). This overstates the case, for (to take but one example) one can offer a semiotic account of religious conversion without being oneself a religious person (without identifying with the practice being investigated). As practitioners or, at least, as those who aim to attain an "interior understanding" of the actual participants in some human practice, we must provisionally grant the practice under consideration an integrity and autonomy of its own, although one hardly inseparable from countless other practices.

Applying Peirce's understanding of evolution to his own doctrine of signs renders this doctrine more applicable than it otherwise would be, not least of all by shifting the focus from the taxonomic to the genealogical. What Darwin wrote near the conclusion of *On the Origin of Species* I might say near the end of this talk: "How far more interesting" does our study become "when we regard every production of nature as one which has had a history". Just as Darwin drove biology in the direction of historical questions, so Peirce devoted himself to logic with a deliberately cultivated historical consciousness of its long history. We ought never to forget that Peirce was, *in his role as a logician*, a historian of logic. Nathan Houser, Don Roberts, and James van Evra, the editors of *Studies in the Logic of Charles Sanders Peirce* (1997), were wise in using a text from Augustus De Morgan as the epigram for this collection of essays: "All the men who are now called discoverers, in every matter [field] ruled by thought, have been men versed in the minds of their predecessors, and learned in what had been [thought] before them" (*A Budget of Paradoxes*, volume 1, p. 5). Whether this truly applies to every logician who has made significant contributions to logic, it certainly applies to Peirce. He was in his role as a scientist and philosopher of science a *historian* of science. Critical attention to what has been called the pragmatics of explanation helps us to appreciate the irreducible plurality of explanatory strategies (see, e.g., Dray, 1954). Of most immediate relevance here, there are historical modes of explanation not reducible to the dominant strategies in science. These are scientific modes of explanation, if not always recognized as such.

One of the principal tasks of practical rhetoric is to win a hearing – nothing more, but also nothing less than a wider, fairer hearing – for some position, perspective, or methodology that is at odds with the self-understanding of exemplary or authoritative practitioners (cf. Darwin, 2000, pp. 209–10). Proof unquestionably has its place in such an effort, but the point of such an endeavor – the purpose of this deployment of rhetoric – is less to prove anything conclusively than it is to widen the field of inquiry to include what is systematically, even unreflectively, pooh-poohed. Peirce was a physicist who argued for tychism in the teeth of the physics of his day. Only a universe in which there is chance is one in which there could be evolution. Only a universe in which there is a fantastic proliferation of living forms and the radical transformation of biological niches partly resulting from the perfusion of (and competition among) such forms, could there be in time consciousness and mind having the degree of complexity and recursivity so manifest in the historical practices of the human animal.

Peirce's mature theory of signs is thoroughly pragmatic, just as his mature articulation of pragmatism is formally semiotic. This implies that deliberative agents passionately identifying with historically evolving communities of self-critical inquirers are not only the authors of such doctrines but also their objects. Peircean pragmatism is, at the very least, a commonsensical yet critical theory of deliberative agency in which the controlling or defining purposes of the doctrines framed by such agency are themselves made explicit objects of rational assessment.

In a letter to James, dated March 7th, 1904, Peirce wrote: "The effect of pragmatism here is simply to open our minds to receiving any kind of evidence, not to furnish the evidence" (CP 8.259). Earlier, in the *Lectures on Pragmatism*, he asserted: "What the true nature of Pragmatism may be, I find it very hard to say; but in my nature it is a sort of instinctive attraction for *living facts*" (CP 5.64; or EP 2:158; emphasis added). What he means by living facts is made manifest when he goes on to claim:

> All nature abounds in proofs of other influences than merely mechanical action even in the physical world. They crowd in upon us at the rate of several every minute. And my observation of men has led me to this little generalization. Speaking only of men who really think for themselves and not of mere reporters, I have not found that it is the men whose lives are mostly passed within the four walls of a physical laboratory who are most inclined to be satisfied with a purely mechanical metaphysics. On the contrary, the more clearly they understand how physical forces work the more incredible it seems to them that such action should explain what happens out of doors.
>
> CP 5.65; EP 2:158

And what we need, more than anything else, is a philosophy possessing the wherewithal to explain what happens out of doors, beyond the walls of the laboratory as much as those of the library. But only a philosophy attuned to the vagaries, varieties, and intricacies of living beings holds the promise of carrying out this task.

4. Toward a pragmaticist reclamation of *living* reason

Peirce's philosophical authorship might itself be read as an indefatigable effort to win a hearing for an evolutionary cosmology in which living beings, both as they manifest themselves in our everyday experience and as they have been theorized in evolutionary biology, are accorded pride of place. However, this substantive position is to some extent always subordinated by Peirce to methodological preoccupations. The growth of experimental intelligence, as a dramatic episode in the evolution of the natural world, involves the transformation of blind groping into intelligent guessing. The evolution of concrete reasonableness encompasses the growth of such intelligence – and the self-understanding of deliberative agents as mortal beings conscientiously devoted to the realization of transcendent ideals signifies a very different relationship to nature than the one encountered in so many philosophers from Peirce's time to our own. An abiding, penetrating and sustaining sense of attunement, rather than a lacerating, defiant, and ultimately delusional sense of alienation, characterizes this relationship.

"How bleak a climate America with its vitally important topics is for vitally unimportant but cosmically vital ideas" (MS 436 [Lecture I, 1898]; reproduced in Stuhr, 1987, p. 46). What we need, however, are not "sporadic ideas on vitally important topics", but rather the systematic articulation of cosmically vital ideas.

Formal, abstract reason is an integral phase, or justified guise, of concrete, *living* reason (Smith, 1995, chap. IV). Whatever else pragmatic intelligence might be, however, it always ultimately returns to assuming the unmistakable guise of living reason. Formal, abstract reason is only an intermediate phase, or temporary (dis)guise, of living human rationality. The emphatic insistence on living reason is found in James as well as in Peirce. In the concluding chapter of his *Pragmatism*, James proclaims:

> But if one talks of rationality and the reason of things, and insists that they can't just come in spots, what *kind* of reason can there ultimately be why anything should come at all? Talk of logic and necessity and categories and the absolute and the contents of the whole philosophical machine shop as you will, the only *real* reason I can think of why anything should ever come is that *someone wishes it to be there*. It is *demanded*, demanded, it may be, to give relief to no matter how small a fraction of the world's mass. This is [James announces] *living reason*, and compared with it material causes and logical necessities are spectral things. James, 1978, p. 138

In one of his most detailed classification of ultimate ends, Peirce notes "*finally*, he [i.e., any rational or deliberative agent] may be filled with the idea that the only reason that can reasonably be admitted as ultimate is that living reason for the sake of which the psychical and physical universe is in process of creation (religionism)" (CP 8.138). I hope to have an opportunity at some point to develop the contrast between the Peircean and Jamesian understanding of living reason, but this must for now be postponed. As pragmatists, both reveal a thoroughgoing commitment to living reason, however differently they might come to spell out the meaning of this form of rationality.

Peirce was acutely aware of how quickly the most sophisticated intellectuals of his day were likely to dismiss, out of hand, such claims. He himself was prone to do so, even with regard to his categories ("This sort of notion is as distasteful to me as to anybody; and, for years, I endeavored to pooh-pooh and refute it; but it long ago conquered me completely" [CP 8.328].) Whereas many of his scientific brethren were fixated on the finality of scientific truth, Peirce was fascinated by the life – thus, the fluidity and mutability – inherent in the pursuit of such truth. Given the typical reaction to so many of his most cherished ideas, then, it is no surprise that he once confessed: "I wish I had the leisure to place before those gentlemen a work to be entitled The History of Pooh-pooh-ing. I think it would do them good" (CP 2.111). There are, at least for Peirce, ideas possessing "inherent, incorruptible *vitality*" (CP 2.217; emphasis added). The idea of growth itself is arguably one such idea. The Peircean idea of symbol is inseparable from his evolutionary understanding of growth, just as his vision of thoroughgoing evolutionism is inseparable from that of the living symbol. "[W]hatever be the kind and degree of our logical assurance that there is any real world, external or internal, that same kind and degree of assurance we certainly have that there not only may be a living symbol, realizing the full idea of a symbol, but [also] even that there actually is one" (CP 2.114; cf. Colapietro, 1989, p. 113).

The growth of signs and especially symbols has reached the point in the actual evolution of human beings of providing us with the rhetorical resources to win a fairer hearing for some of the seemingly more untenable ideas to be harvested from Peirce's writings. Darwin was pooh-poohed in his own day and is still quickly, contemptuously dismissed in our own. Peirce's fate is, if anything, to have suffered such dismissal to an even greater degree. In the monumental book he rushed to complete, Darwin's rhetorical achievement is a stunning one. In the monumental works he envisioned but never finished, Peirce's rhetorical achievement is no less remarkable. For, like his scientific kin, he did much to win a hearing for a view all too readily dismissed in his own day and indeed our own. But this gathering[3] is a vibrant sign of that vital truth. The signs of growth mani-

[3] The reference is to the meeting at which an earlier draft of this paper was presented.

festing themselves at every turn are not irrelevant to formulating the case for the growth of symbols. The life inherent in signs however requires for its articulation an instinctive attraction to living facts, a theoretical imagination attuned to the signs indicative of life and all that life implies. In this as in so many other respects, C. S. Peirce's philosophical ideas appear capable of indefinite growth.

Such growth holds the secret to the question of meaning. Indeed, meaning traces its *origin* to the evolution of relations to a certain minimal degree of complexity, a degree at least making possible (but at certain junctures making likely if not inevitable) ever more complex relations, including intensely and explicitly reflexive ones. In this context, the meaning of evolution virtually coincides with that of emergence.

From Peirce's perspective, however, the origin of meaning is far less important than the development of meaning – and this development is identifiable with the series of interpretants generated by the dynamism between a sign and its object. One of the tropes for understanding this process is evolution, especially as envisioned by Peirce. The meaning of meaning is unintelligible apart from the growth of meaning (especially the growth – or evolution – of symbols) and, in turn, the growth of meaning is unintelligible apart from a vision of the cosmos in which evolution is primordial and pervasive.

5. Conclusion: arts other than those of inquiry

Peirce of course paid closest attention to the actual evolution of our scientific practices. In this regard, he traced the origin of science itself to the arts. "The art of medicine grew", he suggests, "from the Egyptian book of formulas into physiology. The study of the steam engine gave birth to modern thermodynamics. Such is the historical fact. The steam engine made mechanical precisions possible and needful [necessary]. Mechanical precision [in turn] rendered modern observational precision possible, and developed it. Now every scientific development is due to some new means of improved observation. So much for the tendency of the arts" (EP 2:38–9). The destiny of the most immediately practical arts lies beyond the domain of practice in any narrow or anthropocentric sense.

Hence, at this point in his account of the emergence of scientific inquiry as a theoretical pursuit, Peirce poses a rhetorical question: "Can any man with a soul deny that the development of pure science is the great end of the arts?" He is quick to point out, "Not indeed for the individual man.

He uses them, just as [he] uses the deer, which I yesterday saw out of my window; and just as in writing this lecture I am burning great logs in a fireplace. But we are barbarians to treat the deer and the forest trees in this fashion. They have ends of their own, not related to my individual stomach or skin. So, too, man looks upon the arts from a selfish [i.e., barbaric] point of view. But they, too, like the beasts and the trees, are living organisms, none the less so for being parasitic to man's mind; and their manifest internal destiny is to grow into pure science" (EP 2:38-9).

It is likely that there is here a fatal ambiguity regarding the arts (e.g., the arts in their broadest significance and the arts in a narrower sense, one referring to the fine arts), also one regarding selfishness (i.e., exclusive or inordinate self-regard, on the one hand, and self-regard without qualification, on the other). However this may be, I am inclined to warn against the merciless way the arts are treated when they fall into scientific clutches, for they are not taken in their own right – they are not considered in their firstness – but exclusively in their service of bringing into being what is other than art. The fecundity of Peirce's theoretical imagination, especially as embodied in his fragmentary writings on sundry matters concerning signs, issued in an array of conceptions enabling us to take the arts on their own terms, not simply as transitional phases in the evolution of pure science. Peirce's text implies a pragmatic clarification of the term *barbarian*: any individual who habitually fails to approach phenomena and all else in their firstness, who fails to consider what things are *in themselves*, apart from their use to this or that individual. As he stresses elsewhere, however, the capacity to discern what stares us in the face is, in the first instance, nowhere more available for phenomenological study than in the perceptual acuity of the artistic sensibility. Peirce in effect invites us to read him against himself, offering us correctives to his occasionally one-sided assertions. This is but one of countless such instances. The task of interpretation imposes on us the necessity of evolving interpretants that enable us to take a text on its own terms. Only thus can we avoid hermeneutic barbarity. This task also imposes on us the need to be bold, to think beyond – and even against – what Peirce asserted and argued (see Short, 2007). Only thus can we escape hermeneutic sterility. My hope is that, in having fallen into the hands of one more attuned to the broadly rhetorical dimensions (rather than the narrowly logical ones) of Peirce's philosophical authorship, I have avoided not only such barbarity and sterility, but also the merciless treatment of philosophical texts when such a fate befalls them.

References

Alborn, T. (1989). "Peirce's Evolutionary Logic: Continuity, Indeterminancy and the Natural Order." *Transactions of the Charles S. Peirce Society*, 25, 1–28.

Burks, A. W. (1980). "Man: Sign or Algorithm? A Rhetorical Analysis of Peirce's Semiotics." *Transactions of the Charles S. Peirce Society*, 16, 279–292.

Burks, A. W. (1997). "Logic, Learning, and Creativity in Evolution." In N. Houser, D. Roberts, & J. van Evra (Eds.), *Studies in the Logic of Charles Sanders Peirce* (pp. 497–534). Bloomington: Indiana University Press.

Colapietro, V. (1989). *Peirce's Approach to the Self.* Albany: SUNY Press.

Colapietro, V. (2004a). "Portrait of a Historicist: An Alternate Reading of Peircean Semiotic." *Semiotiche*, 2, 49–68.

Colapietro, V. (2004b). "Toward a Truly Pragmatic Theory of Signs: Reading Peirce's Semeiotic in Light of Dewey's Gloss." In E. L. Khalil (Ed.), *Dewey, Pragmatism, & Economic Methodology* (pp. 102–129). London: Routledge.

Colapietro, V. (2007). C. S. Peirce's Rhetorical Turn. *Transactions of the Charles S. Peirce Society,* 43, 16–52.

Darwin, C. (2000). *Darwin.* P. Appleman (Ed.). New York: W. W. Norton & Co.

Dewey, J. (1991). *Later Works of John Dewey*, vol. 11. Carbondale: Southern Illinois University Press. [Abbreviation: LW]

Dray, W. (1954). "Explanatory Narrative in History." *Philosophical Quarterly*, 4(14), 15–27.

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

Gallie, W. B. (1964). *Philosophy and the Historical Understanding*. New York: Shocken Books.

Houser, N., Roberts, D., & van Evra, J. (Eds.) (1997). *Studies in the Logic of Charles Sanders Peirce*. Bloomington: Indiana University Press.

James, W. (1978). *Pragmatism*. Cambridge, MA: Harvard University Press.

O'Hara, R. J. (1988). "Homage to Clio, or Toward a Historical Philosophy of Evolutionary Biology." *Systematic Zoology*, 37(2), 142–55.

Reynolds, A. (2002). *Peirce's Scientific Metaphysics: The Philosophy of Chance, Law and Evolution*. Nashville: Vanderbilt University Press.

Russett, C. (1976). *Darwin in America: The Intellectual Response 1865–1912*. San Francisco: W. H. Freeman & Co.

Segal, H. (1992). "The Achievement of Ambivalence." *Common Knowledge*, 1(1), 92–104.

Short, T. L. (2007). *Peirce's Theory of Signs*. Cambridge: Cambridge University Press.

Smith, J. E. (1995). *Experience and God.* New York: Fordham University Press.

Stuhr, J. J. (Ed.) (1987). *Classical American Philosophy* (1st Ed.). New York: Oxford University Press.

Wiener, P. W. (1965). *Evolution and the Founders of Pragmatism.* New York: Harper & Row.

Wilson, R. J. (1967). *Darwinism and the American Intellectual.* Homewood: The Dorsey Press.

Wittgenstein, L. (1958). *The Blue and the Brown Books.* New York: Harper & Row.

Iconicity as Homomorphism: The Case of Picasso's *Guernica*

Chiara Ambrosio
University College London

> [I]n contemplating a painting, there is a moment when we lose the consciousness that it is not the thing, the distinction of the real and the copy disappears, and it is for the moment a pure dream – not any particular existence and yet not general. At that moment we are contemplating an Icon. Peirce, CP 3.362

1. Introduction

For over four decades, Charles S. Peirce's semiotic formulation of iconicity has been the object of intense debates. Classical conventionalist and nominalist arguments (Eco, 1975; 1997; Bierman, 1963; Goodman, 1962) regarded iconicity as a weak representative relation based upon a form of similarity or likeness.

I propose an interpretation of iconicity which overcomes classical "iconoclast" arguments. Iconicity is a structural relation established by a mind between certain representing facts and the states of affairs that they represent. I argue that such a structural relation is more accurately expressed in terms of the mathematical concept of homomorphism (Shin, 2002; Norman, 1999). A theory of iconicity as homomorphism accounts for structure preservation as a relation which is established through a cognitive act, rather than a physical similarity or a superficial, point-to-point correspondence. In this respect, it can be used as a theoretical device to overcome mimetic accounts of artistic representation.

Pablo Picasso's 1937 painting, *Guernica*, can be used as a testing ground for a theory of iconicity as homomorphism. I examine the painting as a case of iconicity in context and argue that it conforms to Peirce's definition of icons as "composite photograph[s] of images" (CP 2.317) of the objects they represent. The canvas, as such, is an asserted icon – a sign that stands for certain states of affairs by virtue of a structural relation. Iconic representations such as *Guernica* are by their own nature cognitively fertile, as they evoke in a direct and immediate manner mental icons, or what Peirce called "pure dreams" (CP 3.362) – mental representations that are neither particular nor general and that ultimately amount to generalizations from experience.[1]

2. Beyond (and against) resemblance: a few misunderstandings on the nature of iconicity and iconic signs

In his 1962 classic work *Languages of Art*, Nelson Goodman developed the thesis that a notion of resemblance between a sign and the object it stands for is neither relevant nor informative to explain representation relations (Goodman, 1962, pp. 3–6). Goodman's arguments initially focused on a notion of representation in the visual arts and in particular on pictorial depiction. However, in the course of his discussion, he extended his views against resemblance to any kind of relation of signification (Dipert, 1996, p. 379; Shin, 2002, p. 25).

A central claim in Goodman's work is that representation is independent from resemblance: his argument is based on the assumption that resemblance is neither a necessary nor a sufficient condition for signification (Goodman, 1962, p. 5). Goodman motivates his claim by stating that while resemblance is reflexive, representation is not: objects resemble themselves, but this does not mean that they represent themselves. Moreover, resemblance is symmetric: an object A resembles an object B as much as B resembles A (and vice-versa). According to Goodman, the same does not hold for representation: it is possible to say that a portrait represents someone, but it is not possible to say that a person represents his/her portrait (Goodman, 1962, pp. 4–5). To conclude, Goodman stated that "no degree of resemblance is sufficient to establish the requisite relationship of reference. Nor is resemblance *necessary* for reference; almost anything may stand for almost anything else. A picture that represents – like a pas-

[1] I am grateful to Mats Bergman for drawing my attention to this illuminating reading of iconicity in the course of a personal communication (June 2006).

sage that describes – refers to and, more particularly, *denotes* it. Denotation is the core of representation and is independent of resemblance" (Goodman, 1962, p. 5).

Goodman's criticism is addressed to a view of representation considered and defined exclusively in terms of resemblance. It must be noticed, however, that no philosophical definition of visual representations focused exclusively on a notion of resemblance to explain the relation between pictorial representations and the objects they represent (Dipert, 1996, p. 381; Shin, 2002, p. 25).

A proliferation of nominalist and conventionalist theories of representation followed from Goodman's critique of similarity; some of them explicitly addressed the representational status of iconic signs. In a 1963 article entitled "That there are no Iconic Signs", Arthur Bierman claimed that iconic signs dispense with connotation: they only denote and signify. However, there are no signs whose denotation depends exclusively on resemblance; therefore, iconic signs are not signs at all (Bierman, 1963, pp. 244–5). Along similar lines, in his 1975 "Trattato di Semiotica Generale", Umberto Eco stated that "the category of iconicity is useless" (Eco, 1975, p. 282), because it identifies a manifold of phenomena that are not necessarily semiotic and that, just like symbolic representations, hinge on conventions.

In recent years there has been a revival of nominalist and conventionalist arguments, which involved, among other things, a comparison between artistic and scientific representations. Yet, "iconoclast" arguments (advanced in the past as well as in the present) seem to apply exclusively to naïve views of resemblance considered as a superficial, mirror-like correspondence. My contention is that such arguments are based on three fundamental misunderstandings:

1. a misleading conception of similarity as a primitive semiotic notion;

2. a confusion between representations as such and modes of representation;

3. in the case of visual representations, a tendency to criticize a view of representation considered exclusively as a relation of similarity between a sign and the states of affairs that it represents.

A critical examination of Peirce's formulation of iconicity will provide a satisfactory solution to the problem of similarity in representation. I will argue that it is desirable, and indeed possible, to do away with notions such as similarity or resemblance in favor of a more fundamental concept of "structural relation". In spelling out a notion of "structural relation", I will account for the distinction between representations and representational modes, which is a central aspect of Peirce's account of icons and iconic signs. Ultimately, in my examination of Picasso's *Guernica* as a case of iconic representation, I will argue that the painting explicitly questions a view of representation considered exclusively in terms of similarity, and it does so in a way which is to be considered "iconic" in a Peircean sense.

3. Peirce on icons and iconic signs

Peirce defined icons as signs "partaking in the character of the object" (CP 4.531), that is, signs that preserve the relational structure governing their objects. In several instances he seemed to stress that the representative relation at the basis of iconic signs is characterized by a similarity or a likeness with the objects they represent. The definitions below illustrate this point:

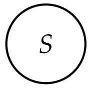
> [An] icon … exhibits a similarity or analogy to the subject of discourse.
> CP 1.369

> [An icon is a] sign which stands for something because it resembles it. CP 3.362

The similarity that apparently governs iconic signs in Peirce's account has been at the core of the misunderstandings that still characterize certain philosophical critiques of iconicity. A more careful study of the representative relation described by Peirce, however, suggests that something more interesting than a simple point-to-point correspondence is involved in iconic representations.

An example from set theory might offer an alternative view of the relation governing iconicity.[2] In Euler's diagrams, circles are employed to represent sets. Suppose that we want to represent the expression "Socrates is a mortal". A strictly symbolic or conventional representation of this expression is "$S \in M$", where "S" denotes Socrates, "M" denotes the set of mortals and "$\in$" denotes membership. In Euler's diagrams this relation is represented in an immediate, visual fashion, by inscribing S inside a circle which stands for the set of mortals:

[2] The example that follows is adapted from Shin (2002, p. 26).



A comparison of Euler's diagram and the notation "$S \in M$" shows that the diagram represents the relation of membership between an object and a set in a more natural and immediately observable way. Strictly speaking, however, no physical resemblance is noticed between the diagram and the states of affairs that it stands for.

Additionally, the signs forming the diagram are conventional: they follow a stipulation by which S stands for Socrates and the circle stands for the set of mortal beings. Nevertheless, the way in which the relation of inclusion of an object (in this case Socrates) in a set (the set of mortals) is expressed through the diagram (S being inscribed in a circle) is not conventional: the diagram preserves the relations of the states of affairs that it represents. Such a structural relation allows one to associate the representation of S inside a circle to the relation of membership or inclusion in a set. Despite the conventional nature of the representing facts, the relation between the elements forming the diagrammatic representation of the statement "Socrates is a mortal" is an instance of semiotic iconicity (Shin 2002, p. 26).

It is not a coincidence that Peirce included diagrams and diagrammatic reasoning among the most fruitful kinds of iconic signs. The visual directness of diagrams depends on the iconic component that characterizes them and that is at the basis of their efficacy in the attainment of novel and valuable conclusions (Shin, 2002, pp. 27 ff.; Pietarinen, 2006, p. 113). Such an iconic component should not be identified with a superficial similarity of appearance. Peirce explicitly stressed this aspect of structural relations:

> Many diagrams resemble their objects not at all in looks; it is only in respect to the relations of their parts that their likeness consists. Thus, we may show the relation between different kinds of signs by a brace, thus:
>
> $$\mathrm{S_i} = \begin{cases} \text{Icons,} \\ \text{Indices,} \\ \text{Symbols} \end{cases}$$
>
> This is an icon. But the only respect in which it resembles its object is that the brace shows the classes of *icons*, *indices* and *symbols* to be related to one another and to the general class of signs, as they really are, in a general way. CP 2.282

The representational nature of diagrams is particularly effective for a clarification of Peirce's notion of iconicity. Peirce specified that diagrams, as all iconic signs, rarely function as pure icons:[3] symbolic elements intervene in the representation and background knowledge of such conventions is indispensable to attain the desired information. In Peirce's terms:

> A *Diagram* is a representamen which is predominantly an icon of relations and is aided to be so by conventions. Indices are also more or less used. It should be carried out upon a perfectly consistent system of representation, one founded upon a simple and easily intelligible idea. MS 492:1[4]

Like diagrams, other examples of iconic signs participate in semiotic processes in a mediated form – that is, in the form of signs that are produced in order to be interpreted by a mind. Considered in a mediated form, iconic signs include conventional and indexical elements, which are indispensable for their construction.

The utmost value of icons consists of instantiating a cognitive rule that allows the mind to establish new relations between previously unconnected representations. Evidently, Peirce's formulation of iconicity is not limited to a superficial resemblance between a sign and the object it stands for. On the contrary, it is a semiotic category that directly concerns the role of representations in the progress towards novel and productive results. The efficacy of iconic signs consists of the process that they trigger in the interpreter's mind. As a result, icons are cognitively treated as real objects rather than representations.

Peirce explained this feature of iconic signs in an illuminating passage of his 1885 "Algebra of Logic":

> A diagram, indeed, so far as it has a general signification, is not a pure Icon; but in the middle part of our reasoning we forget the abstractness in great measure, and the diagram is for us the very thing. So, in contemplating a painting, there is a moment when we lose the consciousness that it is not the thing, the distinction of the real and the copy disappears, and it is for the moment a pure dream – not any particular existence, and yet not general. At that moment we are contemplating an *Icon*. CP 3.362

In the passage, Peirce uses the trichotomy *icon-index-symbol* as an illustration of three classes of signs introduced in his new algebra of logic.

[3] Peirce clarifies that in most cases a sign displays features that belong simultaneously to the class of symbols, indices and icons. He stressed that iconic representations partly consist of symbolic components and considered diagrams as examples of iconicity in mediation. See, for instance, CP 2.276 ff.

[4] Quoted in Pietarinen (2006, p. 111).

What is particularly interesting here is the fact that such an illuminating observation on two instances of iconic signs (diagrams and images, specifically paintings) is made by Peirce in a logical and mathematical context. This might eventually lend further support to the concept of iconicity as a structure-preserving relation that I am trying to advance and apply to the case of Picasso's *Guernica*. This point will become clearer in section 4 of this paper.

If conventional and/or indexical components are temporarily left aside, iconic representations participate in reasoning processes as if they were real entities ("the diagram is for us the very thing"). Peirce maintained that, in this process, the interpreter deals with "pure dreams", that is, representations which are neither general nor particular. Icons enter thought processes in the form of "composite photograph[s] of images" (CP 2.317) of the objects they represent. This does not imply that thought literally proceeds through pictures in the mind. Instead, icons are to be interpreted as "average images" (Bergman, 2006) of real objects, that is, as generalizations deriving from experience. The function of iconic signs, (which are asserted icons, or icons as they appear in communicative processes) consists of evoking mental icons ("pure dreams", in Peirce's terms). The fundamental connection between asserted icons and mental icons is at the basis of the perspicuous and fertile character of certain visual representations. This is also what makes iconicity a constitutive feature of thought processes culminating in genuine discoveries.

4. Iconicity as homomorphism

The structural relation posed by Peirce at the basis of iconic representations is more accurately expressed in terms of the mathematical relation of homomorphism. Homomorphism is a structure-preserving mapping between two algebraic structures or sets. Contrary to isomorphism, homomorphism is not a one-to-one (bijective) mapping. A set A (source domain) can be mapped onto a smaller set B (target domain), so long as their relevant structure is preserved. This requires a correspondence between properties (symmetry/asymmetry; reflexivity/irreflexivity etc.) and operations (relations between elements) of both sets. Notice that, in abstract algebra, homomorphisms do not have to map between sets that have the same operations (for instance, addition can be mapped onto multiplication). Moreover, the structural relation between the sets A and B does not necessarily extend to all the elements of the target domain: part of the elements in the target domain might not be included in the mapping. In mathematical terms, the target domain thus obtained is said to be a homomorphic image of the source domain (Norman, 1999, pp. 21–22; Bartels, 2006, p. 8).

It is possible to summarize the conditions for a homomorphic relation to hold between a representational source and a target domain as follows:

1. Elements of a source domain A represent elements in a target domain B, with different elements of B represented by different elements of A;

2. f is a mapping or function between A and B such that:

    (a) If elements in A stand in some relevant relation R, then there is a relevant relation R′ among elements of B to which they are assigned by f.

    (b) If an element in A has a relevant property P, then there is an element in B with the corresponding property P′.

    (c) If a relation R in A has some structural property (symmetry/asymmetry, reflexivity/irreflexivity, transitivity etc.), then the same property holds for R′ in B.

(Barwise and Hammer, 1996, pp. 71–72; Norman, 1999, p. 22)

Homomorphism helps clarifying the ambiguous notion of similarity or likeness that Peirce considered at the basis of iconic representations. A representational source is an icon of its target if it preserves relevant properties and relations that hold between the elements of the range of phenomena that it stands for. Iconic representations trigger the discovery of novel facts because of the structural relation that they exhibit with the states of affairs that they represent.

A theory of iconicity as homomorphism accounts for structure preservation as a relation which is established by a cognitive act, rather than a superficial correspondence. Moreover, it does not invite conventionalist and nominalist criticisms against resemblance. The two conditions that Goodman posed at the basis of resemblance, symmetry and reflexivity, are no longer indispensable requirements for a homomorphic relation to be established between a source domain and a target domain. This does not imply that symmetry and reflexivity are absent from all mapping operations; it only limits their relevance to specific cases of mapping.[5]

[5] This is the case – for example – of kinds of mapping such as isomorphism and endomorphism. Homomorphism is admittedly an extremely general form of mapping, which might

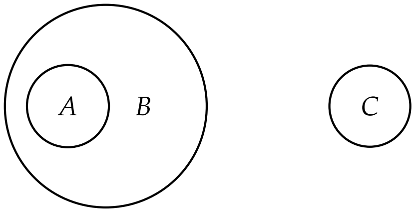
Ultimately, Peirce's discussion of iconic signs offers an interpretative key in support of a theory of iconicity as homomorphism. He stated that physical similarity is only one case of structural relation that can be established between an iconic sign and its object (CP 2.281). He suggested to consider cases in which no physical resemblance occurs, and yet it is possible to devise a structural relation between representing and represented facts: "Every algebraic equation is an icon, in so far as it *exhibits*, by means of algebraic signs (which are not themselves icons), the relations of quantities concerned" (CP 2.282). In the case of algebraic equations, the structural correspondence is inherent in the properties that algebraic signs share with the quantities that they express. Rather than a superficial resemblance based on the physical look of representing and represented facts in a certain representation, it is possible to exemplify this structural relation in terms of a homomorphism between algebraic equations and the states of affairs that they stand for. Peirce extended this line of argumentation to the use of diagrams in mathematical reasoning:

> Mathematical reasoning consists in constructing a diagram according to a general precept, in observing certain relations between parts of that diagram not explicitly required by the precept, showing that these relations will hold for all such diagrams and in formulating this conclusion in general terms. CP 1.54

Peirce's description of mathematical reasoning through diagrams relies on the grasping of structural relations that reveal novel aspects of previously ignored facts. Iconicity is an essential component of this process: A great distinguishing property of the Icon is that by the direct observation of it other truths concerning its object can be discovered than those which suffice to determine its construction (CP 2.279).

What did Peirce mean by "direct observation" in relation to iconic representations? And how does observation relate to the discovery of novel aspects of the objects that iconic signs represent? A mathematical example will clarify these questions. Suppose that we represent by means of Euler's diagrams the following propositions: "All *A* are *B*" and "No *B* is *C*" (Shin, 2002, p. 32):

invite Goodman-like objections: it can be argued that anything might be homomorphic to anything else in some respect or capacity. Hence, homomorphisms might need to be "filled in" with other particular kinds of mapping to account for particular cases of representation (Bartels, 2006, p. 9). This would still rely on a concept of structure-preserving mapping, however. In fact, this is exactly what makes homomorphism an interesting and epistemically fruitful representative relation.



A third proposition emerges from the observation of this diagrammatic representation – namely that "No A is C", for the circles that represent A and C are not related. This novel piece of information is grasped visually – it is "discovered" – in a direct manner through the act of constructing and inspecting the diagram. In a similar fashion, the homomorphism at the basis of iconic representations implies that missing links are reconstructed starting from the relations that the mapping itself establishes. The discovery of novel facts is directly related to the cognitive act of establishing such a structural relation between the source and the target domain.

5. Iconicity in context: Picasso's *Guernica*

An interpretation of iconicity as homomorphism is a helpful theoretical device to overcome both nominalist and mimetic accounts of artistic representation. Pablo Picasso's 1937 painting, *Guernica*, is an illuminating case-study to examine iconicity in context (Ambrosio, 2007). Picasso was a leading figure of avant-garde movements at the beginning of the 20th century. Through Cubism, he proposed a radically novel concept of artistic representation in which geometry played an indispensable role. Geometry allowed Picasso to achieve a simultaneous representation of several perspective points at once. In a sense, it is possible to interpret cubist works as "composite photographs of images" of objects abstracted from experience. Cubist representations preserve properties and relations as they are present in the objects they stand for. Considered as iconic signs, such representations approach the ways in which objects are mentally conceived. This is central to my definition of Picasso's art as conceptual art. Whenever I will discuss the conceptual nature of Cubist paintings and *Guernica*, I will implicitly address their capability of evoking mental icons in a way which is more faithful to cognitive processes than traditionally figurative artworks.

The story of *Guernica* is relatively well known. In January 1937, the Spanish Republican Government in exile commissioned Picasso to paint a large canvas (3.51×7.82m) for the Spanish Pavilion in the Paris Universal

Exhibition. The painting was to be a statement in support of the Spanish cause against the raise of nationalism. At the moment of the commission, Generalissimo Francisco Franco, commander of the Foreign Legion and future chief of Nationalist Spain controlled over one third of the country. Madrid and the Basque region were both under the threat of air siege. On April 26, the airplanes of the Condor Legion bombed the Basque village of Gernika, known throughout Spain as the oldest centre of democracy. The bombing of Gernika is nowadays remembered as one of the first attacks directed against a population of innocent civilians. Picasso read the news and heard radio reports between 27 and 30 April and began painting on May 1.

A great advantage in studying the creation of *Guernica* is that Picasso classified and dated all the preparatory sketches.[6] His then partner, the Surrealist photographer Dora Maar, captured all the states of the painting in a photographic record of the canvas in progress. Picasso's preparatory work gives us a glimpse of the way in which he conceived the representational relation governing *Guernica*. Guernica does not "resemble" the events that it represents – at best it "evokes" them. Resemblance was not Picasso's aim; instead, he attained a universal denounce of the crimes of war through a pictorial tension between representational and abstract elements. He achieved this result through the systematic use of geometry. The geometric core of Cubism allowed Picasso to produce a conceptual representation, an asserted icon that triggers cognitive process by which viewers establish significant relations with certain states of affairs.

In his study of *Guernica*, Rudolf Arnheim states that the monochrome character of the canvas renders it "closer to a diagram – the visual representation of an idea" (Arnheim, 1962, p. 25). He maintains that the pervasiveness of black, white and scales of grey reduces all objects and characters to their fundamental properties. Other aspects of *Guernica* reinforce Arnheim's parallel between the canvas and a diagrammatic representation. The coloring of the painting is surely a decisive element; however, this must be considered in combination with factors such as the conceptual nature of Picasso's representation in its entirety, which draws upon geometry. *Guernica* is close to a diagram because of Picasso's use of geometry as the privileged means of cubist representations.

Due to its geometric core, *Guernica* exhibits an iconic, homomorphic relation with the states of affairs that it represents. Geometry defines in a

[6] For a full examination of the preparatory sketches for Guernica see Ambrosio (2007, pp. 239–319).

clear and evident way properties and relations between objects in space. In the case of *Guernica*, geometry acted as a privileged vehicle to achieve a conceptual representation in which objects, with their properties and their relations were preserved. It is in this sense that Picasso's canvas represents like a diagram. Applied to the case of Guernica, a theory of iconicity as homomorphism accounts for the limits and constraints upon artistic representations considered as efforts to capture satisfactorily a perspicuous image of reality.[7]

References

Ambrosio C. (2007). *Iconicity and Network Thinking in Picasso's Guernica: A Study of Creativity Across the Boundaries*. PhD Thesis, University of London.

Arnheim, R. (1962). *The Genesis of a Painting: Picasso's Guernica*. Berkeley: University of California Press.

Bartels, A. (2006). "Defending the Structural Concept of Representation." *Theoria*, 21(55), 7–19.

Barwise, J. & Hammer E. (1996) "Diagrams and the Concept of Logical System." In G. Allwein and J. Barwise (Eds.) *Logical Reasoning with Diagrams* (pp. 49–77) Oxford: Oxford University Press.

Bergman, M. (2006). "Composite Images and Pure Dreams: The Communicative Function of Iconic Signs.", paper delivered at the International Conference *Beyond Mimesis and Nominalism: Representation in Art and Science* organized by the London School of Economics and the Courtauld Institute Research Forum. London, 22–23 July 2006.

Bierman, A. K. (1963). "That There Are No Iconic Signs." *Philosophy and Phenomenological Research*, 13(2), 243–249.

Eco. U. (1975). *Trattato di Semiotica Generale*. Milano: Bompiani.

Goodman, N. (1976). *Languages of Art*. Indianapolis: Hackett (2nd ed.).

Norman, J. A. (1999). *Diagrammatic Reasoning and Propositional Logic*. MPhil Dissertation. University of London.

Pietarinen, A. (2006). *Signs of Logic*. Dordrecht: Springer.

Shin, S. J. (2002). *The Iconic Logic of Peirce's Graphs*. Cambridge, Mass: MIT Press.

[7] I am grateful to Mats Bergman, Ahti-Veikko Pietarinen, Sun-Joo Shin, Thomas L. Short and an anonymous referee for their invaluable comments on earlier drafts of this paper. I am also grateful to the UCL Graduate School for supporting my contribution to the "Applying Peirce" conference with a Postgraduate Travel Grant.

Not Just Underlying Structures: Towards a Semiotic Approach to Scientific Representation and Modeling

Tarja Knuuttila
University of Helsinki

1. Introduction

The question of representation has started to interest philosophers of science only rather recently. Before the end of 1980's, the term representation was hardly used in the general philosophy of science and when it was, it was neither thematised nor questioned. This situation started to change largely due to the renewed interest in modeling. Unlike with propositions and sentences, such terms as "true" and "false" did not seem to be apt in dealing with the relationship between models and their real-world target systems; and the question then became how these models were linked to the world. "Representation" was considered to be more appropriate term than "truth" in capturing this relationship.

Philosophers of science have indeed been nearly unanimous in saying that models have to represent in order to give us knowledge. Yet, their preferred accounts of representation have differed widely from each other and no consensus as to how representation should be approached has emerged. Interestingly, however, several recent writers on the topic have stressed, in one way or another, that representation is a pragmatic notion involving either the "users" or "interpretation". This means a definite shift in the discussion of scientific representation from dyadic accounts of representation toward triadic ones. In the following I will trace the turn from the dyadic structuralist accounts of representation to triadic pragmatist accounts, discussing the reasons for this development and how it enables a semiotic approach to be taken to scientific representation.

2. Dyadic accounts of scientific representation

Up until recently the reigning conception of scientific representation has been the semantic, or alternatively the structuralist, account of models. The semantic account approaches representation as a dyadic relation between two things, the real system and its abstract and theoretical depiction. According to the semantic conception, models are taken as structures whose relationship with their target systems is analyzed mostly in terms of an isomorphism: a given structure represents its target system if both are structurally isomorphic to each other (see da Costa & French, 2000; French & Ladyman, 1999). By isomorphism it is referred to a kind of mapping that can be established between the two that preserves the relations among elements. Consequently, the representational power of a structure derives from its being isomorphic with respect to some real system or a part of it. One of the advantages of invoking isomorphism seems to be that it can be given a precise formal formulation, which cannot be given for instance to similarity, which is another candidate offered for the analysis of a representational relationship (see Giere, 1988). Also other morphisms, such as partial isomorphism and homomorphism, are occasionally proposed as candidates for analyzing the representational relationship (da Costa & French, 2003; Bartels, 2006). The basic idea behind all approaches relying on a morphism of some kind is that the morphism between the two structures, the model and its target system, guarantees the representational relationship between the two. Consequently, even though the proponents of the semantic approach do not contest the importance of pragmatic factors when it comes to representation in scientific practice, they nevertheless claim that the underlying structures of both the model and its target ground the representational relationship.

The above-mentioned theoretical attractiveness of isomorphism – or any other morphism for that matter – vanishes once we realize that the parts of the real world we aim to represent are not "structures" in any obvious way, at least not in the sense required by the semantic theory. It is perhaps possible to ascribe a structure to some part of the real world, but then it is already modeled (or represented) somehow. This has, of course, been noticed by the proponents of the semantic theory; Patrick Suppes has for instance invoked "models of data" (1962). Thus the isomorphism required by the semantic account concerns actually the relationship between a theoretical model and an empirical model.

Even if we disregard the fact that the world does not present itself to us in ready-made structures, isomorphism does not seem to provide any adequate account of representation. Isomorphism denotes a symmetric relation whereas representation does not: we want a model to represent its target system but not vice versa.[1] Moreover, the isomorphism account does not accept false representations as representations.[2] The idea that representation is (at least partly) either an accurate depiction of its object or then it is not a representation at all does not fit our actual representational practices. Both problems appear to be solved once the pragmatic aspects of representation are taken into account. The users' intentions create the directionality needed to establish a representational relationship; something is being used and/or interpreted as a model of something else, which makes the representational relation triadic, involving human agency. This also introduces indeterminateness into representational relationships: human beings as representers are fallible.

3. Pragmatic approaches and their implications

The critical importance of the use to which representations are put has recently been expressed in various ways by Ronald Giere (2004, 2010); Mauricio Suárez (2004, 2010) and Daniela Bailer-Jones (2003). Of these pragmatic accounts of scientific representation, the one advanced by Bailer-Jones is possibly the most traditional. She discusses representation in terms of propositions entailed by models. By entailment Bailer-Jones does not mean logical entailment, for models "use a whole range of different means of expression, such as texts, diagrams, and mathematical equations", and thus some of the content of a model may be expressed in non-propositional forms. As a result the number of the propositions entailed by a model cannot be conclusively determined. Moreover, models typically entail propositions that are known to be false. This leads Bailer-Jones to consider the functions of models, since models containing false propositions can be accepted for some "higher purpose". Because "a model is intended to meet

[1] This also applies to the similarity account of representation. For thorough studies on the formal and other properties that we might expect an acceptable concept of representation to satisfy, see Suárez (2003) and Frigg (2003).

[2] See however Bartels (2006), who argues that the different criticisms of isomorphism, including the impossibility of misrepresentation, do not apply to the version of homomorphism that he is putting forth as an analysis of the representational relationship.

a certain function... the attempt to meet the function overrides the striving for the model's proximity to truth" (2003, p. 70).

The proposal to speak of representation in terms of propositions entailed by models seems somewhat paradoxical, for as long as philosophy of science operated predominantly on the basis of propositions (derived from theories and models) and their fit with the data (via the procedure of testing), the question of representation did not arise. This question becomes acute once we grant that much scientific reasoning operates on other representational means than (propositional) language. The point of using various representational means arises out of their different affordances in conveying diverse kinds of information, much of which cannot be readily, if at all, propositionally presented. Consider for example how much information a picture or a diagram can convey to us at a glance. In Peircean terms, Bailer-Jones fails to pay enough attention to the expressive and inferential power of the *iconicity* of signs in striving to reduce their content to symbolical form. Besides, as Bailer-Jones leaves the notion of "entailing" unexplained, one is left wondering why it is that models "entail" some propositions and not others. This seems to have something to do with the representational power of models, which this account of representation has actually left untouched.

Ronald Giere (2004), for his part, is explicit in stating what the representational power ultimately hinges on. Though his views on models and representation have changed substantially since the semantic conception propounded in *Explaining Science* (Giere, 1988), he still claims that representation is based on a similarity of some kind. Giere notes that even though no objective measure of similarity can be given, "it is the existence of the specified similarities that makes possible the use of the model to represent the real system" (2004, p. 748). No general analysis of similarity is needed (or can be given) to explain scientific representation because of the irreducibly pragmatic nature of scientific representation. Consequently, instead of concentrating on the two-place relation between a representational vehicle and its target system, Giere proposes that representation can be thought of as having at least four places with roughly the following form:

S uses M to represent W for purpose P.

In the above form, S can be anything from an individual scientist to a scientific community. M is a model, and W stands for an "aspect of the real world, a (kind of) thing or event". More informally, the message of the form can be expressed as: "Scientists use models to represent aspects of the world for various purposes" (2004, p. 747).

In line with Giere, Mauricio Suárez criticizes dyadic conceptions of representation because of their attempt to "reduce the essentially intentional judgments of representation-users to facts about the source and target objects or systems and their properties" (2004, p. 768). As opposed to Giere, however, Suárez does not want to "naturalize representation". This means that he resists saying anything substantive about the supposed basis on which the representational power of representative vehicles rests, i.e. whether it rests for instance on isomorphism, similarity or denotation. According to Suárez such accounts of representation err in trying to "seek for some deeper constituent relation between the source and the target", which could then explain as a by-product why, *firstly*, the source is capable of leading a competent user to a consideration of a target and *secondly*, why scientific representation is able to sustain "surrogate reasoning". Instead, Suárez builds his inferential account of representation directly on these by-products. Consequently, Suárez calls his account of representation "deflationary" – or "minimalist": no deeper features are sought, instead one settles with the surface features.

The formulation Suárez (2004, p. 773) gives to the inferential conception of representation is the following:

> A represents B only if (i) the representational force of A points towards B, and (ii) A allows competent and informed agents to draw specific inferences regarding B.

This formulation presupposes the activity of competent and informed agents. The "representational force", according to Suárez, is "the capacity of the source to lead a competent and informed user to a consideration of the target". This "relational and contextual property of the source" is fixed and maintained in part by the intended representational uses of the source by the agents (2004, p. 768). Part 2 of the formulation contributes to the objectivity that is required of scientific representation. Suárez claims that in comparison to Part 1, Part 2 depends in no way on an agent's existence or activity. Instead "it requires A to have the internal structure that allows informed agents to correctly draw inferences about B" (2004, p. 774). Thus even though Suárez does not want to specify what kind of a relation there is between the source and the target, it nevertheless has to be grounded on the construction of the representative vehicle somehow.

Of all the pragmatists of scientific representation, Suárez challenges most explicitly the idea that representation could be accounted for by reverting only to the properties of the model and its target system. Consequently, Suárez can be interepreted to claim, in line with Peircean semiotics, that representation as a sign relation is genuinely a triadic notion (EP 2:272–3). Thus, there is no single determinable relationship between a certain model and its target system. This has important consequences for how we understand scientific representation. Firstly, as representation cannot be given a general substantive analysis, in each case of representation the extent to which human representers make use of the iconic, indexical or symbolic qualities of the representamen, i.e. the model, is open to further study. This in turn means, secondly, that the focus is shifted from the features of the model and the target system to the interpretive activity of the scientists, that is, to the process of semiosis. Indeed, in the recent discussion on models, the earlier emphasis on representation has been replaced by the attempts to approach modeling from a mediative and productive perspective. A central move taken by that approach is to consider models as independent entities that can be used to gain knowledge in a multitude of ways.

4. Models as epistemic tools

The idea of models as independent entities has been expressed by several recent authors in various ways. Morrison (1999) and Morrison and Morgan (1999) have considered models as *mediators*, which through their construction are partially independent from theory and data. This is because besides being comprised of both theory and data, models typically also involve "additional 'outside' elements" (1999, p. 11). Boumans (1999) for his part disentangles models from the theory-data framework altogether. In his study on business-cycle models he shows from how many different "ingredients" a model can be constructed, such as analogies, metaphors, theoretical notions, mathematical concepts, mathematical techniques, stylised facts, empirical data and finally relevant policy views. From a somewhat different perspective, Weisberg (2007) and Godfrey-Smith (2006) have also come to the conclusion that models should be treated as independent entities. For them independence means independence from a certain real target system. Thus instead of conceiving independence in terms of the relationship of models to the theory and data, they release models from representing any definite real target system. According to Weisberg and Godfrey-Smith, modeling can be viewed as a specific theoretical practice of its own that can be characterized through the procedures of indirect representation and analysis that modelers use to study the real world phenomena. With indirect representation they refer to the way modelers, instead of striving to represent some real target systems directly rather construct simple, ideal model systems to which only a few properties are attributed. As Godfrey-Smith has aptly put it, modeling can be characterized by the "deliberate detour through merely hypothetical systems" it makes use of (2006, p. 734).

Considering models as independent entities urges one to address them as concrete constructed objects whose cognitive value derives largely from our *interaction* with them (Knuuttila & Merz, 2009). From this perspective, models give us knowledge not because they happen to represent their target systems more or less accurately but because they are purposefully constructed so as to allow inferences of various kinds. Apart from licensing inferences, models are also used for other tasks such as prediction, measuring, devising experiments etc. Consequently, models can be considered as multifunctional *epistemic tools* (Knuuttila, 2005; Knuuttila & Voutilainen 2003). The importance of our interaction with models is recognized by Morrison and Morgan (1999), who stress that we learn from models by constructing and manipulating them. However, it seems that they leave this important idea somewhat underdeveloped. Namely, if our aim is to understand how models enable us to learn from the processes of constructing and manipulating them, it is not sufficient that they are considered as autonomous: they also need to be concrete in the sense that they must have a tangible dimension that can be worked upon. This concreteness is provided by the material embodiment of a model: the concrete representational means through which a model is achieved gives it the spatial and temporal cohesion that enables its manipulability. This also applies to so-called abstract models: when working with them we typically construct and manipulate external representational means such as diagrams or equations. Thus even abstract entities need to have a material dimension to give us knowledge. Herein lies also the rationale for comparing models to experiments: in devising models we construct self-contained artificial systems through which we can make our theoretical conjectures conceivable and workable.

The mere structure supposed to underlie any model – on which the semantic conception of representation focuses – does not take us too far. The very variation of the different kinds of models used: scale models, pictures, diagrams, different symbolic formulas and mathematical formalisms, suggests that the material and semiotic dimension of models and the diverse representational means they make use of, are crucial for their epistemic functioning. The representational means used have different characteristic limitations and affordances; one can express different kinds of content with symbols than with iconic signs such as pictures and diagrams, for example. From this perspective the use of diverse external representational means provides external scaffolding for our cognition, which also partly explains what is commonly ascribed as the heuristic value of modeling. It is already a cognitive achievement to be able to express any hypothetical mechanism, structure or phenomenon of interest in terms of some representational means, including assumptions concerning them that are often translated in a conventional mathematical form. Such articulation enables further theoretical inferences as well as new experimental set-ups, but it also imposes its own limitations on what can be done with a certain model.

Another aspect of the scaffolding provided by models is related to the way they help us to conceive the objects of our interest clearly and to proceed in a more systematic manner. Models are typically constructed in such a way that they constrain the problem at hand – which happens typically by way of idealizations and abstractions – thereby rendering the situation more intelligible and workable. As the real world is just too complex to study as such, models simplify or modify the problems scientists deal with. Thus, modelers typically proceed by turning the constraints (e.g., the specific model assumptions) built into the model into affordances; one devises the model in such a way that one can gain understanding and draw inferences from using or "manipulating" it. Yet the seeming simplicity of models disguises the heterogeneity of elements they incorporate, such as familiar mathematical templates, already established theoretical entities, relevant scientific knowledge, certain generally accepted solution concepts, the intended uses of the model, the epistemological criteria that are supposed to apply to it and so forth. All these things that are built into a model provide it also certain original built-in justification (Boumans, 1999). These aspects of models explain, on the one hand, how they allow for *particular* kinds of solutions and inferences, and on the other hand, how they can also lead to unexpected findings, breeding new concepts, problems, and even novel lines of research.

5. Conclusion

In his later work, Peirce's earlier focus on representation became replaced by mediation and production of interpretants.[3] Interestingly, the same has happened in the discussion on models and representation where a more

[3] See e.g. Bergman (2004, Ch. 4).

pragmatic approach to scientific representation has been adopted. As I have argued, the pragmatic accounts of representation, somewhat paradoxically, make apparent the limits of the representational paradigm as regards the epistemic value of modeling. Consequently, abandoning the representational approach to models, I suggest, actually enables us to pay attention to the very means of representation with which scientists build their models. As such this paves the way for applying semiotics to the present discussion on models and scientific representation, a possibility that has so far remained nearly unexplored in the mainstream philosophy of science.

References

Bailer-Jones, D. (2003). "When Scientific Models Represent." *International Studies in the Philosophy of Science*, 17, 59–74.

Bartels, A. (2006). "Defending the Structural Conception of Representation." *Theoria*, 55, 7–19.

Bergman, M. (2004). *Fields of Signification: Explorations in Charles S. Peirce's Theory of Signs.* Doctoral dissertation, Philosophical Studies from the University of Helsinki.

Boumans, M. (1999). "Built-in Justification." In M.S. Morgan & M. Morrison (Eds.), *Models as Mediators* (pp. 66–96). Cambridge: Cambridge University Press.

Da Costa, N., & French, S. (2000). "Models, Theories and Structures: Thirty Years on." *Philosophy of Science*, 67, S116–S127.

Da Costa, N., & French, S. (2003). *Science and Partial Truth: A Unitary Approach to Models and Scientific Reasoning*. Oxford: Oxford University Press.

French, S., & Ladyman J. (1999). "Reinflating the Semantic Approach." *International Studies in the Philosophy of Science*, 13, 103–121.

Frigg, R. (2003). *Models and Representation: Why Structures Are Not Enough.* Measurement in Physics and Economics Discussion Paper Series. London: London School of Economics.

Giere, R. N. (1988). *Explaining Science: A Cognitive Approach.* Chicago: The University of Chicago Press.

Giere, R. N. (2004). "How Models Are Used to Represent Reality." *Philosophy of Science*, 71, 742–752.

Giere, R. N. (2010). "An Agent-Based Conception of Models and Scientific Representation." *Synthese*, 172, 269–281.

Godfrey-Smith, P. (2006). "The Strategy of Model-Based Science." *Biology and Philosophy*, 21, 725–740.

Knuuttila, T. (2005). "Models, Representation, and Mediation." *Philosophy of Science*, 72, 1260–1271.

Knuuttila, T., & Merz, M. (2009). "An Objectual Approach to Scientific Understanding: The Case of Models." In H. de Regt, S. Leonelli, & K. Eigner (Eds.), *Scientific Understanding: Philosophical Perspectives* (pp. 146–168). Pittsburgh: University of Pittsburgh Press.

Knuuttila, T., and Voutilainen, A. (2003). "A Parser as an Epistemic Artefact: A Material View on Models." *Philosophy of Science*, 70, 1484–1495.

Morrison, M. (1999). "Models as Autonomous Agents." In M. S. Morgan & M. Morrison (Eds.), *Models as Mediators* (pp. 38–65). Cambridge: Cambridge University Press.

Morrison, M., & Morgan M. S. (1999). "Models as Mediating Instruments." In M. S. Morgan & M. Morrison (Eds.), *Models as Mediators* (pp. 10–37). Cambridge: Cambridge University Press.

Suárez, M. (2003). "Scientific Representation: Against Similarity and Isomorphism." *International Studies in the Philosophy of Science*, 17, 225–244.

Suárez, M. (2004). "An Inferential Conception of Scientific Representation." *Philosophy of Science*, 71, 767–779.

Suárez, M. (2010). "Scientific Representation." *Blackwell's Philosophy Compass,* 5, 91–101.

Suppes, P. (1962). "Models of Data." In E. Nagel, P. Suppes, & E. A. Tarski (Eds.), *Logic, Methodology and Philosophy of Science: Proceedings of the 1960 International Congress* (pp. 252–261). Stanford: Stanford University Press.

Weisberg, M. (2007). "Who is a Modeler." *British Journal for the Philosophy of Science*, 58, 207–233.

Pragmaticism on the Semantic Web

Catherine Legg
University of Waikato

1. Introduction

It was part of Tim Berners-Lee's original vision for the World Wide Web (Berners-Lee, 2002) that it would shortly evolve into a so-called 'Semantic Web', which would (famously) replace a "web of links" with a "web of meaning". The enormous work that has gone into trying to realize this vision raises (for the astute observer) fascinating philosophical questions, most notably: *What does it mean to 'give' Web pages meaning?* The question is philosophical, but the domain of Information Technology (IT) renders investigation of it fascinatingly concrete. It thus supplies an ideal opportunity to apply Peirce's "pragmatic maxim", which urges that to better understand abstract concepts (such as 'meaning') it is most helpful to think about their specific applications.

Many complex and technical discussions of meaning have taken place in philosophy over the past 400 years. However such debates have almost all shared a basic set of assumptions about meaning which is most unhelpful from an engineering perspective. We call this the "Cartesian Framework for Understanding Meaning". Terrain on the far side of these assumptions is only just being glimpsed (and understood as inviting) with the help of Peirce. This paper will outline the Cartesian framework for meaning (section 2), then the Peircean alternative (section 3), then, after a quick sketch of the semantic web project (section 4), trace some of the differing strategies and results which these two broad approaches may be perceived to bring about (sections 5 and 6).

2. The Cartesian framework for understanding meaning

Key idea: **The meaning of a sign is the intention of its producer**. This 'intention' has 2 key features, which form the basic assumptions of the Cartesian framework:

i) It is *private*. It has a location somehow 'in' a person's mind. The intention's physical location is not the key issue, though, it is that only the producer of the sign has knowledge of it. For Descartes, it was so inaccessible as to constitute a non-physical substance – hence the famous 'Cartesian dualism'.

ii) It is *incorrigible*. I am the ultimate authority on what the signs I produce mean. They mean what I intend them to mean. (This is sometimes referred to as a claim of 'first-person authority' with respect to meaning.)

Although Descartes doesn't discuss meaning explicitly in his *Meditations*, these views are extracted from what he says about *ideas*, which for him are the basic building blocks of thought and meaning. In *Meditation II* (Descartes, 1996), he claims that we only have direct access to the world of our ideas, that things in the world are quite separate from the ideas that accurately or falsely represent them. Thus for Descartes the mind is methodologically disconnected from the world so much so that he claimed to doubt whether the entire external world even exists and the ultimate authority on what its ideas mean. Error is possible, but not about what one's ideas *mean*, only about the way they are put together to form a representation of reality.

Later philosophers in the so-called 'early modern period', such as Locke and Hume, embraced a naturalistic *empiricism*, and gave up Descartes' dualistic understanding of mind as a separate substance from matter. However they retained his concept of the *idea* (private and incorrigible) as the basic unit of meaning. Thus Locke states:

> [W]ords, in their primary or immediate signification, stand for nothing but the ideas in the mind of him that uses them.
>
> Locke, 1994: 3, II, ii

In the 19th century Frege rejected the early modern understanding of meaning in terms of ideas. He pointed out that the any word, for instance 'dog', can be associated with many different, bizarre ideas in the minds of different people (disturbing ideas of being attacked, happy memories of working at the local pound, and so on). For the purposes of logic, Frege wanted a concept of meaning that could be definable more objectively, that could make a distinction between how people actually *do* understand the meaning of a sign and how they *should* understand it in order to grasp true propositions.

He therefore claimed that associated with every term was a "sense" (*Sinn*), which existed over and above its "reference" (*Bedeutung*). This 'Sinn', was an abstract object, common to everyone who grasps the meaning of a term. He sometimes referred to it as the 'mode of presentation' of the sign's reference. Thus Frege gave up the *privacy* of the Cartesian model of meaning. However he seems to have kept the *incorrigibility*. For how can I be wrong about the 'mode of presentation' which I associate with a given term?

Frege dreamed that with his new 'concept-script' he might enable a newly clear and objective understanding of the meaning of all our signs. He hoped it would then be possible to build all knowledge into an integrated taxonomic system which was *deductively complete*. (This dream was of course shattered by Russell's Paradox.) Frege's insights helped to shape twentieth century philosophy's so-called "linguistic turn", which shifted from seeing meaning as an 'idea-world relationship' to seeing it as a 'word-world relationship' (Hacking, 1975). Such theories were played out with many variations: for instance, Quine tried to do away with the concept of meaning altogether for behaviorist reasons, without success, Davidson developed an account of the meaning of propositions in terms of their 'truth-conditions', a theory which was then vastly complicated and sophisticated *via* the technical concept of possible worlds. But the one aspect of the Cartesian picture that still went unchallenged was its *incorrigibility*. For, it was thought, surely I know what the signs I use mean?[1]

3. A Peircean alternative framework for understanding meaning

Key Idea: **The meaning of a sign is the process of interpretation which occurs as the sign is used**. Peirce denied both the privacy and the incorrigibility of the Cartesian framework. In its relationship between the sign (idea or word) and the thing in the world, the Cartesian framework possessed an essentially *dyadic* structure. (Frege *nearly* escapes this dyadicity by postulating a sense as well as a reference for every sign. However given that

[1] To be strictly accurate, this assumption was finally challenged in the 1970s in the discovery of so-called 'a posteriori necessities' – for example 'water', it is claimed, 'means' H_2O whether its users know that water is H_2O or not. However this erudite debate is of limited application to the Semantic Web and will be ignored (for further details, however, see Legg, 2005).

sense for him is an abstract object, logically speaking he has arguably replaced a single dyadic relationship with two dyadic relationships.) Peirce's *triadic* model of the sign, by contrast, consists in an irreducible relation between three elements:

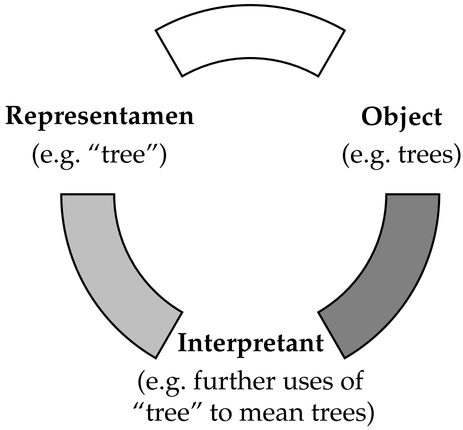


Fig. 1: Peirce: Structure of a sign.

The *representamen* is the actual signifying item. The *object* is what the sign refers to in the world. The *interpretant*, however, is Peirce's original addition to understanding meaning. It consists in further uses of the *same sign* to represent the *same object*. This is just to say that a sign must represent an object in such a way that it is understood and used again. For example, imagine that I decide to name a new star. This will not work unless other people learn the name and use it to pick out the same star. If I just stare at the night-sky, pick a name, and tell no-one about it, the process is literally meaningless, for Peirce, whatever my intentions.

Note that the interpretants, although they pick out the same object as the original sign, can 'interpret' that object in ways that differ to some degree from the ways it was interpreted originally. That is, they can not just continue but also add to, or even *shift* the meaning of the sign. One classic example is the word 'atom' as used by Democritus, and by us. Etymologically, in ancient Greek 'a-tom' meant something that cannot be broken up, but of course we have now 'split the atom'. Yet in *some* sense we are arguably still talking about the same things Democritus was, and the transition from the ancient to the present meaning was not clean or discrete. Thus by contrast to the Cartesian framework, we now have *corrigibility* with respect to meaning. The intention of the sign's producer is no longer the ultimate authority – when Democritus talked of 'atoms', he meant more than he knew.

One might ask at this point: So what is the *real* meaning of the sign? The original or the ultimate interpretation? However, do we have to choose? Peirce's theory raises the possibility that we do not. Arguably now it is more helpful to understand meaning not as an *object* (whose 'properties' can be argued over and had better not be contradictory), but as a *process*. In some real sense the meaning of a sign is what that sign *does* – how it spreads and grows (if, indeed, it does spread and grow). Thus, Peirce wrote (in a striking anticipation of contemporary use of the word 'virtual'):

> no present actual thought (which is a mere feeling) has any meaning, any intellectual value; for this lies not in what is actually thought, but in what this thought may be connected with in representation by subsequent thoughts; so that the meaning of a thought is altogether something virtual. EP 1:42

Note how this account renders meaning *public*. In the Cartesian framework, to really know what a sign means, you would need to get into the head of its producer (which alas is not possible). In the Peircean framework, to know what a sign means, look at what people are *doing* with it. Thus the responsibility for the meaning of a sign resides in a whole community. Relatedly, Peirce derived his account of *truth* by idealizing over this process of developing and using signs in a 'community of inquiry', a view which has been widely criticized as insufficiently objective. Yet Peirce denied this, claiming that over the long-run, within a broad enough community, sign-use was intrinsically self-correcting. It is also important to note that what the community is 'doing with' a given sign is not just what they are 'doing with it in their heads' by thinking about it, but what kinds of *practical activities* they are scaffolding with its help. Consider for instance, the term 'potting mix'. For Peirce it is part of its very meaning that people actually buy a certain brown stuff, put it in pots and insert plants in it.

As co-founder of the new predicate logic, Peirce pursued a vision interestingly different to Frege's regarding how it should advance human knowledge. As a pragmatist Peirce thought Frege's attempt to explicitly formalize the entire meaning of signs impossible, for an irreducible dimension of the meaning of any sign, such as 'tree', is the effects which an agent situated in the world would experience in relevant situations, such as tree-climbing, botanical investigations of new tree species, and so on, and not all of these can be anticipated in advance. In short, then, Peirce replaces a static model of meaning-as-object with a new dynamic model of meaning-as-process, where what a sign means is open to view (public), able to shift and change over time (corrigible), and inextricably entwined with actual tasks and projects.

4. The Semantic Web: an overview

4.1 Goals and challenges

Semantic Web developers embrace a wide variety of goals, including (from lesser to greater ambitiousness):

- disambiguating 'merely syntactic' Web searches, for instance distinguishing "Turkey" the country from "Turkey" the bird
- finding 'semantic joins' in databases
- indexing text and semantic markup together in order to improve Web retrieval performance (to turn the entire Web into one enormous 'distributed database')
- enabling software agents to interpret the meaning of websites in order to solve a wide range of arbitrarily complex tasks (from document-search to scheduling doctor's appointments)

Challenges for implementing it may be divided into 'technical' and 'human'. Technical challenges include inferential tractability, logical consistency, and the rapid changeability of information on the Web. The human challenges are equally problematic, and include: "Who will mark up Web pages with the required semantic metadata?", and "Who gets to say what that metadata means"?

4.2 Basic technologies

Semantic web development so far has centered around two new markup languages, which however by themselves are not sufficient to create a 'Web semantics'.

1) XML. XML was initially conceived of as a simple way to send documents across the Web, allowing authors to define their own tags, and thus document formats, subject to a simple syntax. Each new tag is linked to some unique 'namespace'. Though the term 'namespace' might suggest some further document which includes definitions for the tags, in practice

it is often just a naked URI, essentially only a way of indexing different tags uniquely *via* prefixes.

Anyone can define an XML namespace. So how do they relate to each other, semantically-speaking? Do two tags from different namespaces have the same meaning if they consist of the same character-string? No, for I could define a `<pine>` tag in my namespace to 'mean' pine *trees*, while a `<pine>` tag in another namespace is designed to apply to pine *wood* and anything made from it. Thus each namespace's tags are assumed to be distinct in meaning, and translating between them is a further problem. Thus XML arguably only provides 'syntactic' interoperability at best. This should not be too surprising since XML was not designed to share *meaning* so much as 'document format', a concept which includes any kind of structure within data (e.g. that a document contains just four elements). Semantic web developers' desire to represent meaning more purely and explicitly led to the development of RDF.

2) RDF. RDF stands for 'Resource Description Framework'. Strictly speaking, RDF is not a language but a data-model. In a key advance on XML, RDF introduces propositional structure. Each RDF 'proposition' has three parts, sometimes referred to as 'subject', 'predicate' and 'object' (e.g. Beckett 2004; Swartz, 2002), and sometimes as 'object', 'attribute', and 'value' (e.g. Decker et al, 2000). As an example, take the proposition: `The Kauri is a kind of pine tree.` Here the subject/object would be 'Kauri', the predicate/attribute would be 'a kind of', and the object/value would be 'pine tree'.

Does marking up web pages with RDF propositions make the Web 'semantic'? In the example above, a propositional structure exists, with all three components envisaged to be assigned URIs. However we have seen that URIs are merely indices. Once again, RDF does not determine what they are indexed to. As Sowa has written:

> By standardizing the notations, XML and RDF take an important first step, but that step is insufficient for data sharing without some way of comparing, relating, and translating the vocabularies. Sowa, 2000

5. Cartesian approaches to web semantics

Key idea: **Try to define an authoritative sign-producer's intention for what each sign should mean**. If one believes that the meaning of a sign resides in what the user of a sign *intends* it to mean, it would appear that the way to give the Web meaning is to try to define that intention, in machine-readable fashion, as fully and determinately as possible. This thinking has resulted in many attempts to set up *silos of meaning*, also known as 'formal ontologies'. Some key examples will now be discussed.

1) RDFS. RDF Schema, an extension of RDF, allowed one to declare classes, and properties, populate classes with instances, and organize them into a subsumption hierarchy. It also allowed range and domain constraints to be added to properties, and properties to be ascribed to individuals. It was initially envisaged that web-semantics-defining ontologies would be stored in this language. However, RDFS turned out to be too logically simple to express a great deal of what one might wish to say to authoritatively define the meanings of terms. Though one can declare new classes and populate them with instances, one cannot say anything further about these classes and instances (Delteil et al, 2001). For instance, one cannot state that two names denote the same person. At the end of the day RDFS is still just a set of terms indexed *via* namespaces whose further meaning is opaque. RDFS was never widely used and its main components are now folded into the more expressive OWL (see next).

2) OWL. OWL ('Web Ontology Language') was a renaming and reworking of DAML+OIL. It became a W3C Recommendation in February 2004 and is currently the flagship ontology of the W3C group. OWL goes beyond RDFS by providing additional vocabulary and a formal semantics. The additional vocabulary includes the ability to define classes in terms of logical relationships between other classes, the ability to state class cardinality, equality (for both classes and individuals), and logical characteristics of properties. It was hoped that this greater expressivity would enable it to outdo RDFS in capturing all information needed to define the semantics of terms on the web. Greater expressivity has costs in inferential tractability, however, so OWL has three versions, each an extension of the previous: OWL Lite, OWL DL and OWL Full.

The W3C envisaged that once they provided the OWL language, the world would respond by defining and contributing ontologies, and a number of ontology libraries/clearing-houses have been set up for this purpose (for instance: the DAML ontology library `http://www.daml.org/ontologies/`, and the Protégé ontology library `http://protege.cim3.net/cgi-bin/wiki.pl?ProtegeOntologiesLibrary`). However at present coverage is patchy at best. For instance regarding our test-concept, 'tree', a search on Swoogle, UMBC's ontology search engine (`http://swoogle.`

umbc.edu), produces just a few very scattered assertions.[2] It would thus appear that OWL is not currently widely used outside the academic research context (though OWL DL is used more than the other two).

There are a number of reasons for this. First of all, it is clumsy and verbose: the OWL translation of, "A student is a person who is enrolled in at least one thing" runs to 10 complex nested lines. Secondly, it is complained that its graph/tree data-structure does not scale for real-world applications foundering for example, when dealing with the information in a typical business spreadsheet (Bergman, 2006), nor does it allow user-defined datatypes. Finally, the exact formal relationship between OWL and RDF is a delicate matter. While OWL Full can be viewed as an extension of RDF, OWL Lite and OWL DL can only be viewed as extensions of a restricted view of RDF. (McGuinness and van Harmelen, 2004). This creates a problem for layering OWL over RDF. From the Peircean perspective, however, OWL's most fundamental issue is the 'human' one: its current lack of *use*.

3) CYC. The original (yet continuing) most ambitious formal ontology project of all is the Cyc project (http://www.cyc.com). It has deep roots in classical AI. It is most ambitious in terms of size (over 600 000 categories), depth of knowledge (over 2 million axioms), and time devoted to it (over 700 person-years) (Sowa, 2004). It has its own purpose-built inference engine, and natural language interface. The Cyc project is the most systematic, unified attempt to not just index terms but to *describe* their meanings in machine-readable terms. Thus its representation of a tree, #$Tree-ThePlant, is distinguished from #$Tree-PathSystem. It comes with *axiomatic assertions* (for instance, "A tree is largely made of wood") and *rules* (for instance, "If a tree is cut down, then it will be destroyed"), from which further facts can be deduced (for instance, "If the pine tree in my backyard is cut down, then it will be destroyed."). It manages to bypass the W3C's problems with layering OWL on RDF, by using its own in-house language, the purpose-built CycL (which has the expressivity of higher-order logic).

The company has made strenuous efforts to position itself for the Semantic Web, by for instance mapping in databases such as FIPS (Federal In-

[2] For example, "A Tree is a kind of LandscapeProduct" in http://individual.utoronto.ca/hesham/Ontology/IPDLite.owl, and nothing else, "A TreeRing is a kind of Vegetation" in http://sweet.jpl.nasa.gov/ontology/biosphere.owl, and nothing else. These assertions are mixed with many others concerning trees as mathematical structures, with no obvious way of telling that this is a different concept.

formation Processing Standards), the CIA WorldFactbook (Reed & Lenat, 2002), and WordNet, and producing automated OWL annotation of text documents (Witbrock et al, 2004). Nevertheless, once again, unfortunately Semantic Web developers outside the company have so far made little *use* of this ontology. Its system of categories is extremely complex, requiring philosophical training to understand. Inferential tractability is a particular worry given the expressivity of the CycL language, and the monolithic holism of such a giant ontology unfortunately leads to brittleness.

In conclusion, then, the attempts of these formal ontology projects to 'create *ex nihilo*' the meaning of signs on the semantic web *via* a set of antecedent definitions misunderstand what it is for something to have meaning. From a Peircean perspective the mere fact that these projects are not widely used *is* the key argument against their having real 'significance'.

6. Peircean approaches to web semantics

Key idea: **Build applications which allow interpretants to freely *grow*, within whatever communities choose to use them**. What *is* growing right now on the Web? Some developments manifestly are. (These are sometimes referred to as the 'lower-case semantic web', by contrast to the W3C's official efforts):

1) Tagging. Tags are labels added to the Web voluntarily by users. Ontologically speaking, the practice is entirely uncontrolled – no categories are prepared or agreed upon in advance. (Thus a given CD might be labelled "`boring`", "`Mike_likes_this`", "`driving_music`", and "`songs_about_fish`"). Tagging began as a way of labelling web-pages with words or phrases meaningful to oneself in order to rediscover them quickly, but has spread to embrace a number of other much more public uses, as a variety of websites has emerged to serve as tag clearing-houses. Examples of such sites include del.icio.us. for tagged bookmarks (`http://del.icio.us/`) and Flickr for tagged photographs (`http://www.flickr.com/`).

Tagging is said to produce not a *taxonomy* (in the sense of a mark-up according to a pre-given ontology) but a '*folksonomy*' (Weinberger, 2005). Despite the 'feral' source of tags, it has been argued that at the level of the entire Web the impact of individual idiosyncrasy lessens, and that, "[b]y forgoing formal classification, tags enable a huge amount of user-produced organizational value, at vanishingly small cost" (Shirky, 2005).

2) RSS *autodiscovery*. This technology 'syndicates' websites (frequently weblogs) by providing summaries of their content, links to the full version,

and other meta-data, in an XML file called an RSS feed. Content is filtered for individual users using keywords (the choice of which once again is wholly personal and idiosyncratic).

3) *Collaborative websites*. These provide a medium in which speakers of any language define, describe and discuss topics of contemporary relevance. The resulting information is freely available, electronically encoded and conveniently presented. Such websites are quickly springing up on every conceivable subject, for instance: music (`http://musicbrainz.org/`), exercise (`http://www.favoriterun.com/`) and biosecurity (`http://paipm.cas.psu.edu/biosecurity.html`), to give just a few examples. One of the original and most impressive websites, however, and by far the most comprehensive, is the online encyclopaedia Wikipedia. This project is a remarkable and unanticipated realisation of Peirce's 'community of inquiry', its ever-increasing level of accuracy causing considerable surprise in those who do not hold to Peirce's theory of truth (but a sense of vindication in those who do).

6.1 A case-study in semantics extraction from user-supplied web content

Wikipedia's immense potential as an automated, just-in-time source of semantic knowledge, by contrast to manually encoded, 'frozen' silos of meaning, is just beginning to be explored scientifically. Each web page/ article in Wikipedia defines a specific concept and is inter-linked with other articles in the encyclopaedia. Milne et al. (2006) extract a thesaurus by treating article names as terms and hyperlinks as semantic relations between them. By looking at different types of links, they are able to identify three types of semantic relations that are commonly used in manually crafted thesauri:

- *Synonymy/Polysemy* – Redirect pages in Wikipedia link synonymous phrases to the same article (e.g. 'Pine tree' is linked to 'Pine'). Disambiguation pages help to identify ambiguous terms (e.g. 'Tree' as 'woody plant' and 'Tree' as 'data structure', along with 14 other possible senses)

- *Hierarchical relations* – Wikipedia's category structure defines relations between broader and narrower concepts (e.g. 'Pine' belongs to the category 'Pinaceae', which is in turn a part of the category 'Plant families')

- *Associative relations* – Any other hyperlinks connecting article pages are association between the concepts of different strength. (e.g. On the page 'Pine' there are links to articles 'pine nuts', 'evergreen', 'christmas trees' and 'parks')

In this way they concretely demonstrate how a semantic knowledge base can be created on-the-fly, tailored to any document collection. Figure 2 demonstrates an example, where a mini-version of a thesaurus was extracted given merely Wikipedia and the following short document:

> *"Tane Mahuta is New Zealand's tallest Kauri Tree, growing in Waipoua Forest. Its massive smooth, grey-white trunk rises 59 feet before a branch appears."*

Thick lines represent hierarchical relations, thin lines are association relations; dotted lines reflect polysemy relations to homonyms. Note the detail of this result by contrast to the random and patchy coverage of current OWL ontologies. Furthermore, this semantic structure reflects *public* opinion on the relatedness between document terms, it reflects an up-to-the-minute version of it, and the restriction to a particular document guarantees that all included terms are relevant for this particular knowledge domain.

Given a large agricultural document collection and a thesaurus Agrovoc, manually created to cover the same domain, Milne et al. report that Wikipedia covers more than twice as many document concepts as Agrovoc.

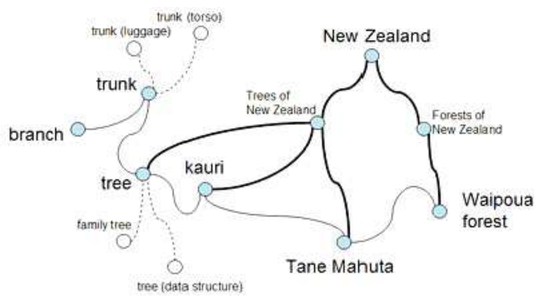


Figure 2. Thesaurus extracted from Wikipedia for a sample document.

7. Conclusion

Cartesians assume that in order to make the Semantic Web happen it is necessary to make a huge defining effort, to somehow encode for the computer the private intentions we have when we produce signs. The Peircean approach by contrast involves realizing that vast quantities of semantic data *already exists* on the Web, our job is to work out how to leverage it. It might be objected that it is difficult to envisage how any kind of coherent inferencing might be built on such a turbulent and amateur base as (is most of) this user-supplied metadata. Still, these criticisms might be made of Google's deployment of its spectacularly successful page-rank algorithm across the turbulent and amateur World Wide Web. Google's genius was to realize that it did not need to pay people to inspect and rate websites, as such data already existed in the form of hyperlinks. In Peircean terms, we can say that Google realized that hyperlinks constitute *interpretants* of the web-pages they link to. For in most cases such links indicate that the creator of the linking page thought that their page was in some sense relevant to, and thus *about the same thing* (object) as the linked-to page. In a similar way, then, tags can be considered as interpretants of the web-pages they describe, blog syndications as interpretants of the blogs syndicated, Wikipedia entries as interpretants of the terms defined, and so on. The kinds of inferencing that will trace such interpretants and transform them into semantic data is not the neat, deductivist rule-based reasoning of 'good old fashioned AI'. We need new models.

Having mentioned AI, it's worth noting that here also philosophical theories of meaning are not mere abstract speculation but directly influence what we envision and attempt to build. This is not surprising since the Semantic Web at its most boosterish arguably consists in many old AI goals in 1990s dress (Halpin, 2004). The classic 1950s-era model of AI – something like a digital encyclopedia in the head of a robot – may now be seen as a poignant attempt to make concrete the Cartesian picture of meaning as idea *in* the head. By contrast, Peirce's account of meaning as interpretants led him to write, "just as we say that a body is in motion, and not that motion is in a body, we ought to say that we are in thought, and not that thoughts are in us." (EP 1:42 fn.). In this sense, perhaps as with 'Web semantics' also with 'Web intelligence' we already have more at our disposal than we realize.[3]

[3] A considerably revised and expanded version of this paper is forthcoming in *Semiotica*, under the title "Peirce, Meaning and the Semantic Web".

References

Beckett, D. (2004). "RDF/XML Syntax Specification (Revised)." Retrieved 10 August 2007 from http://www.w3.org/TR/2004/REC-rdf-syntax-grammar-20040210/

Bergman, M. K. (2006). "OWL Ontologies: When Machine-Readable is not Good Enough." Retrieved 20 August 2007 from http://www.mkbergman.com/?p=194

Berners-Lee, T. (2002). "Foreword." In D. Fensel (Ed.), *Spinning the Semantic Web: Bringing the World Wide Web to its Full Potential*. Cambridge: MIT Press.

Berners-Lee, T., Hendler, J, & Lassila, O. (2001). "The Semantic Web." *Scientific American*, 284(5), 34–43.

Brickley, D. & Guha, R. V. (2003). "RDF Vocabulary Description Language 1.0: RDF Schema." Retrieved 16 May 2007 from http://www.w3.org/TR/rdf-schema/

Decker, S., van Harmelen, F., Broekstra, J., Erdmann, M., Fensel, D., Horrocks, I., Klein, M., & Melnik, S. (2000). "The Semantic Web – On the Respective Roles of XML and RDF." IEEE Internet Computing, 4(5) 63–74.

Descartes, R. (1996). *Meditations on First Philosophy: With Selections from the Objections and Replies.* (Eds.) Cottingham, J., Williams, B. & Ameriks, K. Cambridge: Cambridge University Press.

Fikes, R., Hayes, P., & Horrocks, I., (Eds.) (2002). "DAML Query Language (DQL) Abstract Specification." Retrieved 20 August 2007 from http://www.daml.org/2002/08/dql/

Frege, G. (1879). *Begriffsschrift: eine der arithmetischen nachgebildete Formelsprache des reinen Denkens*. Halle (Appears in English in *Conceptual Notation, and Related Articles.* Bynum, T. W. (Ed. & Trans.) Oxford: Clarendon Press, 1972.)

Gruber, T. R. (1995). "Toward Principles for the Design of Ontologies Used for Knowledge-Sharing." *International Journal of Human and Computer Studies*, 43 (5/6), 907–928.

Guha, R. (2003). "Semantic Issues in Web-Scale Knowledge Aggregation." *Knowledge Systems Laboratory*, 2003. Retrieved 16 May 2007 from http://ksl.stanford.edu/KSL_Abstracts/KSL-03-15.html

Guha, R. V., Lenat, D.B., Pittman, K., Pratt, D., & Shepherd, M. (1990). "Cyc: A Midterm Report." *Communications of the ACM* 33 (8).

Guha, R. & McCool, R. (2003). "TAP: A Semantic Web Platform." *Journal of Network Computing* 42, 557–577.

Hacking, I. (1975). *Why Does Language Matter to Philosophy?* Cambridge: Cambridge University Press.

Halpin, H. (2004). "The Semantic Web: The Origins of AI Redux." *Proceedings of the Fourth International Workshop on the Philosophy and History of Mathematics and Computation*, San Sebastien, Spain, 2004.

Horrocks, I., Patel-Schneider, P., & Van Harmelen, F. (2002). "Reviewing the Design of DAML+OIL: An Ontology Language for the Semantic Web." *Proceedings* *of the 18th National Conference on Artificial Intelligence* AAAI2002. Edmonton, Canada, 792–797.

Legg, C. (2005). "The Meaning of Meaning-Fallibilism." *Axiomathes*, 15 (2), 293–318.

Lenat, D. B. (1995). "Cyc: A Large-Scale Investment in Knowledge Infrastructure." *Communications of the* ACM, 38(11), 33–38

Locke, J. (1690/1994). *An Essay Concerning Human Understanding*. Prometheus Books.

McCool, R., Fikes, R., & Guha, R. (2003). "Semantic Issues in Web-Scale Knowledge Aggregation." Retrieved 1 August 2007 from `http://www-ksl.stanford.edu/KSL_Abstracts/KSL-03-15.html`

McGuinness, D., & van Harmelen, F. (2004). "OWL Web Ontology Language: Overview." Retrieved 8 August 2007 from `http://www.w3.org/TR/owl-features/`

Maedche, A., Motik, B., & Stojanovic, L. (2003). "Managing Multiple and Distributed Ontologies on the Semantic Web." *The* VLDB *Journal*, 12, 286–302.

Melnik, S. (1999). "Bridging the Gap Between RDF and XML." Retrieved 6 August 2007 from `http://www-db.stanford.edu/ melnik/rdf/fusion.html`

Milne, D., Medelyan, O., & Witten, I. (2006). "Mining Domain-Specific Thesauri from Wikipedia: A Case Study." IEEE/WIC/ACM International *Conference on Web Intelligence (WI 2006 Main Conference Proceedings).* WI'06, 442–448.

Patel-Schneider, P.F. & Fensel, D. (2002). "Layering the Semantic Web: Problems and Directions." In I. Horrocks and J. Hendler (Eds.), ISWC *2002,* LNCS *2342* (pp. 16–29).

Patel-Schneider, P.F. & Siméon, J. (2002). "The Yin/Yang Web: XML Syntax and RDF Semantics." *WWW* 2002. Honolulu, Hawaii.

Phipps, S. (2000). "Meaning, not Markup." XML *Journal*, 1(1), 66.

Ramachandran, D., Reagan, P., & Goolsbey, K. (2005). "First-Orderized Research-Cyc: Expressivity and Efficiency in a Common-Sense Ontology." In P. Shvaiko et al (Eds.), *Papers from the 2005* AAAI *Workshop on Contexts and Ontologies: Theory, Practice and Applications* (pp. 33-40). Menlo Park: The AAAI Press.

Reed, S., & Lenat, D. (2002). "Mapping Ontologies into Cyc." AAAI *2002 Conference Workshop on Ontologies For The Semantic Web*, Edmonton, Canada.

Shah, U., Finin, T., Joshi, A., Cost, R.S., & Mayfield, J. (2002). "Information Retrieval on the Semantic Web." In D. Grossman (Ed.), *Proceedings of the 11th International Conference on Information and Knowledge Management:* CIKM*'02* (pp. 461-468). New York: ACM Press.

Shirky, C. (2005). "Ontology Is Over-Rated: Categories, Links and Tags." Retrieved 24 May 2007 from `http://www.shirky.com/writings/ontology_overrated.html`

Sowa, J. (2000). "Ontology, Metadata, and Semiotics." In B. Ganter & G. W. Mineau (Eds.), *Conceptual Structures: Logical, Linguistic, and Computational Issues, Lecture Notes in AI #1867* (pp. 55–81) Berlin: Springer-Verlag.

Sowa, J. (2001). "Signs, Processes, and Language Games." Retrieved 10 December 2002 from `http://www.jfsowa.com/pubs/signproc.htm`

Sowa, J. (2004). "The Challenge of Knowledge Soup." Retrieved 24 May 2007 from `http://www.jfsowa.com/pubs/challenge.pdf`

Swartz, A. (2002). "The Semantic Web in Breadth." Retrieved 20 August 2007 from `http://logicerror.com/semantic-Web-long`

Weinberger, D. (2005). "Taxonomies to Tags: From Trees to Piles of Leaves." Release 1.0, 23(2), 1–33.

Witbrock, M., Panton, K., Reed, S.L., Schneider, D., Aldag, B., Reimers, M., & Bertolo, S. (2004). "Automated OWL Annotation Assisted by a Large Knowledge Base." In *Workshop Notes of the 2004 Workshop on Knowledge Markup and Semantic Annotation at the 3rd International Semantic Web Conference* ISWC*2004* (pp. 71-80). Hiroshima, Japan.

Towards a Sound Contextualism: Applying Peircean Ideas at the Semantics-Pragmatics Interface

Daniel Rellstab
University of Bern

1. Introduction

The conceptualization of the semantics-pragmatics-interface is fiercely discussed in linguistics and philosophy today. One important point of departure of this discussion lies in Grice's writings on meaning (cf. Grice, 1989). Grice argues that meaning in natural language is not homogeneous, but consists of different genera and species. In his famous William James Lecture on *Logic and Conversation* (1967), he discerns in the total signification of an utterance (1) the conventional sentence meaning, (2) "what is said," and (3) "what is implicated." He discriminates between (a) conventional and (b) conversational implicatures, and he distinguishes (i) generalized conversational implicatures from (ii) particularized conversational implicatures (cf. Grice, 1967). Today, Grice's adherents and successors try to complete the picture which remained sketchy in Grice's writings. They examine and propagate different stratifications of meaning in utterances. They strive to find out what separates literal from non-literal meaning, what language itself contributes to the meaning of utterances, and what is determined by contextual, pragmatic factors. The solutions offered are many, but they differ with regard to one factor: the emphasis put on pragmatics. More or less radical pragmaticists, also called contextualists (cf. Récanati, 2004, p. 3), maintain that pragmatics "infects" semantic content in a substantial way (cf. Borg, 2007). "Literalists," on the other hand, intend to hold off any, or too much pragmatic intrusion. Literalists admit that natural language sentences are context-dependent to become truth-evaluable to a certain degree: They admit that indexicals and other variables in the sentence need contextual assignments of values. The conventionalists of this camp perceive the variables to be functions from context to content and therefore dismiss pragmatics (cf. Kaplan, 1977). The minimalist literalists go one step further and acknowledge that pragmatic processes are involved; yet they maintain that these processes are triggered by the grammar of the sentence (cf. e.g., Stanley, 2000). All in all, the field is divided and heavily mined: Contextualists are dubbed the "natural enemies" of the literalists, and Katarzyna Jaszczolt states sardonically that literalists are in need of good ammunition against the contextualists because it seems that contextualists are winning the battle (Jaszczolt, 2007, p. 5; cf. Borg, 2007).[1]

2. Contextualism in philosophy and linguistics

The central claim of contextualism is that a sentence S is unable to provide conditions under which S is true, that S does not provide the proposition expressed by S, and that S fails to specify what intuitively is (literally) said. Another claim is that pragmatic processes are not only triggered by the syntax of a sentence, but that they are caused by the structural indeterminacy which inheres in every sentence. For contextualists, pragmatic processes are endemic. This is intuitively plausible, as many examples show. Imagine sitting down for lunch with a friend, asking her whether she is hungry, then getting the following answer:

(1) *I've had a large breakfast.*

Taken literally, the sentence uttered is inappropriate: It only expresses that the speaker has had a large breakfast sometime in her life. In order to evaluate (1), you have to enrich it to *I've had a large breakfast this morning*. Otherwise you cannot grasp what contextualists call the intuitive truth-conditions of the utterance, and you cannot compute the implicature of the utterance. The enriched part of the utterance, the "unarticulated constituent," is considered to be part of the statement, but corresponds to nothing in the sentence (cf. Perry, 2000; Récanati, 2002, pp. 300–1).[2] Now imagine someone stating (2):

[1] Accounts of the various factions are given by Cappelen and Lepore (2005b, pp. 46–7); Récanati (2004, 2005), and Borg (2007).

[2] Another famous example necessitating a bridging inference is: *Mary took out her keys and opened the door*, meaning. . . with that key.

(2) *I am parked out back.*

You would not take the speaker to be a car, but you would transfer the predicate in order to make sense of the sentence. Of course, advocating processes of free enrichment and predicate transfer does not turn a philosopher or linguist into a contextualist yet. Nevertheless, it leads her towards contextualism (cf. Bach, 2005a; 2005b).[3] 'Real' contextualists assert that we always need to adjust word meaning because it is underdetermined, as e.g. (3) shows:

(3) *While Jane cut the grass, Jill cut the cake.*

The word *cut* is not ambiguous, as homographs or homonyms are, but there is a big difference between *cutting the grass* and *cutting a cake*: The word makes different contributions to the truth-conditions of the respective utterance (cf. Searle, 1980, pp. 222–3). Adherents of the "wrong format view" declare that word meanings are either too schematic, or too abstract, or too rich, and that it always undergoes a process of determination, of fleshing out, or feature-cancellation in order to contribute to truth-evaluable meaning. According to this view, compositionality of sentences alone is not sufficient. Meaning eliminativists even go one step further. They deny that there is anything like linguistic meaning: Word types cannot be associated with abstract conditions of applications, but they are always connected to particular applications, and they are always used another first time (cf. Récanati, 2005, pp. 189–90).

Philosopher contextualists find their combatants in linguistics under the banner of relevance theory (cf. e.g., Carston, 2002; Sperber and Wilson, 1996), and default semantics (cf. Jaszczolt, 2005). To buttress their theories of communication, cognition, and natural language, linguist-contextualists use experimental psychological research methods. What else can they do after having abandoned the idea that sentences bear meaning, or, if they are eliminativists, given up the idea that truth-conditions for utterances can be found? They proceed inductively, design experiments, and hope to reveal one day how people understand utterances (cf. e.g., Noveck, 2006; Papafragou and Musolino, 2003). There is a trap attached to this methodology, though: It surrenders to the plurality of meaning phenomena, as a quote of Jaszczolt demonstrates:

> Some presumed meanings are context-free, some are not. Some are automatic, some appear to use some minimal inference. Next, some

[3] Cappelen and Lepore (2005a) consider Bach to be a contextualist, Borg (2007) thinks he is heavily leaning towards contextualism. Bach (2005a) claims that this is wrong.

> are local, some are global (albeit on some accounts only accidentally global, when the relevant expression falls at the end of the sentence). Some come from the lexicon or grammar, others come from the way humans think or the way they construct their social and cultural reality. There seems to be no compelling argument for their unitary analysis. It appears that it is this diversity of salient meanings that the research has to turn to first. Jaszczolt, 2006

Obviously, linguist contextualists have not found a sound methodology compatible with their favored theory of language yet.

This looks different in the other camp: Literalists do not have to abandon the idea of a theory which accounts for the compositionality of natural language, its productivity, and the systematicity of linguistic comprehension and use. They can even work with formal methods and remain close to the goal of linguistics, which should not be reduced to collecting and classifying data (cf. Borg, 2007) – at least not in the field of semantics and pragmatics. However, literalists are removed from linguistic reality. The way to proceed would be to adapt a contextualist philosophy, but a methodology as rigid as a literalist one. To find ideas and principles for such an undertaking, contextualists might turn to Peirce.

3. Peirce's contextualist conception of natural language

To dub Peirce a "contextualist" means committing an anachronism, although a legitimate one. That Peirce estimates pragmatic processes as important is already evident in his triadic, functional definition of the sign (cf. e.g., MS 637:31). Even closer parallels to contemporary contextualism can be found in his conception of natural language. A contextualist conception of natural language is based on the idea that the type of a word and the syntax of a sentence do not solely contribute to truth-evaluable meaning. Peirce argues similarly: He describes the connections between a word and its different dimensions of meaning as complex, and he highlights how difficult it is to draw a line between word, object, and interpretants. Nevertheless, he is convinced that distinctions have to be made, even if they appear to be slight (cf. MS 292:20–2). He describes these differences as different rules governing the meaning of a word on the one hand, and its replication as a token of a type on the other hand (cf. CP 2.292; Short, 1984, pp. 20–2).

Of course, this does not turn Peirce into a contextualist yet. As the conventionalist literalist shows, assignments of values can be conceptualized without acknowledging the importance of pragmatic processes (cf. Kaplan, 1977). Yet Peirce does not neglect these processes. This becomes obvious in his treatment of linguistic indices:

The most interesting aspect is that Peirce consistently develops his conception of linguistic indexicality out of an investigation of the functioning of dialogues. In MS 409, he distinguishes between (1) direct objective indicatives, (2) direct personal indicatives, (3) relative pronouns, and (4) adverbs and prepositions. Direct objective indicatives, e.g. demonstrative pronouns, "do not exhibit anything; they only show in the sense of directing the hearer where to search for the thing meant" (MS 409:18–9). Therefore, calling them demonstratives is wrong: They demonstrate nothing. On the other hand, direct personal indicatives do not need associated demonstrations to indicate their objects: They are what could be called "Peircean pure indexicals." This set is rather small and consists only of the personal pronouns *I*, *we*, and *you*, the pronouns to denote the participants of a dialogue. *He*, *she*, and *they* are not so easily interpretable in communication and therefore belong to the set of direct objective indicatives (cf. MS 409:19). Similar to current research, Peirce places adverbs and prepositions near either the category of direct objective indicatives, or the category of direct personal indicatives. Adverbs and prepositions in need of accompanying gestures, e.g. *left* and *right*, are "closely allied to 'demonstrative pronouns'," or to "*direct objective indicatives*." Others, e.g. *here* and *now*, are similar to personal pronouns. The items of the last set of linguistic indices, anaphora, "direct us to observe, not outward objects, but the words that have been used, and their meanings" (MS 409:19); they "directly refer, and need only refer, to the images in the mind which previous words have created" (CP 2.305). In a similar way, Peirce defines *every, whatever, whoever, some* as selectives (cf. MS 1135:11), and he perceives two subdivisions, universal and particular selectives. Universal selectives are terms such as *anybody, nobody*; particular selectives are expressions such as *some, something, somebody*. Selectives prompt their interpreters to actively look for their objects (cf. SS 1:209–10).[4]

According to Peirce, every sentence contains symbols, or general terms, but also indices, or at least grammatical subjects functioning as indices. This has consequences for his conception of sentence meaning. If every sentence contains indices, and if interpreters must actively resolve the in-

---

[4] This treatment of quantifiers has been elaborated and made rigorous in game-theoretic semantics, and Jaakko Hintikka and Risto Hilpinen repeatedly pointed out that Peirce can be interpreted as a precursor of this specific program. Cf. e.g. Hilpinen (1992); Hintikka (1997).

dices of the sentence by way of finding the objects meant in order to interpret the sentence as so connected with the object (cf. Houser, 1992, p. 494; Pape, 1991, p. 173), then a sentence becomes only meaningful when interpreted by an interpreter and when applied in a specific context (cf. CP 3.868; EP 2:279).

Yet does the claim that interpreters have to do something in order to resolve linguistic indices put Peirce in the contextualist camp? There is another aspect of Peirce's theory of language which makes the categorization of Peirce as contextualist more plausible. According to Peirce, terms as symbols are general, and their exact meaning depends on their use in a specific situation (cf. EP 2:220). Peirce is a precise observer of communication, and he realizes that symbols are in need of narrowing because their meaning potential is rich. Symbols grow out of experiences, they evolve, semiotically speaking, through icons and indices (cf. e.g., EP 2:264). On the basis of every symbol is a "composite photograph," (EP 2:21) a sort of picture of what I experienced as being alike (cf. SS 3:206). Whenever I interpret a symbol, e.g. the symbol *dog*, I make use of the general idea of dogs which also contains, as Peirce succinctly writes, "general ideas of dogs' ways, of the law of caninity, some of them invariable, so far as I have observed, such as his frequent napping, others merely usual, such as his way of cycling when he is preparing to take a nap" (EP 2:223; cf. MS 318, pp. 202–03; MS 641:30). Moreover, as symbols are grounded in experiences, they cannot have but an encyclopedic character: They are connected to a wealth of other symbols (cf. also CP 5.505–05). Therefore, word meaning is not determinate. Peirce also writes:

> In another sense, honest people, when not joking, intend to make the meaning of their words determinate, so that there shall be no latitude of interpretation at all. That is to say, the character of their meaning consists in the implications and non-implications of their words; and they intend to fix what is implied and what is not implied. They believe that they succeed in doing so, and if their chat is about the theory of numbers, perhaps they may. But the further their topics are from such presciss, or "abstract," subjects, the less possibility is there of such precision of speech. In so far as the implication is not determinate, it is usually left vague; but there are cases where an unwillingness to dwell on disagreeable subjects causes the utterer to leave the determination of the implication to the interpreter; as if one says, "That creature is filthy, in every sense of the term." EP 2:351

This paragraph is important evidence that Peirce is in fact a contextualist philosopher of natural language (cf. also Pietarinen, 2006, pp. 392ff.). Peirce is convinced that natural language is not precise, perhaps not even as technical language which is used to talk about precise objects. He believes that sentences uttered in everyday conversation are underdetermined. Therefore, the meaning of a sentence is never just given compositionally. Moreover, a sentence may bear a heap of implications. Some of these implications could be explicated by the speaker. Others will be left vague, sometimes for strategic reasons because being vague gives the speaker the possibility to imply things she did not say. Definite determination is left to the interpreter. This sounds almost Gricean; Grice defined the content of conversational implicatures as having "various possible specific explanations, a list of which may be open" (Grice, 1967, p. 40).

Peirce's classification of interpretants in MS 318 helps to sustain the claim that he is a contextualist. Peirce distinguishes here three different interpretants: the emotional interpretant, the energetic or existential interpretant, and the logical interpretant. The emotional interpretant is defined as the sense of how to use a word, "a sense of comprehending the meaning of the sign," (MS 318:79) or "a feeling of recognition" (MS 318:156). The emotional interpretant belongs to the phenomenological category of Firstness and is only a possibility, waiting to be actualized in an actual interpretation. Peirce also compares this interpretant to the familiarity with the usage of the word (cf. MS 835:2). It is not farfetched to equate this interpretant with the lexical and grammatical meaning of words and syntactic constructions of natural language sentences. The actual interpretations are realized as efforts of the interpreter, as the "energetic interpretants". Realized in the outer world, they are actions; realized in the inner world, they are inhibitions, or the self-restraints, "which make so large a part of the effort to pay attention" (MS 318:36). Energetic interpretants are an intermediate step. They can be interpreted as what contextualists call "modulations" of the word meaning (Récanati, 2004, pp. 131ff.). They lead to the truth-evaluable content of a sentence, the logical interpretant, the "thought" (MS 318:89). Yet this is not the final step. This thought is still "general in its possibilities of reference (i.e. refers or is related to whatever there may be of a certain description)" (MS 318:89). Therefore, it has to be applied to a situation, and this is done by resolving the indices. Interpreting a sentence uttered presupposes the modulation of the linguistic content and the resolution of indices. Both processes work hand in hand towards the construction of the logical interpretant and its contextual evaluation.

4. A sound contextualism

To impute Peirce a radical contextualism would be implausible. Yet his realism does not prevent him from being a contextualist of the "wrong format view". Although his theory might seem sketchy, Peirce has ideas to offer which could help to refine contextualist approaches, and which could lead linguists and philosophers out of methodological dead-ends.

Ahti Pietarinen's criticism that the post-Gricean tradition of communication research neglected the role of the interpreter of utterances completely is clearly justified (cf. Pietarinen, 2006, pp. 399f.). On the one hand, it is astonishing that this tradition did not focus on the interpreter. Do contextualists' arguments not hinge on insights in underdeterminations of sentences and necessities of pragmatic processes? On the other, it is probably not surprising. Post-Griceans claim that truth-evaluable meaning of a sentence uttered depends on speaker's intentions, and this emphasis on speaker's intentions might have led to a neglect of the role of the interpreter. Yet bringing the interpreter into the game of language is necessary to develop a sound contextualism. It does not blur the picture but helps to see clearer. A way to introduce the interpreter without raising psychological notions is sketched in Peirce's semiotics: It is the notion of the interpretant. The interpretant can be understood as the result of a "phenomenological reduction" of the interpreter (cf. MS 318:52ff.). Moreover, Peirce proves in his Existential Graphs that the analysis of interpretants arising in different contexts can be conducted in a rigorous, formal, and logical framework. Of course, he did not develop his Graphs to conduct linguistic research. Yet Peirce pointed out that there is equivalence between the graphs and "familiar language" (MS 484:12–4), and that it is the job of the logician and mathematician to reveal the logical form of sentences to linguists in order "to render them more intelligible" (MS 654:5). As Peirce implemented pragmatic factors in his Existential Graphs, they can be interpreted as a very early approach to formal pragmatics (cf. also Sowa, 1997a, Sowa, 1997b):[5] The sheet of assertion represents the universe of discourse, which "must be well known and mutually known to be known and agreed to exist, in some sense, between speaker and hearer, between the mind as appealing to its own further consideration and the mind as so appealed to, or there can be no communication, or 'common ground,' at all." (CP 3.621).

[5] Therefore, he can be interpreted as a precursor of Discourse Representation Theory (DRT). For a critique of Peirce's graphs from a formal pragmatic point of view cf. Rellstab (2007, pp. 307–9).

The sheet of assertion is not only a logical notion, but also a pragmatic one because it includes background assumptions, believes, and expectations (cf. also MS 614:1–2). The dots in the graphs indicate the individuals denoted by the indices of the sentence, and the line of identity, together with the depiction of negation, the so-called cuts, traces the resolution of anaphora in sentence and discourse (cf. e.g., CP 4.403–06, MS 478:115ff., Roberts, 1992, p. 645). The graphs do not depict indices, or variables, and possible relations. They show denoted individuals and interpreted relations. They are not representations of the syntactic structure of sentences, but representations of post-pragmatic meaning structures of the interpreted sentences. They do not represent the cognitive structure located in the mind of an individual, but they are iconic representations of a logical interpretant of a sentence in a specific situation, therefore a depiction of the actualized meaning potential of a sentence. Although not psychologically meant, they are nonetheless cognitively plausible.

The goal of contextualists is to find out how linguistic structures and pragmatic processes work together. Although Peirce does not present a complete contextualist theory of natural language, or a methodology readily applicable to the analysis of natural language, his work must impress linguistics and ordinary language philosophers alike. He shows that a contextualist must not abandon the search for precise means to represent meaning in context, but that she has to invent a richer logic which helps to analyze the relationship between the context, the syntactic structure, and the semantic potential of a sentence uttered in a specific context.

References

Bach, K. (1999). "The Semantics-Pragmatics Distinction: What It Is and Why It Matters." in K. Turner (Ed.), *The Semantics/Pragmatics Interface from Different Points of View* (pp. 65–84). Oxford: Elsevier.

Bach, K. (2005a). "Context Ex Machina." In Z. Szabó (Ed.), *Semantics vs. Pragmatics* (pp. 15–44). Oxford etc.: Oxford University Press.

Bach, K. (2005b). "The Excluded Middle. Semantic Minimalism without Minimal Propositions." *Philosophy and Phenomenological Research*, 73(2), 436–42.

Borg, E. (2007). "Minimalism Versus Contextualism in Semantics." In G. Preyer and G. Peter (Eds.), *Context-Sensitivity and Semantic Minimalism. New Essays on Semantics and Pragmatics* (pp. 339-359). Oxford: Oxford University Press.

Cappelen, H. and E. Lepore (2005a). *Insensitive Semantics. A Defense of Semantic Minimalism and Speech Act Pluralism.* Malden, Mass.: Blackwell.

Cappelen, H. and E. Lepore (2005b). "Radical and Moderate Pragmatics: Does Meaning Determine Truth Conditions." In Z. Szabó (Ed.),*Semantics vs. Pragmatics* (pp. 45–71). Oxford: Oxford University Press.

Carston, R. (2002). *Thoughts and Utterances. The Pragmatics of Explicit Communication.* Oxford: Blackwell.

Grice, P. (1967). "Logic and Conversation." In P. Grice. *Studies in the Way of Words* (pp. 22–40). Cambridge, MA: Harvard University Press.

Grice, P. (1989). *Studies in the Way of Words*. Cambridge, MA/London: Harvard University Press.

Hilpinen, R. (1992). "On Peirce's Philosophical Logic – Propositions and Their Objects." *Transactions of the Charles S. Peirce Society*, 28, 467–488.

Hintikka, J. (1997). "The Place of C. S. Peirce in the History of Logical Theory." In J. Brunning and P. Forster (Eds.), *The Rule of Reason. The Philosophy of Charles Sanders Peirce* (pp. 13–33). Toronto: University of Toronto Press.

Houser, N. (1992). "On Peirce's Theory of Propositions: A Response to Hilpinen." *Transactions of the Charles S. Peirce Society*, 28(3), 489–504.

Jaszczolt, K. (2005). *Default Semantics. Foundations of a Compositional Theory of Acts of Communication*. Oxford: Oxford University Press.

Jaszczolt, K. (2006). "Defaults in Semantics and Pragmatics." *Stanford Encyclopedia of Philosophy*.
`http://plato.stanford.edu/entries/defaults-semantics-pragmatics/`, retrieved 27. 10. 2010.

Jaszczolt, K. (2007). "On Being Post-Gricean." In R. A. Nilsen, N. A. A. Amfo and K. Borthen (Eds.), *Interpreting Utterances: Pragmatics and Its Interfaces* (pp. 21–38). Oslo: Novus.

Kaplan, D. (1977). "Demonstratives. An Essay on the Semantics, Logic, Metaphysics, and Epistemology of Demonstratives and Other Indexicals." In J. Almog, J. Perry and H. Wettstein (Eds.), *Themes from Kaplan* (pp. 481–563). Oxford: Oxford University Press.

Kappner, S. (2004). *Intentionalität aus semiotischer Sicht. Peirceanische Perspektiven.* Berlin/New York: Walter de Gruyter.

Noveck, I., (Ed.) (2006). *Experimental Pragmatics*. Basingstoke: Palgrave Macmillan.

Papafragou, A., and J. Musolino (2003). "Scalar Implicatures: Experiments at the Semantics-Pragmatics Interface." *Cognition: International Journal of Cognitive Science*, 86(3), 253–82.

Pape, H. (1991). "Not Every Object of a Sign Has Being." *Transactions of the Charles S. Peirce Society*, 27(2), 141–77.

Perry, J. (2000). *The Problem of the Essential Indexical and Other Essays.* Expanded Ed. Stanford, CA: CLSI Publications.

Peirce, C. S. (2000). *Semiotische Schriften*. 3 vols. C. J. W. Kloesel and H. Pape (Eds. and Trans.), Frankfurt: Suhrkamp.

Pietarinen, A. (2006). *Signs of Logic. Peircean Themes on the Philosophy of Language, Games, and Communication*. Dordrecht: Springer.

Récanati, F. (2002). "Unarticulated Constituents." *Linguistics and Philosophy*, 25, 299–345.

Récanati, F. (2004). *Literal Meaning*. Cambridge: Cambridge University Press.

Récanati, F. (2005). "Literalism and Contextualism: Some Varieties." In G. Preyer and G. Peter (Eds.), *Contextualism in Philosophy: Knowledge, Meaning, and Truth* (pp. 171–196). Oxford: Oxford University Press.

Rellstab, D. (2007). *Charles S. Peirce' Theorie natürlicher Sprache und ihre Relevanz für die Linguistik: Logik, Semantik, Pragmatik*. Tübingen: Narr.

Roberts, D. (1992). "The Existential Graphs." *Computers and Mathematics with Applications*, 23(6–9), 639–663.

Searle, J. (1980). "The Background of Meaning." In J. Searle, F. Kiefer, and M. Bierwisch (Eds.), *Speech Act Theory and Pragmatics* (pp. 221–232). Dordrecht: Reidel.

Short, T. (1984). "Some Problems Concerning Peirce's Conceptions of Concepts and Propositions." *Transactions of the Charles S. Peirce Society*, 20, 20–37.

Sowa, J. (1997a). "Matching Logical Structure to Linguistic Structure." In N. Houser, D. Roberts and J. Van Evra (Eds.), *Studies in the Logic of Charles Sanders Peirce* (pp. 418–444). Bloomington/Indianapolis: Indiana University Press.

Sowa, J. (1997b). "Peircean Foundations for a Theory of Context." In D. Lukose et al. (Eds.), *Conceptual Structures: Fulfilling Peirce's Dream. Fifth International Conference on Conceptual Structures*, ICCS *97, Seattle, August 1997* (pp. 41–64). Berlin: Heidelberg.

Sperber, D. and D. Wilson (1996). *Relevance. Communication and Cognition.* Oxford: Blackwell.

Stanley, J. (2000). "Context and Logical Form." *Linguistics and Philosophy*, 23, 391–434.

PART III

Habits as Vehicles of Cognition

Pentti Määttänen
University of Helsinki
Aalto University

1. Introduction

According to Charles Peirce, habits of action properly understood (that is, not as blind routines) are beliefs. He wrote, "a deliberate, or self-controlled habit is precisely a belief" (CP 5.480). On the other hand, he maintained that habits are meanings: "what a thing means is simply what habits it involves" (CP 5.400). Meanings and beliefs have obviously a lot to do with cognition. The question is, then: What are habits and what could be their role in cognition? The purpose of this paper is to discuss these ideas of Peirce and apply them in a naturalistic framework. My understanding of naturalism is, however, slightly different from the common view that appeals to natural science. Naturalism can be defined by the principle that the world is causally closed. This principle does not, in itself, entail any commitments to specific methods of scientific investigation. Neither does it entail any commitments to reductionism in the sense that concepts and theories referring to mind, culture and the social world could or should be replaced by natural scientific concepts and theories: there are genuinely emergent phenomena within the causal closure. It entails only that all processes in this world, especially the processes realizing cognition, proceed through physical causal processes. This version of naturalism is based on John Dewey, who stated simply that culture is a product of nature. Culture is developed by living biological organisms. This version of naturalism can be called soft naturalism (Määttänen, 2006).

2. What is a habit of action?

Habits can be characterized in different ways. Richard Rorty, for example, maintains that habits are bodily states "attributed to organisms of a certain complexity" (Rorty, 1991, p. 93). Can habits be bodily states? From a certain point of view it may seem so. Peirce compared habits with dispositions (CP 5.440), and dispositions are sometimes understood to be properties of individuals. A person is said to have a disposition to act in a certain way in certain circumstances.

It can be argued, however, that habits are better understood as forms of interaction rather than as bodily states. The first thing to note is that a disposition to act is a relational concept in the sense that there is no disposition to act without (potential) action, and no action without some circumstances. A disposition to act requires a situation and the specific circumstances which make this action possible. The definition of a disposition refers to these circumstances, and it remains an open question how a relation that consists of a living agent, action and specific circumstances can be considered as a bodily state. Generally speaking, it would be a logical category error to reduce a relation to one of its elements, and habits as forms of interaction are relations between living organisms and their environment. Peirce actually appealed to the role of circumstances when he explained how habits in fact differ from dispositions:

> Habits differ from dispositions in having been acquired as consequences of the principle, virtually well-known even to those whose powers of reflexion are insufficient to its formulation, that multiple reiterated behaviour of the same kind, under similar combinations of percepts and fancies, produces a tendency – the habit – actually to behave in a similar way under similar circumstances in the future.
>
> CP 5.487

The formation of a habit depends on the acting agent and on the circumstances to which action is accommodated. The role of the circumstances is neglected if one considers habits as bodily states.

There is another alternative. On this view, a habit exists through its instances. These instances are repeated sequences of acts, which are performed in a similar manner in similar circumstances. Instances of a habit exist as actual action in some circumstances, the objective conditions of action. Similarity unites several ways of behaving or several sequences of acts. There is a certain structure (a scheme or script) of action that is the same in different occasions of acting although these occasions may differ in various ways. On the other hand, an instance of a habit requires a similarity of the circumstances; that is, similarity of those features of the environment that are relevant for performing the action.

3. The dichotomy of external and internal

The idea that habits as forms of interaction may function as vehicles of cognition may seem strange from the viewpoint of contemporary discussions on cognition (with the exception of different approaches on distributed cognition). It is quite commonly assumed that cognition proceeds by manipulation of internal mental representations. However, it is precisely this assumption that enables one to use Peirce's ideas for critical purposes. Peirce criticized René Descartes in many occasions. One way of continuing this line of criticism is to question the dichotomy between external and internal altogether. For Descartes ideas are internal thought contents as opposed to the external material world. Franz Brentano drew an analogy between external linguistic expressions and internal mental states by appealing to their character as intentional units. Mental states are distinguished from bodily states by the fact that they are *about* something: they refer to and represent something else just like words. This is the origin of the doctrine of internal mental representations.

Contemporary naturalists tend to accept these views in spite of the denial of a separate mental substance. Naturalism is often interpreted to entail that minds must be identified with or reduced to brains. Accordingly, internal mental representations reside literally in the brain. This stand actually retains the Cartesian distinction between external and internal. As Max Bennett and Peter Hacker argue, what Descartes attributed to the soul, is by this view attributed to the brain (Bennett & Hacker, 2003, pp. 111–4). Similar background assumptions are effective in Daniel Dennett's effort to find intentional units literally in the head. When criticizing the views of Bennett and Hacker, Dennett maintains that a person can be divided into subpersons, and then these can be broken down further into less personlike agents until we reach agents so stupid that they can be replaced by a machine. By such a maneuver, genuine intentionality disappears, but it is still necessary to attribute some kind of intentionality to the parts of a person. Dennett does not have much to say about this special kind of intentionality: it is "hemi-semi-demi-proto-quasi-pseudo intentionality" (Dennett, 2007, p. 88). This is not particularly informative, but the influence of Brentano's analogy is clear. It may be noted that

Rorty seems to be under the same influence in maintaining that habits are bodily states.

However, naturalism does not imply reductionism. Naturalism is supposed to be, or should be, a serious alternative to all forms of (Neo-)Cartesianism because of its principle that the world is causally closed. This principle entails only that everything is realized through physical causal processes (Melnyk, 2003). Especially the interaction between a living organism and its environment – that is, perception and action – proceed through physical causal processes, and this holds also for our interaction with the symbolic environment, reading and writing, speaking and listening. Not a word is emitted without some bodily behavior. So there is the obvious but neglected possibility that these causal processes may play a role in cognition. Naturalism allows for a quite greater variety of views than is commonly assumed.

Naturalism entails no commitments to the traditional dichotomy of internal and external. Our interaction with the world consists of perception and action. Peirce characterized the relation of perception and action by stating that that in action "our modification of other things is more prominent than their reaction on us" as compared to perception "where their effect on us is overwhelmingly greater than our effect on them" (CP 1.324). This can be considered as a loop, where ongoing action (output) is controlled with the help of received perceptual input. That which is external to the body is not necessarily external to the processes realizing cognition. In sum, the idea that habits as forms of interaction realize cognitive processes rejects reductionism as well as the dichotomy of internal and external.

4. Cognition as anticipation of action

How can habits of action be vehicles of cognition? The answer lies in the principle that thinking is the anticipation of action. A habit makes anticipation possible because it has been formed in the past. Past experiences of acting in certain kinds of circumstances, where action is accommodated to objective conditions of action, have given to these sequences of acts a certain form and structure. A new occurrence of a similar situation brings it about that the present situation is associated with the memory of the kind of a situation that has previously been the outcome of acting according to the habit in question. The anticipation is successful only if there is a certain similarity in the situations which an agent encounters during its course of life. In other words, there have to be some permanent, or relatively permanent, conditions of action to which the agent has had to accommodate its behavior. As far as similar conditions of action prevail also in the future, an instance of the habit will probably lead to a similar outcome. The point is that a habit makes it possible to anticipate something that is not immediately present. This kind of cognitive distance is typically a function of meanings. A meaningful entity, a sign-vehicle, makes it possible to think about something that is not here and now but somewhere else some other time. By virtue of a habit, an observed situation functions as a kind of sign-vehicle referring to the anticipated future situation.

The definition that thinking is anticipation of action should not be taken too literally. It does not entail that it is only possible to think about future events. Rather it is a characterization of the mechanism of taking cognitive distance. The anticipation is based on past experience, and the memorizing of past instances of a habit and the anticipation of what will happen as a result of future habitual action are the two sides of the same coin. Further, this definition of thinking is not supposed to be enough for explaining human consciousness, which is characterized by the use of symbols. However, the principle that meaning is use – the approach made famous by Ludwig Wittgenstein – is very close to the Peircean idea that habits are meanings. The use of sign-vehicles for communication surely belongs to the habits they involve (Määttänen, 2005). From this point of view, the meanings of symbolic expressions are habitual ways of using these expressions in the context of non-symbolic practices. Therefore, the principles that habits are meanings and that cognition is an anticipation of action can be applied to symbolic cognition as well.

The point is that the habit of action is the basic mechanism providing the means of taking cognitive distance to the immediately present situation and thus functions as a vehicle of meaningful cognition. And as forms of interaction habits (that is, meanings) do not reside literally in the head.

5. The pragmatist law of association

A habit makes it possible to create an association between an observed situation and a future situation which will appear as a result of habitual behavior. This sort of an association, which can be called the pragmatist law of association, is not included in David Hume's principles of connection among ideas: resemblance, contiguity in time or place and cause (or effect). These classical laws of association are, in a form or another, still effective in contemporary work in artificial intelligence. One example is

Teuvo Kohonen's work on self-organizing neural networks (1988, p. 3). Kohonen discusses the phenomenon called autoassociative recall of missing fragments (Kohonen, 1988, pp. 160–163). Suppose that a photograph of a human face is stored in an associative memory. When a fragment of the face is used as a key pattern, the network is able to reconstruct the whole face as an output. This is due to the associative connections, which have been formed between the nodes of the network during the storing process. A similar approach can be used for processes that proceed in time. Kohonen describes networks that can store temporal sequences (Kohonen, 1988, pp. 16–18). The rest of the stored sequence is recalled by using its first item as a key pattern. The important question is, of course, what gives the order to the sequence. In Kohonen's version of the classical laws of association it is simply the fact that they occur in close succession, that there is a "temporal contact" (Kohonen, 1988, p. 3). Items are stored in the memory one after the other.

The pragmatist law of association differs from this in that the associative connections between items are formed not only because they occur in a sequence, but because they associated with a certain form of action, a habit. Sensory inputs are associated not only with each other but also, and more importantly, with neural mechanisms controlling overt motor action. It is the course of habitual action that determines what kind of sensory inputs are integrated associatively with one another in a sequence and what sequence of the neural processes controlling motor movements is associated with it. The important point is that when habitual action determines the sequence of sensory inputs that are associated with each other, the sequence corresponds to the objective conditions of action to which the action is accommodated. The operational success explains why the habit has become what it is, and it explains also why the sequence of sensory inputs associated with each other is what it is. The operational success is the criterion for picking up the stored items from the temporal flow of sensory input. A mere temporal contact is not enough.

6. Pragmatist conception of experience

The role of actual action in the formation of associations makes it necessary to revise the concept of experience. For the empiricists experience is sense experience. The world is "out there", and the mind gets it inputs through the sense organs. Accordingly, the associations between sensory inputs are formed in the mind. This conception of experience is not enough for explaining how a habit of action can function as an associative principle. It is too narrow.

Habits of action are formed on the ground of past experience because of the need to accommodate action to objective conditions of action. But accommodation takes place only through actual action. Therefore, in Peircean pragmatism "the concept of *experience* is broader than that of *perception*" (CP 1.336, emphasis in the original). And what makes it broader is, of course, action. In this view, experience is not about individual states of affairs consisting of individual objects, properties and relations but about how states of affairs are related to each other through habitual action that takes place in some circumstances, in the middle of different processes taking place in the environment. In other words, instead of a perceived situation we have the perceived situation associated with various habits of action. These habits make it possible to anticipate probable future situations which are outcomes of acting according to those habits. The world is experienced as providing various possibilities of habitual action (or affordances, to use J. J. Gibson's term).

In a nutshell, experience is habit formation, and habit formation is a mode of cognition for Peirce. He does not hesitate to describe a habit as a "real and living logical conclusion" (CP 5.491). To be more precise, habit formation is an induction (CP 5.297). "By induction, a habit becomes established" (CP 6.145). The logical formula of induction "expresses the physiological process of formation of a habit" (CP 2.643). This entails that even at the level of bodily movements the formation of a habit is a mode of induction. Objective conditions of action force the movement, by virtue of a muscular effort and resistance (by virtue on encountering hard facts; see, for example, CP 1.431) to a certain form and structure, and the developing habit is a general conclusion (or a general law, CP 2.148) on the ground of practical experience.

7. Vehicles of cognition

Habits as vehicles of cognition are radically different from internal mental representations. There are, of course, various characterizations of internal representations, but crudely speaking this notion stems from Brentano's (unfortunate) analogy. Words are individual units, sequences of letters, which are capable of referring to something, and in the same way there are internal units carrying mental content. Cognition then proceeds by processing these internal units. The naturalistic version of this view maintains that internal brain states and processes are the units that represent external things and are connected to mental contents. However, there are not too many explications of what exactly is the connection between physiological states and processes, on the one hand, and meanings or mental contents on the other. Rather, these connections are simply taken for granted. In this Neo-Cartesian version of naturalism, the processing or manipulation of internal units takes place in the brain, and the role of overt action in this manipulation is not essential. The obvious question here, one not too often raised, is of course: Who or what manipulates or processes these internal units? We don't have any direct access to our own brain processes. All attempts to specify and individuate some internal neural mechanism as an active "centre of consciousness" that does the manipulating faces the question: On what kind of principles does this mechanism itself work? There is a certain analogy with the notorious homunculus-theories, which only push the problem to another level without even trying to solve it.

The pragmatist law of association does not require any internal mechanism for manipulating these internal processes. They get manipulated through practice. At the simplest level they are manipulated by moving around in the observed environment. One activates different anticipatory mechanisms simply by looking at different things. Habits function as vehicles of cognition as elements of the ongoing interaction, and the active agent is the biological organism as a whole. In pragmatism the problem of the meaning of words is *not* posed as "What gives the black dots 'table' the capacity to refer to different tables?" but rather: "How are the habitual ways of using the word 'table' related to other habitual activities having something to do with tables?". Similarly, the problem of mental content is *not* posed as: "How is some mental content related to some unit in the brain and/or to things in the environment?" but rather: "What is the role of brain states and processes in controlling human behavior, especially in using language and other symbolic systems?".

The idea that habits of action are vehicles of cognition is an alternative to views based on the Cartesian distinction between external and internal and on the assumption that there are internal units representing the external world. The basic claim of this alternative is that cognition requires interaction with our natural and cultural environment and that the habit of action is one of the key concepts in analyzing this interaction. Internal mechanisms have a role in controlling behavior also from the viewpoint of the pragmatist law of association. However, these internal mechanisms are not supposed to be intentional units, and the internal connections between them are not supposed to be generated by virtue of literally internal operations. Internal connections are created by virtue of interaction with non-symbolic and symbolic environment. Symbol manipulation is (actual or potential) manipulation of external symbols (Donald, 2001).

8. Causal closure and teleology

Peirce writes at several places that in a certain sense it is correct to say that the future has an effect on the present. The notion of habit explains how this can be without assuming any suspicious notions of backward causation. A habit is a vehicle of anticipation, and it is precisely this anticipated future that has an effect on the present (but not on the past). This is however only possible because of repeated action by which the habit has been formed in the past. This requires, of course, that "the laws and habitudes of nature" have been stable enough to make it possible that correct mechanisms of habitual anticipation can be formed during the phylo- and ontogenesis of living creatures.

The anticipatory mechanisms created by the habit formation thus make it possible that the anticipated future has an effect on behavior. In other words, habit is a notion for a teleological or intentional explanation of behavior. Action is explained be referring to a goal; that is, an anticipated and desired outcome of a habitual behavior. The important point is that this explanation does not involve internal intentional units (representations), and neither does it violate the principle of the causal closure of the world. Habit formation does not require internal representations. Meaningful sign-vehicles are always objects of perception. Further, habits are always realized through interaction, through the loop of perception and action. This loop, in its turn, is realized through physical causal processes.

References

Bennett, M., & Hacker, P. (2003). *Philosophical Foundations of Neuroscience*. Oxford: Blackwell.

Dennett, D. (2007). "Philosophy as Naïve Anthropology." In M. Bennett, D. Dennett, P. Hacker, & J. Searle (Eds.), *Neuroscience & Philosophy. Brain, Mind, & Language* (pp. 73–95) New York: Columbia University Press.

Donald, M. (2001). *A Mind So Rare. The Evolution of Human Consciousness.* New York: W.W. Norton & Company.

Kohonen, T. (1988). *Self-Organization and Associative Memory.* Second Edition. Berlin: Springer-Verlag.

Melnyk, A. (2003). *A Physicalist Manifesto. Thoroughly Modern Materialism.* Cambridge: Cambridge University Press.

Määttänen, P. (1993). *Action and Experience. A Naturalistic Approach to Cognition*. Annales Academiae Scientiarum Fennicae B 64. Helsinki: Suomalainen tiedeakatemia.

Määttänen, P. (1997). *Intelligence, Agency and Interaction*. In G. Grahne (Ed.), SCAI'97, *Sixth Scandinavian Conference on Artificial Intelligence* (pp. 52–58). Amsterdam: IOS Press.

Määttänen, P. (2005). "Meaning as Use: Peirce and Wittgenstein." In F. Stadler & M. Stöltzner (Eds.), *Time and History, Papers of the 28th International Wittgenstein Symposium* (pp. 171–172). Kirchberg: Austrian Ludwig Wittgenstein Society.

Määttänen, P. (2006). "Naturalism: Hard and Soft." In H. J. Koskinen, S. Pihlström, & R. Vilkko (Eds.), *Science – A Challenge to Philosophy?* (pp. 227–236). Frankfurt am Main: Peter Lang.

Rorty, R. (1991). *Objectivity, Relativism, and Truth. Philosophical Papers*, Vol. I. Cambridge: Cambridge University Press.

Peirce's Theory of Assent

Giovanni Maddalena
University of Molise

1. Introduction

What is assent? And what is its role in knowledge and in belief? In order to understand whether Peirce's semiotics can be useful in this field, we have to compare its approach with some of the more valuable theories proposed in the last two centuries.

Both John H. Newman and Ludwig Wittgenstein rejected the old psychological view of a power that presides over the task of assenting to propositions, a power whose different degrees would justify the common experience of having different degrees of belief.[1] Newman proposed a radical explanation of assent and belief in terms of apprehension of reality: the kind of reality we apprehend determines the degree of belief, so that belief cannot be a subjectively shaped mental state or action. The change was remarkable. If assent is not simply explainable in a psychological way, as will intervening on already settled propositions with different degrees of intensity, our beliefs, i.e. propositions we assent to when they are not completely evident, share criteria of validity with the general way in which evident conceptions are attained. Belief is the first stage of an evident or true knowledge, not a wrong interpretation that will be completely removed when true knowledge appears. This first result, already foreshadowed by Locke, is followed by a realist analysis of assent.

[1] As a clue of a common ground on which to compare the two great philosophers, Wittgenstein quotes Newman in the very first paragraph of *On Certainty* (Wittgenstein, 1969, 2e). The traditional settlement of the issue in Stoicism, in Saint Augustine, in Medieval philosophy, and in Descartes shares a psychologist ground that begins to find a more complicated treatment in Locke and, partly, in Hume.

In Newman's work assent depends on the kind of relationship we have with reality. When we know a singular concrete object, our assent and belief are real, but when we know an abstract (general) object, our assent and belief are formal. In the background of this theory is Locke's nominalist theory, which regards simple ideas as stemming from sensations and reflection, while complex ideas stem from the comparison of the first ideas. Accordingly, knowledge is certain when it is immediate perception of the agreement between two ideas, while it is only probable when it is a mediate perception of that agreement. In Newman's terms, real knowledge can only be immediate and about a singular, while generals permit only a mediate and formal knowledge. Certainly, Newman was concerned with the problem of real and formal assent in religious faith, which is a sort of belief. His view on assent allowed him to say that faith or belief are kinds of knowledge, and to maintain a difference between real faith, which stems from real assent and is real knowledge, and formal faith, which stems from formal assent and is fake knowledge. The difference is that in the second we have missed the real knowledge that comes from the experience of the singular concrete object, whether it be God or some other object (Newman, 1973). So, Newman's view applies to any sort of assent and belief, and his view, which is based on a direct relationship between reality, knowledge, and belief, is an important reference for our topic.

Paradoxically, Newman's theory is very close to the more modern views inspired by the "copy theory" of knowledge of Wittgenstein's *Tractatus*. According to these, among which it is worth quoting at least Ruth Marcus's, belief is always the correct representation of a state of things; there is a direct correspondence between the state of facts and our belief, understood once again as a form of evident knowledge. For Marcus, false beliefs are impossible, like formal faith or belief was simply not faith, and not knowledge, according to Newman. Belief is knowledge and knowledge is a reflection of reality as it is, something to which we cannot help giving our assent. In this sense it is impossible to have either false beliefs or true beliefs implying false ones (Marcus, 1993; 1995). Newman's option points toward one of the most important solutions to the riddle of assent: assent is a kind of knowledge and it is an immediate consequence of our acquaintance with reality.

The other option I want to consider in order to cast a light on the topic is the late Wittgenstein's. Quite naturally, Wittgenstein's harsh criticism on his earlier views involves also the problem of belief, including assent. If in the *Tractatus* belief is knowledge and knowledge is a copy of states of things, then in his later books belief is part of the language game theory. In this late version, belief is understandable in terms of "certainty", assenting to propositions that we hold to be true. Using Kripke's (1982) reading of the late Wittgenstein, we could see this phase as Wittgenstein's answer to radical skepticism. In *On Certainty*, we can see an endless attempt to find a justification for our certainties or beliefs. Not finding any strong foundation for them, Wittgenstein stresses the role of rules and use as ways to keep beliefs in the usual contexts of our "language games" (Wittgenstein, 1969, 59e–62e). In this way, Wittgenstein's scheme of the problem of belief introduces the holistic view of language and context. In this sense, belief is a contextual convention.

These two answers represent two extreme solutions to the problem of assent and belief. In the first, assent is compelled by reality, and belief is "true knowledge" of reality. In the second, assent depends on the game we are playing, and there is no "true knowledge". Assent and belief are somehow dependent on the way we are played by the game or the way we play it, but in neither case is there a reality against which we can measure our beliefs. Eventually, there is a convention, through which we escape 'nonsense'.

In this paper, I will try to face the problems of assent by applying Peirce's semiotics. Peirce did not hold any specific and definite theory about assent. Nevertheless, in his writings, we can find scattered suggestions that can help us find the place of assent in the development of his epistemology. I will try to ascertain whether a Peircean way of looking at assent makes it possible to avoid the alternatives sketched above.

2. The threefold nature of assent

Peirce's scattered indications compel us to look at the many characteristics that a possible semiotic theory of assent could possess. The first clue that we have to take into account is exactly the lack of any definite theory about assent in Peirce's work. This is a surprising fact given that a considerable part of his corpus of manuscripts is dedicated to the normative sciences, a department distinguished by the presence of self-control, the characteristic that transforms a pure phenomenological view into a normative one. Why did Peirce not focus on the topic of assent, which intuitively is connected to self-control? Apparently, he denied this connection. So, what is assent according to Peirce?

Assent is that element of knowledge which makes a simple proposition into a judgment. A judgment is a proposition to which we assent.

> the problem of the day is needlessly complicated by the attention of most logicians, instead of extending to propositions in general, being confined to "judgments," or acts of mental acceptance of propositions, which not only involve characters, additional to those of propositions in general – characters required to differentiate them as propositions of a particular kind – but which further involve, beside the mental proposition itself, the peculiar act of assent. CP 2.309

But in itself assent is an act of the mind:

> an act of assent is an act of the mind by which one endeavors to impress the meanings of the proposition upon his disposition, so that it shall govern his conduct, including thought under conduct, this habit being ready to be broken in case reasons should appear for breaking it. Now in performing either of these acts [the other is "assertion"], the proposition is recognized as being a proposition whether the act be performed or not. CP 2.315

Here is the dilemma: either Peirce was considering assent only as a psychological act – in which case we have a psychological item at the very heart of the formation of judgment – or he was pointing out some peculiar feature of it that makes assent unquestionable. The first solution would lead us to the old psychological view (of which he accuses Sigwart [EP2:166, 169, 255]). It would be really strange if Peirce would not have noticed such an important theme as the presence of a psychological tool in the formation of judgment. We know, for instance, his extreme care in distinguishing among perceptions, percepts, and perceptual judgments when he acknowledged the presence of perception in reasoning. He was equally careful when he sought to explain interpretants. Why would he have ignored the importance of a psychological tool at the heart of judgment? Moreover, we know how systematically he denied any psychological foundation of logic, which he considered one of two important laws (the other being metaphysical realism) he had to teach (MS 633:4). It would be strange if he had overlooked this possible defense of the basic role of psychology in knowledge.

A more plausible explanation is that he did not see any problem in assent because he considered it not only as a psychological tool, but also as a part of something that he really analyzed. Namely, he viewed assent as a psychological act with a different core. What, then, are the other possible characteristics, beside the psychological one?

Being "a way to impress meaning upon conduct", assent seems to be part of the self-control we need in order to formulate any logical reasoning. Even as self-control is an act of will, Peirce specifies that such an act can only be the act of inference itself. Drawing an inference, we show self-control (EP 2:200). Any other explication involves a surrendering to a psychological view, namely a return to a static faculty of will that presides over reasoning. So, we should find assent within the actual functioning of reasoning. And we partially find it: when Peirce develops the theory of abductive reasoning, in which we have to assent to the working hypothesis that stems from the surprising phenomenon we are investigating in order to verify it, he attributes this acceptance or assent to the guiding principles stemming from esthetics and ethics.[2] When Kepler hypothesized the elliptic curve of the trajectory of planets, he first assented to his theory because it fitted an admirable order (esthetics) in a plausible way (ethics). This second ethical move is the one in which the hypothesis becomes actual, and in this sense assent is the moment in which ethics enters into our reasoning.[3] So, a second basic characteristic of assent is its ethical function in forming self-controlled reasoning.

However, I do not think that we have explained everything by saying that assent is partly a psychological tool and partly an ethical decision. There is a third aspect of assent, well covered by Peirce's analyses: its semiotic structure. From this standpoint, assent is something in which Peirce was always interested: holding a belief as true. In this way the problem of assent can be located within the very Peircean question of fixing a belief.[4]

Peirce explains the difference between the psychological and the semiotic analysis of the phenomenon of assent also in the famous 1902 Carnegie Application, where he writes:

> The German word *Urtheil* confounds the proposition itself with the psychological act of assenting to it. This confusion is a part of the general refusal of idealism, which still considerably affects almost all German thought, to acknowledge that is one thing to *be* and quite another to *be presented*. I use the word *belief* to express any kind of holding for true or acceptance of a representation. NEM 4:39

[2] For this reconstruction of the abductive pattern see Maddalena (2005, 2009, pp. 57–96).

[3] I thank V. Colapietro, who pointed out this very important topic during the oral presentation of this paper in Helsinki on June 13, 2007. As for the impact of ethics in Peirce's account of reasoning, see EP 2:196–205, 253–5.

[4] See the paper on "The fixation of belief" in *Popular Science Monthly* 12 (1877, pp. 1–15), CP 5.358–87 and W 3:242–56, which Peirce tried to re-publish with the Open Court in 1909–1911 (cf. MSS 618–40).

Here, Peirce cautiously distinguishes between what belongs to logic and what belongs to psychology. But this "holding for true or acceptance of a representation" also has a semiotic feature, since "all thinking is conducted in signs" (MS 200:43). Consequently, assent can be analyzed according to three main aspects: psychological, ethical, and semiotic. I will focus now on the third element, which will give us a sort of basic grammar for the syntax of assent that ethics and psychology will complete dynamically.

3. The semiotic grammar of assent

What is assent or acceptance from a purely semiotic point of view? In Peirce's work, semiotic assent is always connected to the study of "interpretants". For instance, let us take a definition from 1866:

> Now that which, thus, appeals to an interpretant – that is so constructed and intended so as to develop a restatement on the part of another or assent – is an argument, a syllogism minus the conclusion, for the Conclusion of a syllogism is no part of the argument but is the assent to it, the interpretant. W 1:477

Other passages from different years (1891, 1907, 1908, 1911) show the consistency of Peirce's thought on this topic; he always pointed out that assent is connected to the final part of the development of signs and reasoning.[5] If we look at our experience, we will see that assent is at play in that part of our reasoning that many years later Peirce will call "a sense of apprehending the meaning" (EP 2:430). Assent is the moment at which we start holding a belief or a representation as true, a moment at which ethical and psychological will are at stake too, even though they alone cannot account for our experience. When a hypothesis comes to our mind, we feel it is the right one; we see its plausibility in relation to everything else we know and do, and we start considering it as true. This third part is the

[5] "[P]erception attains a virtual judgment, it subsumes something under a class, and not only so, but virtually attaches to the proposition the seal of assent – two strong resemblances to inference which are wanting in ordinary suggestions" (CP 8.66 [1891]). "I begin by arguing that a concept is a mental sign, that all our deliberations within ourselves take a dialogical form, the ego of one instant appealing to the ego of the next instant for reasonable assent" (April 10, 1907, Letter to Papini [Max Fisch's Folder on Papini at the Peirce Edition Project, Indiana and Purdue University at Indianapolis]). "The next point is that all thinking is a dialogue in form. Your self of one instant appeals to your deeper self for his assent. Consequently all thinking is conducted in signs" (MS 200:43 [1908]). "By Reasoning shall here be meant any change in thought that results in an appeal for some measure and kind of assent to the truth of a proposition called the Conclusion of the Reasoning" (EP 2:454 [1911]).

logical one; in Peirce's terms, assent is thus a semiotic problem tied to the interpretant.

What does it mean to be an interpretant? Peirce gave many definitions of it. I will pick up one of them from a 1908 letter to Lady Welby:

> I define a Sign as anything which on the one hand is so determined by an Object and on the other hand so determines an idea in a person's mind, that this latter determination, which I term the Interpretant of the Sign is thereby mediately determined by that Object. EP 2:484

The interpretant is the outcome of the sign in a determination of the interpreter's mind (including all non-human minds). But Peirce was not satisfied with a simple definition, and between 1904 and 1906 he struggled to find a subdivision capable of explaining any possible kind of interpretant (see MS 339 c–d; MS 499). He proposed many trichotomies in order to understand the problem better. Peirce scholars have argued about the number and the names of interpretants, but I will not enter this discussion.[6] Here, I will assume that there are only three interpretants, so that there is a substantial agreement (even though there is a difference of perspective not relevant for our topic) between immediate, dynamic, and final interpretant on the one hand, and emotional, energetic, and logical interpretant on the other. For our aim, let us recall here one of the definitions, taken from "Pragmatism" (1907), which gives the horizon of the interpretant's functions:

> In all cases, it [the interpretant] includes feelings; for there must, at least, be a sense of comprehending the meaning of a sign. If it includes more than mere feeling, it must evoke some kind of effort. It may include something besides, which, for the present, may be vaguely called "thought". I term these three kinds of interpretant the "emotional", the "energetic", and the "logical" interpretants. EP 2:409

Setting aside any discussion on the third interpretant, which Peirce identifies in the same paper as a habit of action, I will focus on the first two, because there we can find that apprehension of signs that we pinned down as the characteristic, semiotic experience of assent. When Peirce compares kinds of objects with kinds of interpretants, he finds in the immediate interpretant exactly what we are looking for:

[6] This interesting debate can be followed through the *Transactions of the Charles S. Peirce Society* in articles by T. L. Short (1981; 1982; 1996) and J. J. Liszka (1990). See also Short (2007, pp. 180–190).

> In point of fact, we do find that the immediate object and the emotional interpretant correspond, both being apprehensions, or are "subjective"; both, too, appertain to all signs without exception.
> EP 2:410

But this explanation would work for assent only partially because it does not leave room for dissent, a necessary alternative implied in any "holding for true" from a logical point of view.[7] An immediate interpretant is unavoidable; it is the interpretability that any sign has.

> My Immediate Interpretant is implied in the fact that each sign must have its peculiar Interpretability before it gets any Interpreter.
>
> The Immediate Interpretant is an abstraction, consisting in a Possibility. The Dynamical Interpretant is a single actual event. The Final Interpretant is that toward which the actual tends. SS 111

Even in the Immediate Interpretant, there is some possibility of denial, as Peirce seems to indicate when he says:

> I might describe my Immediate Interpretation, as so much of the effect of the Sign would enable a person to say whether or not the Sign was applicable to anything concerning which that person had sufficient acquaintance. SS 110

But this possibility of denial is limited, since it is overwhelmed by the fact that any sign has "its peculiar Interpretability" that is undeniable. If we want to find the possibility of dissent, of not accepting a representation and going beyond the application of representation to something we are acquainted with, we have to turn our attention to the dynamical interpretant which warrants the reference to the world of facts exterior to the sign itself.[8]

> The Immediate Interpretant is the Interpretant as Represented in the sign as a determination of the sign to what the sign appeals. The dynamic interpretant is the determination of a field of representation exterior to the sign (such a field is an interpreter's consciousness) which determination is affected by the sign. MS 339c:504

[7] I thank A. De Tienne for this important remark.

[8] According to Peirce, propositions can only express "facts" while a wider knowledge of reality is bound to what he calls "occurrences" or "slices" of reality in its infinite richness of objects and events. Facts are the part of occurrences that has been codified in a system of signs. For the distinction between occurrences and facts, and the connection between facts and propositions, see MSS 647–8.

We do not assent to a representation when it is a call for acknowledgment, but when it fixes the reference to the context within which the sign is meaningful. So, Peirce could say that the conclusion of a proposition requires assent because we can affirm or deny something as a conclusion of previous facts only if we understand the field of representation the conclusion will refer to.

The dynamic interpretant is an evolution of the immediate interpretant understood as interpretability (MS 339c:510; SS 108–19), but it has a specific nature which better corresponds to the characteristics we are looking for. The reference to "consciousness" confirms the peculiar assenting/dissenting function of the dynamic interpretant: only in consciousness can we find the dichotomic possibility of "true" and "false".[9]

If the dynamic interpretant constitutes the semiotic, fundamental characteristic of assent, let us also consider the classification of signs that it implies. In Peirce's late classification of signs, there are two trichotomies related to the dynamic interpretant. In 1908, he classifies the sign according to the "nature of the dynamic interpretant" as "sympathetic, shocking, usual", and according to the "appeal to the dynamic interpretant" as "suggestive, imperative, indicative" (EP 2:483–91). It is worth noting that this second triad was used in some of Peirce's previous classifications to indicate the immediate interpretant, while the classification according to the "nature of the dynamic interpretant" included "feeling, conduct, thought" (MS 339c:504). My assumption is that this change occurred because Peirce acknowledged our possible refusal of a representation, so that the suggestive power had to be used in reference to the dynamic interpretant rather than to the immediate one.

In any representation, there is a level at which we can either accept ("hold it for true") or refuse the representation itself. In a figurative way, any representation is an answer to a suggestion that comes from reality. More precisely, assent is the level at which we confirm a selection of something within the infinite richness of occurrences, reading it as "fact" – namely, accepting to hold it as true.[10] In any representation, this answer is a semiotic element, which warrants the unity of a proposition, and which precedes the ethical and psychological stages. Confirming this interpretation, Peirce says that the unity of judgment does not depend on the "Ich denke" as Kant maintained, but on an answer to a question that reality is always asking us: "don't you think so?" (MS 636:24–26).

[9] Peirce often describes consciousness as a dialogue between ego and non-ego (EP 2:154).

[10] See footnote 7 above.

4. Assent and belief: an answer to Newman and Wittgenstein

Two questions remain: What is the role of assent in belief? And what is the alternative this kind of reading of assent provides to those proposed by Newman and Wittgenstein? I pointed out that assent has a semiotic heart that accounts for that "holding for true" that is the gnoseological aspect of any belief. Semiotically speaking, this aspect is analyzable in terms of interpretants, in particular in terms of dynamic interpretants. Therefore, the role of assent in belief is the acceptance of a representation as part of a determined context. Any sign or representation appeals[11] to our acknowledgment, and we are called to accept it or refuse it when it determines a field of interpretation, not when it is an undetermined possibility.

An experiential reading of this interpretation is provided by Peirce's late attempts to show that interpretants, basic elements of our semiotic grammar of assent, correspond to the degrees of clearness of an idea as described in the 1878 paper "How to Make our Ideas Clear" and in the 1897 paper "The Logic of Relatives": the degrees of familiarity, logical definition, and pragmatic rule (EP 1:124–36; CP 3.457). These attempts are not always consistent, but they show the direction of Peirce's work. In some letters to James written in 1909, Peirce maps interpretants on Lady Welby's trichotomy of "sense, meaning and significance", and the latter on the degrees of clearness. The mapping of immediate and dynamic interpretant varies.[12] However, it is worth noting that Peirce wants to foster this comparison:

> In the second part of my Essay on Pragmatism, in the Popular Science of November 1877 and January 1878, I made three degrees of Clearness of Interpretation. The First was such a Familiarity as gave a person familiarity with a sign and readiness in using it or interpreting it. In his consciousness he seemed to himself quite at home with the sign. In short, it is Interpretation in Feeling. The second was Logical Analysis = Lady Welby's Sense. The third was Pragmaticistic Analysis [and] would seem to be a Dynamical Analysis but is identified with the Final Interpretant. EP 2:496–7

If Peirce was right in attempting to map interpretants on degrees of clearness of ideas, the result is that assent, whose semiotic key element is

[11] The topic of "appeal" should be studied in another paper.

[12] On February 26, he indicates that "significance" is comparable to "final interpretant", "meaning" to "immediate interpretant" and "sense" to "logical analysis" or "dynamic interpretant". On March 14, he compares "sense" to "impression" and "meaning" to "purpose" (EP 2:496–500).

the dynamic interpretant, is part of the second degree: the degree of logical analysis or definition. Again, the stage of definition is the one in which occurrences that are undetermined become determinate as facts; it is the stage in which we are free to answer "yes" or "no" to reality, accepting or refusing its transformation in definite propositions.

If I am right, we have to understand assent as part of a development, in which there would be a third and a fourth degree corresponding to the "pragmaticistic analysis" in which belief is a habit completely formed – or, as Peirce sometimes puts it, an experiment (MS 318:172) – and to "concrete reasonableness" that Peirce considered to be the "admirable ideal" to which our knowledge tends (CP 5.3–4).

Now, we can try to read Newman's and Wittgenstein's proposals about assent, certainty, and belief in the light of Peirce's insight. Newman stresses the distinction between real and formal assent, focusing on the difference between real and formal apprehension of reality. Peirce's understanding agrees as far as understanding assent as a form of apprehension, at least in one of its main characteristics, the one I described as semiotic or logical. But his semiotic analysis allows him to overcome the Lockean ground of Newman's theory. There is no real apprehension of the singular or formal apprehension of the general. Peirce shows that our commonsensical perception of degrees of belief is related to evolving degrees of representation, analyzable as different kinds of interpretants. Peirce's semiotic view covers the difference between real and formal assent that Newman identified, but it explains it better as degrees of semiotic response to reality and, accordingly, as degrees of clearness of ideas. Formal assent and apprehension can be interpreted as second degrees of clearness of ideas, namely, from the semiotic grammar standpoint, as a dynamic interpretant that has not yet been transformed into a third, "pragmaticistic" kind of representation. In other words, when we assent we begin to know, but we do not know completely. We know, because we answered "yes" to the question that reality asked us, but our knowledge is still partial, because we have not yet tested the proposition that we accepted. So, we can say we have a certain kind of knowledge because we know a definition, but we do not know as well as those who have already tested that definition. If knowledge stopped at the definition, it would be a formal apprehension, that is, a knowledge in which we stop the development of signs and, consequently, of belief. So, formal assent is not due to the generality of apprehension, but to an insufficient understanding of the infinity of inquiry. According to Newman, knowledge fails when it is pushed beyond the singular object, and according to Peirce, knowledge fails when it is not general enough, namely when it does not reach the true object we will have at the end of inquiry.

In the same way, a Peirce-driven theory of assent can answer Wittgenstein's concern about the justification of beliefs. "Use" and "rules" are not the only possible justifications. According to my interpretation, "rules" are dynamic interpretants, and "use" is close to the immediate interpretant and to the degree of familiarity of ideas. "Use", understood as familiarity, is the weakest degree of clearness of ideas and belief; here, our meanings and our beliefs are vague or undetermined even when they are strong. As for "rules", if they are the way in which we grant meaning, as in Kripke's reading of Wittgenstein, then they can only permit a formal assent or a standard belief not verified by further tests. Peirce's understanding of assent and belief tells us that the second stage, the one in which we find the dynamic interpretant, definition, and rules, is a necessary step in a broader development of representation. If we do not stop there, we will test our beliefs until the point at which they will turn out to be "true". The real justification of our beliefs is not their familiar use or their being structured by rules, but the possibility to verify them.

The semiotic view encompasses the insights of the two approaches we identified as accounts of assent based on apprehension of reality and conventional agreement. In a Peirce-driven explanation, we can embrace both the need for the relationship with reality, expressed by Newman's view, and the nuanced, not self-evident justification of beliefs, stated by Wittgenstein. At the same time, the semiotic explanation proposes a view of the relationship with reality that permits logical degrees as well as a two-valued logic. It justifies beliefs, not by turning to an *a priori* reality or truth, but by appeal to an *a posteriori* foundation of reality through tests. This is one of the richest heritages that pragmatism has left in our culture.

References

De Tienne, A. (2009). "Prefazione." In G. Maddalena, *Metafisica per assurdo*. Soveria Manelli: Rubbettino.

Engel, P. (1999). "Dispositional Belief, Assent, and Acceptance." *Dialectica*, 53, 211–226.

Kripke, S. (1982). *Wittgenstein on Rules and Private Language*. Oxford: Blackwell.

Lizska, J. J. (1990). "Peirce's Interpretants." *Transactions of the Charles S. Peirce Society*, XXVI(1), 17–62.

Maddalena, G. (2005). "Abduction and Metaphysical Realism." *Semiotica* 153 1/4, 243–259.

Maddalena, G. (2009). *Metafisica Per Assurdo.* Soveria Manelli: Rubbettino.

Marcus, R. B. (1981). "A Proposed Solution to a Puzzle about Belief." *Midwest Studies in Philosophy*, VI, 501–510.

Marcus, R. B. (1986). "Some Revisionary Proposals about Belief and Believing." *Philosophy and Phenomenological Research*, L, 133–153.

Marcus, R. B. (1993). *Modalities*. Oxford: Oxford University Press.

Marcus, R. B. (1995). "The Anti-naturalism of Some Language-centered Accounts of Belief." *Dialectica*, 49, 113–129.

Newman, J. H. (1973). *An Essay in Aid of a Grammar of Assent*. Westminster: Christian Classics Inc.

Short, T. L. (1981). "Semeiosis and Intentionality." *Transactions of the Charles S. Peirce Society*, XVII(3), 197–223.

Short, T. L. (1982). "Life among the Legisigns." *Transactions of the Charles S. Peirce Society*, XVIII(4), 285–310.

Short, T. L. (1996). "Interpreting Peirce's Interpretant: A Response to Lalor, Liszka, and Meyers." *Transactions of the Charles S. Peirce Society*, XXXII(4), 488–541.

Short, T. L. (2007). *Peirce's Theory of Signs.* Cambridge: Cambridge University Press.

Wittgenstein, L. (1967). *Philosophical Investigations.* Oxford: Basil Blackwell.

Wittgenstein, L. (1969). *On Certainty*. Oxford: Basil Blackwell.

Mindless Abduction: From Animal Guesses to Artifactual Mediators

Lorenzo Magnani
University of Pavia

1. Introduction

Many animals – traditionally considered 'mindless' organisms – make up a series of signs and are engaged in making, manifesting or reacting to a series of signs: through this semiotic activity – which is fundamentally *model-based* – they are at the same time engaged in "being cognitive agents" and therefore in thinking intelligently.[1] An important effect of this semiotic activity is a continuous process of 'hypothesis generation' that can be seen at the level of both instinctual behavior, as a kind of 'wired' cognition, and representation-oriented behavior, where nonlinguistic pseudothoughts drive a plastic model-based cognitive role. This activity is at the root of a variety of *abductive* performances. Another important character of the model-based cognitive activity is the externalization of artifacts that play the role of mediators in animal languageless reflexive thinking. The interplay between internal and external representations exhibits a new cognitive perspective on the mechanisms underlying the semiotic emergence of abductive processes in important areas of model-based thinking of 'mindless' organisms. A considerable part of abductive cognition occurs through an activity consisting in a kind of reification in the external environment and a subsequent re-projection and reinterpretation through new configurations of neural networks, and of their chemical processes. Anal-

[1] The term "model-based reasoning" is used to indicate the construction and manipulation of various kinds of representations, not mainly sentential and/or formal, but mental and/or related to external mediators and to the exploitation of internalized models of diagrams, pictures, etc. (cf. Magnani, 2009).

ysis of the central problems of abduction and hypothesis generation helps to address the problems of other related topics in model-based reasoning, like pseudological and reflexive thinking and the role of pseudoexplanatory guesses in plastic cognition.

2. 'Mindless' organisms and cognition

Philosophy has for a long time disregarded the ways of thinking and knowing of animals, traditionally considered 'mindless' organisms. Peircean insight regarding the role of abduction in animals was a good starting point, but only more recent results in the fields of cognitive science and ethology about animals, and of developmental psychology and cognitive archeology about humans and infants, have provided the actual intellectual awareness of the importance of the comparative studies.

Philosophy has anthropocentrically condemned itself to partial results when reflecting upon human cognition because it has lacked in appreciation of the more 'animal-like' aspects of thinking and feeling, which are certainly in operation and are greatly important in human behavior. Also in ethical inquiry a better understanding of animal cognition could in turn increase knowledge about some hidden aspects of human behavior, which I think still evade any ethical account and awareness.

In *Morality in a Technological World* (Magnani, 2007a), I maintain that people have to learn to be 'respected' as things sometimes are. Various kinds of 'things', and among them work of arts, institutions, symbols, and of course animals, are now endowed with intrinsic moral worth. Animals are certainly morally respected in many ways in our technological societies, but certain knowledge about them has been disregarded. It is still difficult to acknowledge respect for their cognitive skills and endowments. Would our having more knowledge about animals happen to coincide with having more knowledge about humans and infants, and be linked to the suppression of constitutive 'anthropomorphism' in treating and studying them that we have inherited through tradition? Consequently, would not novel and unexpected achievements in this field be a fresh chance to grant new 'values' to humans and discover new knowledge regarding their cognitive features? (Gruen, 2002). Darwin has already noted that studying cognitive capacities in humans and non-humans animals "possesses, also, some independent interest, as an attempt to see how far the study of the lower animals throws light on one of the highest psychical faculties of man" – the moral sense (Darwin, 1981).

Among scientists it is of course Darwin who first clearly captured the idea of an "inner life" (the "world of perception" included) in some humble earthworms. A kind of mental life can be hypothesized in many organisms: Darwin wanted "to learn how far the worms acted consciously and how much mental power they displayed" (Darwin, 1985). He found levels of "mind " where it was not presumed to exist. It can be said that this new idea, which bridges the gap between humans and other animals, in some sense furnishes a scientific support to that metaphysical synechism claimed by Peirce contending that matter and mind are intertwined and in some sense indistinguishable.[2]

2.1 Worm intelligence, abductive chickens, instincts

Let us consider the behavior of very simple creatures. Earthworms plug the opening of their burrow with leaves and petioles: Darwin recognized that behavior as being too regular to be random and at the same time too variable to be merely instinctive. He concluded that, even if the worms were innately inclined to construct protective basket structures, they also had a capacity to "judge" based on their tactile sense and showed "some degree of intelligence". Instinct alone would not explain how worms actually handle leaves to be put into the burrow. This behavior seemed more similar to their "having acquired the habit" (Darwin, 1985). Crist says: "Darwin realized that 'worm intelligence' would be an oxymoron for skeptics and even from a commonsense viewpoint 'This will strike everyone as very improbable' he wrote (Darwin, 1985). [...] He noted that little is known about the nervous system of 'lower animals', implying they might possess more cognitive potential than generally assumed" (Crist, 2002).

It is important to note that Darwin also paid great attention to those external structures built by worms and engineered for utility, comfort, and security. I will describe later on in this article the cognitive role of artifacts in both human and non-human animals: artifacts can be illustrated as *cognitive mediators* (Magnani, 2001) which are the building blocks that bring into existence what it is now called a "cognitive niche":[3] Darwin maintains that "We thus see that burrows are not mere excavations, but may rather be compared with tunnels lined with cement" (Darwin, 1985). Like

[2] The recent discovery of the cognitive roles (basically in the case of learning and memory) played by spinal cord further supports this conviction that mind is extended and distributed and that it can also be – so to say – "brainless" (Grau, 2002).

[3] A concept introduced by Tooby and DeVore (1987) and later on reused by Pinker (1997, 2003).

humans, worms build external artifacts endowed with precise roles and functions, which strongly affect their lives in various ways, and of course their opportunity to 'know' the environment.

I have said their behavior cannot be accounted for in merely instinctual terms. Indeed, the "variability" of their behavior is for example illustrated by the precautionary capacity of worms to exploit pine needles by bending over pointed ends: "Had this not effectually been done, the sharp points could have prevented the retreat of the worms into their burrows; and these structures would have resembled traps armed with converging points of wire rendering the ingress of an animal easy and its egress difficult or impossible" (Darwin, 1985). Cognitive *plasticity* is clearly demonstrated by the fact that Darwin detected that pine was not a native tree! If we cannot say that worms are aware like we are (consciousness is unlikely even among vertebrates), certainly we can acknowledge in this case a form of material, interactive, and embodied manifestation of awareness in the world.

Recent research has also demonstrated the existence of developmental plasticity in plants. For example developing tissues and organs "inform" the plant about their states and respond according to the signals and substrates they receive. The plant adjusts structurally and physiologically to its own development and to the habitat it happens to be in (for example a plasticity of organs in the relations between neighboring plants can be developed) (Sachs, 2002; Grime and Mackey, 2002).

In this article I am interested in improving knowledge on abduction and model-based thinking. By way of introduction let me quote the interesting Peircean passage about hypothesis selection and chickens, which touches on both ideas, showing a kind of completely language-free, model-based abduction:

> How was it that man was ever led to entertain that true theory? You cannot say that it happened by chance, because the possible theories, if not strictly innumerable, at any rate exceed a trillion – or the third power of a million; and therefore the chances are too overwhelmingly against the single true theory in the twenty or thirty thousand years during which man has been a thinking animal, ever having come into any man's head. Besides, you cannot seriously think that every little chicken, that is hatched, has to rummage through all possible theories until it lights upon the good idea of picking up something and eating it. On the contrary, you think the chicken has an innate idea of doing this; that is to say, that it can think of this, but has no faculty of thinking anything else. The chicken you say pecks by instinct. But if you are

> going to think every poor chicken endowed with an innate tendency toward a positive truth, why should you think that to man alone this gift is denied? CP 5.591 [1903]

and again, even more clearly, in another related passage

> When a chicken first emerges from the shell, it does not try fifty random ways of appeasing its hunger, but within five minutes is picking up food, choosing as it picks, and picking what it aims to pick. That is not reasoning, because it is not done deliberately; but in every respect but that, it is just like abductive inference. MS [1901][4]

From this Peircean perspective hypothesis generation is a largely instinctual and *nonlinguistic* endowment of human beings and, of course, also of animals.[5] It is clear that for Peirce abduction is rooted in the instinct and that many basically instinctual-rooted cognitive performances, like emotions, provide examples of abduction available to both human and non-human animals. Also cognitive archeology (Mithen, 1996; Donald, 2001) acknowledges that it was not language that made cognition possible: rather it rendered possible the integration in social environments of preexistent, separated, domain-specific modules in prelinguistic hominids, like complex motor skills learnt by imitation or created independently for the first time (Bermúdez, 2003). This integration made the emergence of tool making possible through the process of "disembodiment of mind" that I recently illustrated in (Magnani, 2006). Integration also seeks out established policies, rituals, and complicated forms of social cognition, which are related to the other forms of prevalently nonlinguistic cognitive behaviors.

[4] See the article "The proper treatment of hypotheses: a preliminary chapter, toward and examination of Hume's argument against miracles, in its logic and in its history" (MS 692 [1901]).

[5] It can be hypothesized that some language-free, more or less stable, *representational* states that are merely model-based are present in animals, early hominids, and human infants. Of course tropistic and classically conditioned schemes can be accounted for without reference to these kinds of model-based "representations", because in these cases the response is invariant once the creature in question has registered the relevant stimuli. The problem of attributing to those beings strictly nonlinguistic model-based inner "thoughts", beliefs, and desires, and thus suitable ways of representing the world, and of comparing them to language-oriented mixed (both model-based and sentential) representations, typical of modern adult humans, appears to be fundamental to comprehending the status of animal presumptive abductive performances. The problem of nonlinguistic endowments of human beings and animals is strictly related to the relationship between iconicity and logicality in reasoning and to the contrast between the instinct and heuristic strategies, I have treated in detail in the first two sections of chapter five of my recent book (Magnani, 2009).

2.2 Nonlinguistic representational states

It can be hypothesized that some language-free, more or less stable, *representational* states that are merely model-based[6] are present in animals, early hominids, and human infants. Of course tropistic and classically conditioned schemes can be accounted for without reference to these kinds of model-based 'representations', because in these cases the response is invariant once the creature in question has registered the relevant stimuli.

The problem of attributing to those beings strictly nonlinguistic model-based inner 'thoughts', beliefs, and desires, and thus suitable ways of representing the world, and of comparing them to language-oriented mixed (both model-based and sentential) representations, typical of modern adult humans, appears to be fundamental to comprehending the status of animal presumptive abductive performances.

Of course this issue recalls the traditional epistemological Kuhnian question of the incommensurability of meaning (Kuhn, 1962). In this case it refers to the possibility of comparing cognitive attitudes in different biological species, which express potentially incomparable meanings. Such problems already arose when dealing with the interpretation of primitive culture. If we admit, together with some ethologists, animal behaviorists, and developmental psychologists, that in nonlinguistic organisms there are some intermediate representations, it is still difficult to make an analogy with those found in adult humans. The anthropologists who carried out the first structured research on human primitive cultures and languages already stressed this point, because it is difficult to circumstantiate thoughts that can hold in beings but only manifest themselves in superficial and external conducts (cf. Quine, 1960).

A similar puzzling incommensurability already arises when we deal with the different sensorial modalities of certain species and their ways of being and of feeling to be in the world. We cannot put ourselves in the living situation of a dolphin, which lives and feels by using echolocations, or of our cat, which 'sees' differently, and it is difficult to put forward scientific hypotheses on these features using human-biased language, perceptive capacities, and cognitive representations.[7] The problem of the existence of 'representation states' is deeply epistemological: the analogous

[6] They do not have to be taken like, for example, visual and spatial imagery or other internal model-based states typical of modern adult humans, but more like action-related representations and thus intrinsically intertwined with perception and kinesthetic abilities. Saidel (2002) interestingly studies the role of these kinds of representations in rats.

[7] On this subject cf. also the classical (Nagel, 1974).

situation in science concerns for example the status of the so-called theoretical terms, like quarks or electrons, which are not directly observable but still 'real', reliable, and consistent when meaningfully legitimated/justified by their epistemological unavoidability in suitable scientific research programs (Lakatos, 1970).

I have already said that commitment to research on animal cognition is rare in human beings. Unfortunately, even when interested in animal cognition, human adult researchers, victims of an uncontrolled, 'biocentric' anthropomorphic attitude, always risk attributing to animals (and of course infants) their own concepts and thus misunderstanding their specific cognitive skills (Rivas and Burghardt, 2002).

3. Animal abduction

3.1 "Wired cognition" and pseudothoughts

Nature writes programs for cognitive behavior in many ways. In certain cases these programs draw on cognitive functions and sometimes they do not. In the latter case the fact that we describe the behavioral effect as 'cognitive' is just a metaphor. This is a case of *instinctual* behavior, which we should more properly name 'wired cognition' (or hard-wired cognition).

Peirce spoke – already over a century ago – of a wide semiotic perspective, which taught us that a human internal representational medium is not necessarily structured like a language. In this article I plan to develop and broaden this perspective. Of course this conviction strongly diverges from that maintained by the intellectual traditions which resort to the insight provided by the modern Fregean logical perspective, in which thoughts are just considered the "senses of sentences". Recent views on cognition are still influenced by this narrow logical perspective, and further stress the importance of an isomorphism between thoughts and language sentences (cf. for example Fodor's theory (Fodor, 1987)).

Bermúdez clearly explains how this perspective also affected the so-called *minimalist view* on animal cognition (also called *deflationary view*) (Bermúdez, 2003). We can describe nonlinguistic creatures as thinkers and capable of goal-directed actions, but we need to avoid assigning to them the type of thinking common to linguistic creatures, for example in terms of belief-desire psychology: "Nonlinguistic thinking does not involve propositional attitudes – and, a fortiori, psychological explanation at the nonlinguistic level is not a variant of belief-desire psychology" (ibid.). Belief-desire framework should only be related to linguistic creatures. Instead, the problem for the researcher on animal cognition would be to detect how a kind of what we can call "general belief" is formed, rather than concentrating on its content, as we would in the light of human linguistic tools.

Many forms of thinking, such as imagistic, empathetic, trial and error, and analogical reasoning, and cognitive activities performed through complex bodily skills, appear to be basically model-based and manipulative. They are usually described in terms of living beings that adjust themselves to the environment rather than in terms of beings that acquire information from the environment. In this sense these kinds of thinking would produce responses that do not seem to involve sentential aspects but rather merely "non-inferential" ways of cognition. If we adopt the semiotic perspective above, which does not reduce the term "inference" to its sentential level, but which includes the whole arena of sign activity – in the light of Peircean tradition – these kinds of thinking promptly appear full, inferential forms of thought. Let me recall that Peirce stated that all thinking is in signs, and signs can be icons, indices, or symbols, and, moreover, all *inference* is a form of sign activity, where the word sign includes "feeling, image, conception, and other representation" (CP 5.283).

From this perspective human and the most part of non-human animals possess what I have called *semiotic brains* (Magnani, 2007b), which make up a series of signs and which are engaged in making or manifesting or reacting to a series of signs: through this semiotic activity they are at the same time occasionally engaged in 'being cognitive agents' (like in the case of human beings) or at least in thinking intelligently. For example, spatial imaging and analogies based on perceiving similarities – fundamentally context-dependent and circumstantiated – are ways of thinking in which the 'sign activity' is of a nonlinguistic sort, and it is founded on various kinds of implicit naïve physical, biological, psychological, social, etc., forms of intelligibility. In scientific experimentation on prelinguistic infants a common result is the detection of completely language-free working ontologies, which only later on, during cognitive development, will become intertwined with the effect of language and other 'symbolic' ways of thinking.

With the aim of describing the kinds of representations which would be at work in these nonlinguistic cognitive processes Dummett (1993) proposes the term *protothought*. I would prefer to use the term *pseudothought*, to minimize the hierarchical effect that – ethnocentrically – already affected some aspects of the seminal work on primitives of an author like Lévi-

Bruhl (1923). An example of the function of model-based pseudothoughts can be hypothesized in the perception of space in the case of both human and non-human animals. The perceived space is not necessarily three-dimensional and merely involves the apprehension of movement changes, and the rough properties of material objects. Dummett (1993) illustrates the case of the car driver and of the canoeist:

> A car driver or canoeist may have to estimate the speed and direction of oncoming cars and boats and their probable trajectory, consider what avoiding action to take, and so on: it is natural to say that he is highly concentrated in thought. But the vehicle of such thoughts is certainly not language: it would be said, I think, to consist in visual imagination superimposed on the visual perceived scene. It is not just that these thoughts are not in fact framed in words: it is that they do not have the structure of verbally expressed thoughts. But they deserve the name of "protothoughts" because while it would be ponderous to speak of truth or falsity in application to them, they are intrinsically connected with the possibility of their being mistaken: judgment, in a non-technical sense, is just what the driver and the canoeist need to exercise. Dummett, 1993, p. 122

3.2. Plastic cognition in organisms' pseudoexplanatory guesses

To better understand what the study of nonlinguistic creatures teaches us about model-based and manipulative abduction (and go beyond Peirce's insights on chickens' 'wired' *abductive* abilities), it is necessary to acknowledge the fact that it is difficult to attribute many of their thinking performances to innate releasing processes, trial and error or to a mere reinforcement learning, which do not involve complicated and more stable internal representations.

Fleeting and evanescent (not merely reflex-based) pseudorepresentations are needed to account for many animal 'communication' performances even at the level of the calls of "the humble and much-maligned chicken", like Evans says:

> We conclude that chicken calls produce effects by evoking representations of a class of eliciting events [food, predators, and presence of the appropriate receiver]. This finding should contribute to resolution of the debate about the meaning of referential signals. We can now confidently reject reflexive models, those that postulate only behavioral referents, and those that view referential signals as imperative. The humble and much maligned chicken thus has a remarkably sophisticated system. Its calls denote at least three classes of external objects.

> They are not involuntary exclamations, but are produced under particular social circumstances. Evans, 2002

In sum, in nonlinguistics animals, a higher degree of abductive abilities has to be acknowledged: chicken form separate representations faced with different events and they are affected by prior experience (of food, for example). They are mainly due to internally developed plastic capacities to react to the environment, and can be thought of as the fruit of learning. In general this plasticity is often accompanied by the suitable reification of external artificial 'pseudorepresentations' (for example landmarks, alarm calls, urine-marks and roars, etc.) which artificially modify the environment, and/or by the referral to externalities already endowed with delegated cognitive values, made by the animals themselves or provided by humans.

The following is an example of not merely reflex-based cognition and it is fruit of plasticity: a mouse in a research lab perceives not simply the lever but the fact that the action on it affords the chance of having food; the mouse 'desires' the goal (food) and consequently acts in the appropriate way. This is not the fruit of innate and instinctual mechanisms, merely a trial and error routine, or brute reinforcement learning able to provide the correct (and direct) abductive appraisal of the given environmental situation. Instead it can be better described as the fruit of learnt and flexible *thinking* devices, which are not merely fixed and stimulus driven but also involve 'thought'. 'Pseudothought' – I have already said – is a better term to use, resorting to the formation of internal structured representations and various – possibly new – links between them. The mouse also takes advantage in its environment of an external device, the lever, which the humans have endowed with a fundamental predominant cognitive value, which can afford the animal: the mouse is able to cognitively pick up this externality, and to embody it in internal, useful representations.

Another example of plastic cognition comes from the animal activity of reshaping the environment through its mapping by means of seed caches:

> Consider, for example, a bird returning to a stored cache of seeds. It is known from both ethological studies and laboratory experiments that species such as chickadees and marsh tits are capable of hiding extraordinary number of seeds in a range of different hiding places and then retrieving them after considerable periods of time have elapsed.
> Sherry, 1988 (quoted in Bermúdez, 2003)

It is also likely to hypothesize that this behavior is governed by the combination of a motivational state (a general desire for food) and a memory of the particular location, and how to get to it.[8] The possibility of performing such behavior is based on structured internal pseudorepresentations originating from the previous interplay between internal and external signs suitably picked up from the environment in a step-by-step procedure.

To summarize, in these cases we are no longer observing the simple situation of the Peircean, picking chicken, which "has an innate idea of doing this; that is to say, that it can think of this, but has no faculty of thinking anything else". This "cognitive" behavior is the one already described by the minimalist contention that there is no need to specify any kind of internal content. It is minimally – here and now and immediately related to action – goal-directed, mechanistic, and not "psychological" in any sense, even in a metaphorical one, as we use the term in the case of animals (Bermúdez, 2003).

On the contrary, the birds in the example above have at their disposal flexible ways of reacting to events and evidence, which are explainable only in terms of a kind of thinking 'something else', to use the Peircean words, beyond mere mechanistic pre-wired responses. They can choose between alternative behaviors founding their choice on the basis of evidence available to be picked up. The activity is 'abductive' in itself: it can be *selective*, when the pseudoexplanatory guess, on which the subsequent action is based, is selected among those already internally available, but it can also be *creative*, because the animal can form and excogitate for the first time a particular pseudoexplanation of the situation at hand and then creatively act on the basis of it. The tamarins quickly learn to select the best hypothesis about the tool – taking into account the different tools on offer – that has to be used to obtain the most food in 'varied' situations. To avoid 'psychological' descriptions, animal abductive cognitive reaction at this level can be seen as an emergent property of the whole organism, and not, in an anthropocentric way, as a small set of specialized skills like we usually see them in the case of humans. By the way, if we adopt this perspective it is also easier to think that some organisms can learn and memorize even without the brain.[9]

Animals occupy different environmental niches that "directly" afford their possibility to act, like Gibson's original theory teaches, but this is

[8] Of course the use of concepts like 'desire', deriving from the 'folk-psychology' lexicon, has to be considered merely metaphorical.

[9] It is interesting to note that recent neurobiological research has shown that neural systems within the spinal cord in rats are quite a bit smarter than most researchers have assumed, they can, for example, learn from experience (Grau, 2002). Cf. also footnote 2 above.

only one of the ways the organism exploits its surroundings to be suitably attuned to the environment. When behaviors are more complicated other factors are at stake. For example, animals can act on a goal that they cannot perceive – the predator that waits for the prey for example – so the organism's appraisal of the situation includes factors that cannot be immediately perceived.

Well-known dishabituation experiments have shown how infants use model-based high-level physical principles to relate to the environment. They look longer at the facts that they find surprising, showing what expectations they have; animals like dolphins respond to structured complex gestural signs in ways that can hardly be accounted for in terms of the Gibsonian original notion of immediate affordance. A similar situation can be seen in the case of monkeys that perform complicated technical manipulations of objects, and in birds that build artifacts to house beings that have not yet been born. The problem here is that organisms can dynamically abductively 'extract' or 'create' – and further stabilize – affordances not previously available, taking advantage not only of their instinctual capacities but also of the plastic cognitive ones.[10]

4. Conclusion

The main thesis of this paper is that model-based reasoning represents a significant cognitive perspective able to unveil some basic features of abductive cognition in non-human animals. Its fertility in explaining how animals make up a series of signs and are engaged in making or manifesting or reacting to a series of signs in instinctual or plastic ways is evident. Indeed in this article I have demonstrated that a considerable part of this semiotic activity is a continuous process of hypothesis generation that can be seen at the level of both instinctual behavior and representation-oriented behavior, where nonlinguistic pseudothoughts drive a 'plastic' model-based cognitive role. I also maintain that the various aspects of these abductive performances can also be better understood by taking some considerations on the concept of affordance into account. From this perspective the referral to the central role of the externalization of artifacts that act as mediators in animal languageless cognition becomes critical to the problem of abduction. Moreover, I tried to illustrate how the interplay between internal and external 'pseudorepresentations' exhibits a new cog-

[10] On the creation/extraction of new affordances through both evolutionary changes and construction of new knowledge and artifacts cf. Magnani and Bardone (2007).

nitive perspective on the mechanisms underling the emergence of abductive processes in important areas of model-based inferences in the so-called mindless organisms.[11]

References

Bermúdez, J. L. (2003). *Thinking Without Words*. Oxford: Oxford University Press.

Crist, E. (2002). "The Inner Life of Earthworms: Darwin's Argument and Its Implications." In M. Bekoff, C. Allen, and M. Burghardt (Eds.), *The Cognitive Animal. Empirical and Theoretical Perspectives on Animal Cognition* (pp. 3–8). Cambridge, MA: MIT Press.

Darwin, C. (1981 [1871]). *The Descent of Man and Selection in Relation to Sex*. Princeton: Princeton University Press.

Darwin, C. (1985 [1881]). *The Formation of Vegetable Mould, through the Action of Worms with Observations on their Habits*. Chicago: University of Chicago Press.

Donald, M. (2001). *A Mind So Rare. The Evolution of Human Consciousness*. New York: W. W. Norton and Company.

Dummett, M. (1993). *The Origins of Analytical Philosophy*. London: Duckworth.

Evans, C. S. (2002). "Cracking the Code. Communication and Cognition in Birds." In M. Bekoff, C. Allen, and M. Burghardt (Eds.), *The Cognitive Animal. Empirical and Theoretical Perspectives on Animal Cognition* (pp. 315–322). Cambridge, MA: MIT Press.

Fodor, J. (1987). *Psychosemantics*. Cambridge, MA: MIT Press.

Grau, J. W. (2002). "Learning and Memory Without a Brain." In M. Bekoff, C. Allen, and M. Burghardt (Eds.), *The Cognitive Animal. Empirical and Theoretical Perspectives on Animal Cognition* (pp. 77–88). Cambridge, MA: MIT Press.

Grime, J. P., & Mackey, J. M. L. (2002). "The Role of Plasticity in Resource Capture by Plants." *Evolutionary Ecology*, 16, 299–307.

Gruen, L. (2002). "The Morals of Animal Minds." In M. Bekoff, C. Allen, and M. Burghardt (Eds.), *The Cognitive Animal. Empirical and Theoretical Perspectives on Animal Cognition* (pp. 437–442). Cambridge, MA: MIT Press.

Kuhn, T. S. (1962). *The Structure of Scientific Revolutions*. Chicago: University of Chicago Press.

Lakatos, I. (1970). "Falsification and the Methodology of Scientific Research Programs." In I. Lakatos, and A. Musgrave (Eds.), *Criticism and the Growth of Knowledge* (pp. 365–395). Cambridge, MA: MIT Press.

Lévi-Bruhl, L. (1923). *Primitive Mentality*. Boston: Beacon Press.

Magnani, L. (2001). *Abduction, Reason, and Science. Processes of Discovery and Explanation*. New York: Kluwer Academic/Plenum Publishers.

[11] Other aspects concerning the relationships between animal cognition and abduction are treated in Magnani (2007c).

Magnani, L. (2006). “Mimetic Minds. Meaning Formation Through Epistemic Mediators and External Representations.” In A. Loula, R. Gudwin, and J. Queiroz (Eds.), *Artificial Cognition Systems* (pp. 327–357). Hershey, PA: Idea Group Publishers.

Magnani, L. (2007a). *Morality in a Technological World. Knowledge as Duty.* Cambridge: Cambridge University Press.

Magnani, L. (2007b). “Semiotic Brains and Artificial Minds. How Brains Make Up Material Cognitive Systems.” In R. Gudwin and J. Queiroz (Eds.), *Semiotics and Intelligent Systems Development* (pp. 1–41). Hershey, PA: Idea Group Publishers.

Magnani, L. (2007c). “Animal Abduction. From Mindless Organisms to Artifactual Mediators.” In: L. Magnani and P. Li (Eds.), *Model-Based Reasoning in Science, Technology, and Medicine. Studies in Computational Intelligence, Vol. 64* (pp. 3–37). Berlin/New York: Springer.

Magnani, L. (2009), *Abductive Cognition. The Epistemological and Eco-Cognitive Dimensions of Hypothetical Reasoning*. Heidelberg/Berlin: Springer.

Magnani, L., & Bardone, E. (2007). “Sharing Representations and Creating Chances through Cognitive Niche Construction. The Role of Affordances.” In S. Iwata, Y. Oshawa, S. Tsumoto, N. Zhong, Y. Shi, and L. Magnani (Eds.), *Communications and Discoveries from Multidisciplinary Data* (pp. 3–40). Berlin: Springer.

Mithen, S. (1996). *The Prehistory of the Mind. A Search for the Origins of Art, Religion and Science*. London: Thames and Hudson.

Nagel, T. (1974).“What Is it Like to be a Bat?” *The Philosophical Review*, 83, 435–450.

Pinker, S. (1997). *How the Mind Works*. New York: W. W. Norton.

Pinker, S. (2003). “Language as an Adaptation to the Cognitive Niche.” In M. H. Christiansen and S. Kirby (Eds.), *Language Evolution* (pp. 16–37). Oxford: Oxford University Press.

Quine, W. V. O. (1960). *Word and Object*. Cambridge: Cambridge University Press.

Rivas, J. & Burghardt, G. M. (2002). “Crotaloporphysm: a Metaphor for Understanding Anthropomorphism by Omission.” In M. Bekoff, C. Allen, and M. Burghardt (Eds.), *The Cognitive Animal. Empirical and Theoretical Perspectives on Animal Cognition* (pp. 9–18). Cambridge, MA: MIT Press.

Sachs, T. (2002). “Consequences of the Inherent Developmental Plasticity of Organ and Tissue Relations.” *Evolutionary Ecology*, 16, 243–265.

Saidel, E. (2002). “Animal Minds, Human Minds.” In M. Bekoff, C. Allen, and M. Burghardt (Eds.), *The Cognitive Animal. Empirical and Theoretical Perspectives on Animal Cognition* (pp. 53–58). Cambridge, MA: MIT Press.

Sherry, D. S. (1988). “Food Storage, Memory, and Marsh Tits.” *Animal Behavior*, 30, 631–633.

Tooby, J. & DeVore, I. (1987). "The Reconstruction of Hominid Behavioral Evolution through Strategic Modeling." In W. G. Kinzey (Ed.), *Primate Models of Hominid Behavior* (pp. 183–237). Albany: Suny Press.

The Logicality of Abduction, Deduction and Induction

Gerhard Minnameier
RWTH *Aachen University*

1. Reasoning and logic

One of the most crucial and intriguing questions in the cognitive sciences is what thought in general has to do with logic in particular. In order to answer it, of course, we have to enquire into the very notion of "logic", at first. On the one hand, logic is often equated with rules of deduction, so that logic essentially means deductive logic. Consider, e.g., Suppes' notion of a theory of logical inference, which he understands as the theory of correct reasoning, that is "...the theory of proof or the theory of deduction" (1957, p. xi). The very basis of logic, or logical inference, thus seems to be "correct reasoning", which translates directly into principles of deduction. On the other hand, it may, of course, be asked whether deduction is the only way of reasoning correctly and whether, consequently, induction and – perhaps even more so – abduction would have to be regarded as kinds of "incorrect" reasoning, or (differently put) whether they are inferences at all. Indeed, reproaches of this sort have been levelled against advocates of non-deductive inferences. For instance, T. Kapitan argued that hypotheses are not inferred by way of abduction (see 1992, pp. 6-7) and B. van Fraassen claimed that "inference to the best explanation" was "no inference at all" (1989, p. 161). Peirce's notion of abduction in particular has been subject to this criticism, mainly because of his notorious association of abduction with "guessing" (CP 7.219 [1901]; 5.172 [1903]) and "instinct" (CP 7.220 [1901]; 6.476 [1908]; see also Paavola, 2005). The logicality of abduction thus appears to be begging the question.

It should, however, be noted that also for Peirce "logic is, in the main, criticism of reasoning as good or bad" (CP 2.144 [1902]) – a view that is taken to be valid also today (see Copi & Cohen, 2004, p. 4). Therefore, if abduction and induction are to be logical inferences, they have to follow their own specific principles on which their validity in terms of correctness of reasoning depends. In other words, there has to be specific and precise criteria that make specific types of inferences correct or incorrect.

The present paper aims at revealing those principles and thus the specific logicality of each type of inference. This is done by a formal analysis of the inferential process, which incorporates Peirce's distinction of three subprocesses of inferences in general, i.e. colligation, observation and judgement (MS 595:35; CP 2.444). As a consequence of this analysis, a system of the three inferences that encompasses the overall process and dynamic of the discovery of new ideas and the acquisition of knowledge emerges. The inferential approach allows us to pinpoint all crucial steps and the various logical aspects of this overall process.

2. The inferential triad

Before analysing the central question of logicality, we have to be clear about the content of and the relations between the three inferential types. This is important for at least two reasons: Firstly, Peirce changed his inferential theory significantly during the last decade of the 19th century. This is well known, but none the less there seems to be a good deal of confusion prevalent even today (see e.g. Hintikka, 1998; Minnameier, 2004; Paavola, 2006). Secondly, I would like to reveal the core of the three inferences, especially of abduction and induction, which is the necessary basis for the subsequent analyses.

The mature Peirce understands abduction as "the process of forming an explanatory hypothesis. It is the only logical operation which introduces any new idea" (CP 5.171 [1903]). "Explanation" in this context means to develop a theory to accommodate explanation seeking facts in a very broad sense. It can be a narrative account of certain puzzling facts like in a criminal case or a scientific theory or merely a simple disposition like the "dormitive power" of opium, to quote a famous example of Peirce (see CP 5.534 [c. 1905]).

Now Peirce himself has contributed to the controversy about abduction being an inference with his notorious claim that our capacity of abduction is grounded in an obscure guessing instinct (see e.g. CP 5.172 [1903];

CP 7.219–220 [1901]). If abducing meant just guessing, one could well rely on Popper and Hempel who have argued that the invention of theories is a matter of "happy guesses" and that "(s)cientific hypotheses and theories are not *derived* from observed facts" (Hempel, 1966, p. 15). As opposed to this view, however, Peirce maintains "that abduction [. . .] is logical inference, asserting its conclusion only problematically or conjecturally, it is true, but nevertheless having a perfectly definite logical form" (CP 5.188 [1903]). And he is certainly right, for *new* theories cannot be generated by way of guessing, not only because "the possible theories, if not strictly innumerable, at any rate exceed a trillion" (CP 5.591 [1898]; see also CP 7.220 [1901]), but also because guessing implies a certain given frame of reference from which we pick out any piece of information by chance. In the case of new theories, or abduction in general, however, we have to come up with an entirely new concept (relative to where the reasoning starts from).

Given this function of abduction, the dynamic interaction of abduction, deduction, and induction can be reconstructed as follows and as depicted in Figure 1. Abduction leads to a new concept or theory that explains surprising facts at t0, where facts can be anything that the epistemic subject takes for granted. Thus, a factual constellation could also consist in the firm conviction that a certain theory has been disproved by certain observations – which establishes a need for abductive reflection. According to Peirce, "Abduction merely suggests that something *may be.* Its only justification is that from its suggestion deduction can draw a prediction which can be tested by induction" (CP 5.171 [1903]).

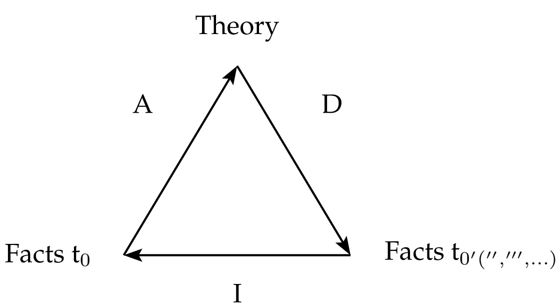


Figure 1: The dynamical interaction of abduction, deduction, and induction

As Figure 1 shows, deduction results in new facts $t_{0'}$, $t_{0''}$ and so on (as forecasts or general consequences) that are the subject of empirical investigation and inductive reasoning. If induction leads to the conclusion that the theory in question is true, then it (the theory) is projected onto all cases to which it applies, i.e. the original surprising facts (t_0), the tested cases ($t_{0'}$, $t_{0''}$, ...), and all future cases to be encountered (at t_1, t_2, ...) as well as all the relevant cases from the past. This also implies that when the theory is subsequently applied to any suitable case is not only being applied, but also being reassessed over and over again (see also Minnameier, 2004; 2005).

In this sense, induction can only establish truth relative to the current state of affairs. It can never be excluded that future evidence may challenge a currently well established theory. However, it is not necessary to invoke a notion of approximate truth, but as said, truth relative to evidence at hand and the current state of knowledge. Therefore, the extrapolation to future or unobserved instances of the theory in question is only valid based on current evidence, and does not imply prognostic certainty.

3. Logical analysis of abduction, deduction and induction

3.1 The inferential process

All inferences are mental acts of reasoning, and as such describe a process with a definite beginning and a definite end. Any inference begins with an explicit or implicit question that demands an answer in the form of the respective conclusion. Abduction asks for possible explanations in the sense described above, deduction asks for what follows from certain facts or assumptions, and induction asks for the justification for taking on a certain belief or following a certain course of action. According to Peirce, the process of answering these questions, however, can – and supposedly has to – be subdivided into three distinct steps.

Several versions of these three steps can be found in Peirce's work, the most appropriate of which I consider the differentiation between "colligation", "observation", and "judgment".

> The first step of inference usually consists in bringing together certain propositions which we believe to be true, but which, supposing the inference to be a new one, we have hitherto not considered together, or not as united in the same way. This step is called *colligation*.
>
> CP 2.442 [c. 1893]

> The next step of inference to be considered consists in the contemplation of that complex icon [...] so as to produce a new icon. [...] It thus appears that all knowledge comes to us by observation. A part is

> forced upon us from without and seems to result from Nature's mind; a part comes from the depths of the mind as seen from within
>
> CP 2.443–4

> A few mental experiments – or even a single one [...] – satisfy the mind that the one icon would at all times involve the other, that is, suggest it in a special way [...] Hence the mind is not only led from believing the premiss to judge the conclusion true,[1] but it further attaches to this judgment another – that *every* proposition *like* the premiss, that is having an icon like it, *would* involve, and compel acceptance of, a proposition related to it as the conclusion then drawn is related to that premiss. [This is the third step of inference.] CP 2.444

He concludes that "[t]he three steps of inference are, then, colligation, observation, and the judgment that what we observe in the colligated data follows a rule" (CP 2.444). The step of colligation is consistently used and explained and thus seems to be rather clear (cf. e.g. CP 5.163; 5.569). However, Peirce is less precise about the other two – or about the distinction between the other two – sub-processes. In particular, his differentiation between a "plan" and "steps" of reasoning may cause some confusion (see CP 5.158–66). As for the "plan", he says that "we construct an icon of our hypothetical state of things and proceed to observe it. This observation leads us to suspect that something is true, which we may or may not be able to formulate with precision, and we proceed to inquire whether it is true or not" (CP 5.162).

This account matches perfectly with the above description. However, Peirce then proceeds "to the reasoning itself" (CP 5.163) and distinguishes "three kinds of steps" (ibid.). "The first consists in copulating separate propositions into one compound proposition. The second consists in omitting something from a proposition without possibility of introducing error. The third consists in inserting something into a proposition without introducing error" (ibid.). Apparently, those three steps are all to be subsumed to the process of "judgement", i.e. the inquiry into whether an inference is valid or not. At least this would explain why Peirce emphasises the exclusion of error in the last passage. And it is also supported by a similar description that he gives elsewhere:

> [We] begin a Deduction by writing down all the premises. Those different premisses are then brought into one field of assertion, that is, are *colligated* ... Thereupon, we proceed attentively to observe the graph.

[1] The talk of "truth" here is certainly misleading, since the passage should apply to all three inferences. It would be more appropriate to speak of a "valid" inference.

> It is just as much an operation of *Observation* as is the observation of bees. This observation leads us to make an *experiment* upon the Graph. Namely, we first duplicate portions of it; and then we erase portions of it, that is, we put out of sight part of the assertion to see what the rest of it is. We observe the result of this experiment, and that is our deductive conclusion. Precisely those three things are all that enter into the experiment of any Deduction – Colligation, Iteration, Erasure.
>
> CP 5.579 [1898]

It is obvious that "experiment" here is equivalent to the process of "judgement" in the statement further above, and it should be noted that in this statement judgement is also explained in terms of one or more experiments carried out. Furthermore, the last passage reveals that the trivium of "colligation", "iteration" and "erasure" denotes indeed sub-processes of "experiment" (or "judgement" for that matter). I therefore take it that the overall phases of inference are colligation, observation and judgement, whilst the other three refer to the details of proving that the respective inference is valid.

The inferential process may thus be described as follows: It starts with the colligation of relevant facts which constitute the respective logical problem (abductive, deductive, or inductive). Then these facts are observed in order to find a solution to the problem, but although a deliberate act, observation only results in spontaneous ideas that spring to our minds as we contemplate the premises (see CP 5.581 [1898]; CP 7.330–1 [1873]; CP 2.443–4, see above). The very notion of inference, however, requires the result to be controlled by the mind (see CP 5.181 [1903]), and this concerns the process of judgement (see also CP 7.330–4 [1873]). The difference between mere observation and judgement could also be described in terms of secondness and thirdness. In this respect Peirce argues that "if the force of experience were mere blind compulsion, . . . we then never could make our thoughts conform to that mere Secondness" (CP 5.160 [1903]), and he goes on: "But the saving truth is that there is a Thirdness in experience, an element of Reasonableness to which we can train our own reason to conform more and more" (ibid.). And it should be noted that all "arguments" are essentially characterised as thirds (see CP 2.252 [c. 1897]).

Now, Peirce's reflections on the present issue mainly refer to deduction, so that it may be asked how these processes relate to abduction and induction. To be sure, Peirce says something in this respect, but is less explicit about the sub-processes (especially judgement) as far as abduction and induction are concerned (see esp. CP 5.579–83). Nonetheless, I think the revealed principles can be transferred in a fairly straightforward manner.

As for abduction, the colligated premise consists of all the relevant facts that constitute the initial problem, i.e. colligation here is equivalent to the problem statement. Observation refers to the search for a solution and the subsequent spontaneous generation of an explanatory idea that allows us to accommodate the problematic facts (see CP 5.197 [1903]). In this regard, Peirce argues that observation "is the enforced element in the history of our lives ... which we are constrained to be conscious of by an occult force residing in the object which we contemplate" (CP 5.581 [1898]) and to which we ultimately surrender. "Now the surrender which we make in Retroduction, is a surrender to the insistence of an Idea" (ibid.).

This eventual surrender, however, is the result of the third inferential sub-process ("judgement"). The abductive judgement consists in the adoption of the hypothesis as worth of further consideration. In other words, it is to be judged that (or whether) the new idea really does accommodate the facts, i.e. that the hypothesis really solves the problem so that the "surprise" inherent in the initial problem statement vanishes (see also below, where the validity of the three inferences is discussed).

Let us finally turn to induction:

> Induction consists in starting from a theory, deducing from it predictions of phenomena, and observing those phenomena in order to see how nearly they agree with the theory. CP 5.170 [1903]

> (Induction) has three parts. For it must begin with classification...by which general Ideas are attached to objects of Experience; or rather by which the latter are subordinated to the former. Following this will come the testing-argumentations, the Probations; and the whole inquiry will be wound up with the Sentential part of the Third Stage which, by Inductive reasonings, appraises the different Probations singly, then their combinations, then makes self-appraisal of these very appraisals themselves, and passes final judgment on the whole result.
> CP 6.472 [1908]

In other words, induction begins with deduced observable facts (colligation) which are then being observed. It may either be an experiment to be carried out, or past events that are recollected in order to be observed under the current aspect. The important point is only that premises for induction are items that can be deduced from the hypothesis in question and prior knowledge (where these items might also simply be reiterated).

Thus, the colligated inductive premise contains necessary consequences that can be used to test a hypothesis or evaluate the suggested idea.

In the next step, the experiments or past experiences are observed in order to determine whether the hypothesis can ultimately be accepted or rejected, or whether the matter is still pending. In this way, the epistemic subject perceives aspects that speak for or against the approach that is to be tested.

The eventual inductive judgement accordingly consists in weighing the evidence and deciding

> whether the hypothesis should be regarded as proved, or as well on the way toward being proved, or as unworthy of further attention, or whether it ought to receive a definite modification in the light of the new experiments and be inductively reexamined *ab ovo*, or whether finally, that while not true it probably presents some analogy to the truth, and that the results of the induction may help to suggest a better hypothesis. CP 2.759 [1905]

3.2 The validity of abduction, deduction, and induction

So far we have analysed the three inferential sub-processes with respect to all three inferential types. However, one question deserves still closer attention: What precisely does it mean to say that an inference (i.e. the judgement) is valid, especially with respect to abduction and induction? Peirce propounds a strong notion of logicality for all three inferences:

> [W]hile Abductive and Inductive reasoning are utterly irreducible, either to the other or to Deduction, or Deduction to either of them, yet the only *rationale* of these methods is essentially Deductive or Necessary. If then we can state wherein the validity of Deductive reasoning lies, we shall have defined the foundation of logical goodness of whatever kind. CP 5.146 [1903]

When Peirce says that abduction and induction, i.e. the respective judgements, are "essentially Deductive and Necessary", the stress must be on "essentially", for if they were equivalent to deduction, the argument of irreducibility would be false. The inconsistency on the surface vanishes with Peirce's explanation of what he means by necessary reasoning: A statement is "necessary", if it makes us see that what we perceive is of a general nature. He gives us an example:

> A line abuts upon an ordinary point of another line forming two angles. The sum of these angles is proved by Legendre to be equal to the

> sum of two right angles by erecting a perpendicular to the second line in the plane of the two and through the point of abuttal. This perpendicular must lie in the one angle or the other. The pupil is supposed to see that. He sees it only in a special case, but he is supposed to perceive that it will be so in any case. The more careful logician may demonstrate that it must fall in one angle or the other; but this demonstration will only consist in substituting a different diagram in place of Legendre's figure. But in any case, either in the new diagram or else, and more usually, in passing from one diagram to the other, the interpreter of the argumentation will be supposed to *see* something, which will present this little difficulty for the theory of vision, that it is of a *general nature*. CP 5.148 [1903]

This may remind us of another passage quoted above, where Peirce describes judgement as satisfying the mind "that the one icon would *at all times* involve the other" (emphasis mine) and "that *every* proposition *like* the premises … *would* involve, and compel acceptance of, a proposition related to it as the conclusion". A valid judgement, then, must basically reveal that it would at all times yield the same result. In fact, this is what distinguishes judgement from observation which is spontaneous, volatile and uncontrolled.

Peirce's notion of the abductive judgement is well known and goes like this:

> 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. CP 5.189 [1903]

It has been questioned whether this can be rightly called an abduction, it being essentially a deductive argument (Kapitan, 1992). However, Kapitan fails to see that this statement does not describe the entire process of abductive reasoning, but only the abductive judgement (see also Fann, 1970, p. 52; Paavola, 2005, p. 141). Moreover, we have just seen that Peirce requires any judgement to be "deductive" or "necessary" in some sense. Therefore, Kapitan's criticism misses the point. What the judgement tells us is no more and no less than that A explains C, and that this is necessarily so. It is easy to see that necessity of this kind does not imply any statement regarding the truth of A. Nor does it involve any claim of entailment in the deductive sense, for C does not entail A. It is only stated that A entails C, which is just the explanatory relation.[2]

[2] As opposed to this, deduction aims at revealing further necessary consequences (new derivable statements) of the hypothetical statement of A together with premises from back-

As Fann points out, however, the validity of abduction also depends on what is being asserted by the abductive judgement, and he claims that explaining the facts is a weak criterion, since it simply (re)states what abduction *is* rather than providing an independent argument for its validity (1970, pp. 52–53). However, Fann's reservations can be countered in a twofold manner. First, when discussing the logical validity of abduction, we are not concerned with explaining how humans manage to come up with fruitful hypotheses, as he does. Second, what we should be concerned with is the nature of explanation, and here we have to distinguish "explanation" in the deductive nomological sense (which is equivalent to the early Peirce's concept of hypothesis) and theoretical explanation (which is equivalent the mature Peirce's concept of abduction). Earnan McMullin has made this very clear:

> To explain a law, one does not simply have recourse to a higher law from which the original law can be deduced. One calls instead upon a theory, using this term in a specific and restricted sense. Taking the observed regularity as effect, one seeks by abduction a causal hypothesis which will explain the regularity. To explain why a particular sort of thing acts in a particular way, one postulates an underlying structure of entities, processes, relationships, which would account for such a regularity. What is ampliative about this, what enables one to speak of this as a strong form of understanding, is that if successful, it opens up a domain that was previously unknown, or less known.
>
> McMullin, 1992, p. 91

Even Hempel differentiated between explanation in the deductive-nomological sense and theoretical explanation (1965, pp. 5–6). And explanation in this latter sense means that an explanatory concept has to render something possible, i.e. the explanation-seeking facts, which before have been perceived as impossible (not as facts, but from a logical point of view). And therefore, the explanatory concept is accepted as a possibility, too. Hence, a valid abductive judgment establishes the possibility of an explanatory concept. This is why Peirce also claims that "Deduction proves that something *must be*; … Abduction merely suggests that something *may be*" (CP 5.171 [1903]).

Concerning the validity of the inductive judgement Peirce points out that it basically consists in projecting a regularity that has been observed

---

ground knowledge. It should, however, also be noted that things are slightly different with respect to theorematic deduction – an issue which cannot be treated in the present paper (see Minnameier, 2005, pp. 195–218).

and following the suggested hypothesis onto all possible instances. He gives the example of an infinite series of symbols for which a certain pattern is assumed and examined, and for which a judgement as to its overall regularity is made on the basis of finite experience (see CP 5.170). He concludes that "the validity of induction depends upon the necessary relation between the general and the singular" (ibid.).

Induction, thus, is the inference that yields factual knowledge, constituting factual truth (whereas deduction only yields so-called logical truths and abduction merely plausible ideas). Now, what may been seen as problematic in this respect is the relation between knowledge and truth. The classical notion of knowledge as *justified true belief* requires that a proposition be true in order to be known. However, a main theorem from the point of view of pragmatism is that knowledge is logically prior, i.e. knowledge establishes truth rather than requiring it as a condition.

The same line is followed by F. Suppe (1997) when he suggests a non-reliabilistic externalist approach to knowledge. On this view, we know p when it is not causally possible (indicated by a causal possibility operator $\Diamond_c$)[3] that we perceive the evidence unless the suggested hypothesis is true. Without being able to spell this out in detail here, this approach meets with the elaborated eliminative inductivism proposed by Earman (1992) and the notion of practical truth suggested by Da Costa and French (e.g. 2003) (see also Minnameier, 2004). According to Suppe's approach truth collapses with knowledge in a conscious act, which is described in condition (iv) below. And "satisfying (iv) entails the satisfaction of condition (iii)" (Suppe, 1997, p. 402), since R and/or K function as decisive indicators for Φ.

S propositionally knows that ϑ *if and only if*

(i) S undergoes a cognitive process R, or S has prior knowledge that K;

(ii) S, knowing how to use Φ and knowing how to use ϑ with the same propositional intent, as a result of undergoing R or having prior knowledge that K entertains the proposition Φ with that propositional intent as being factually true or false;

(iii) 'Φ' is factually true;

[3] Causal possibility refers to all logically possible worlds consistent with the natural laws of our world.

(iv) there exists a conjunction C of partial world state descriptions and probability spaces such that C & $\sim\diamondsuit\Phi$(C & R & K & $\sim$ Φ) & $\diamondsuit\Phi$(C & $\sim$ Φ) & $\diamondsuit$R & $\Diamond$(R & $\sim\Phi$);

(v) as a result of undergoing R or K, S believes that Φ. (Suppe, 1997, p. 405.)

4. Conclusion

The results of the above analysis are condensed in the following formal diagram (which is reduced to the essential features).

Inference:	Abduction	Deduction	Induction
Colligation:	C	$H \wedge P$	$\Box((H \wedge P) \to E) \wedge E$
Observation:	$H \to \diamondsuit C$	$(H \wedge P) \to E$	$E \wedge \neg\diamondsuit(E \wedge \neg H)$
Judgement:	$\diamondsuit H$	$\Box((H \wedge P) \to E)$	$\diamondsuit H$

Figure 2: Formalisation of inferential processes

Abduction starts from the colligated premise C, leads to H as a possible explanation (observation that $H \to \diamondsuit C$) which is asserted in the conclusion (judgement). H is input into deduction, together with suitable premises from background knowledge or antecedent conditions (P). Deductive analysis (observation) leads to the derivation of E as a consequence which is judged logically necessary in the conclusion. Again, this is input for induction, together with an experimental setting (or prior experience) and the observable results E. These results E are observed in order to reveal aspects of it that speak in favour or against the hypothesis, and eventually – provided the evidence is favourable – it is inductively inferred that H is causally necessary, hence true (or, to be precise, considered true on the basis of all available background knowledge).

References

Copi, I. M., & Cohen, C. (2004). *Introduction to Logic* (12th ed.). Englewood Cliffs, NJ: Prentice Hall.

Da Costa, N. C. A., & French, S. (2003). *Science and Partial Truth: A Unitary Approach to Models and Scientific Reasoning.* Oxford: Oxford University Press.

Earman, J. (1992). *Bayes or Bust? A Critical Examination of Bayesian Confirmation Theory.* Cambridge, MA: MIT Press.

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

Hempel, C. G. (1965). "Scientific Explanation." *Forum Lectures: Philosophy of Science Series*, 11, 1–8.

Hempel, C. G. (1966). *Philosophy of Natural Science.* Englewood Cliffs, NJ: Prentice-Hall.

Hintikka, J. (1998). "What is Abduction? The Fundamental Problem of Contemporary Epistemology." *Transactions of the Charles S. Peirce Society*, 34(3), 503–533.

Kapitan, T. (1992). "Peirce and the Autonomy of Abductive Reasoning." *Erkenntnis*, 37, 1–26.

McMullin, E. (1992). *The Inference that Makes Science*. Milwaukee, WI: Marquette University Press.

Minnameier, G. (2004). "Peirce-suit of Truth: Why Inference to the Best Explanation and Abduction Ought not to Be Confused." *Erkenntnis*, 60, 75–105.

Minnameier, G. (2005). *Wissen und inferentielles Denken: Zur Analyse und Gestaltung von Lehr-Lern-Prozessen*. Frankfurt/Main: Lang.

Paavola, S. (2005). "Peircean Abduction: Instinct or Inference?" *Semiotica*, 153, 131–154.

Paavola, S. (2006). "Hansonian and Harmanian Abduction as Models of Discovery." *International Studies in the Philosophy of Science*, 20, 93–108.

Suppe, F. (1997). "Science without Induction." In J. Earman & J. D. Norton (Eds.), *The Cosmos of Science: Essays of Exploration* (pp. 386–429). Pittsburgh, PA: University of Pittsburgh Press.

Suppes, P. (1957). *Introduction to Logic*. New York: Van Nostrand.

van Fraasen, B. C. (1989). *Laws and Symmetry.* Oxford: Clarendon Press.

Peirce, Abduction and Scientific Realism

Ilkka Niiniluoto
University of Helsinki

1. Introduction

Charles S. Peirce's notion of abduction has been applied as a tool within philosophy of science by many scientific realists. This paper considers the idea that abductive inference can be reformulated by taking its conclusion to concern the truthlikeness of a hypothetical theory on the basis of its success in explanation and prediction. The strength of such arguments is measured by the estimated verisimilitude of its conclusion given the premises. This formulation helps to make precise the "ultimate argument for scientific realism": the empirical success of scientific theories would be a miracle unless they are truthlike. This kind of explanation is not available to those pragmatists who define truth in terms of empirical or pragmatic success. Critical scientific realism seems to give the only viable explanation of the success of science.

2. Peirce and critical scientific realism

Scientific realism as a philosophical position has (i) ontological, (ii) semantical, (iii) epistemological, (iv) theoretical, and (v) methodological aspects (see Niiniluoto, 1999a; Psillos, 1999). It holds that (i) at least part of reality is ontologically independent of human mind and culture. It takes (ii) truth to involve a non-epistemic relation between language and reality. It claims that (iii) knowledge about mind-independent (and mind-dependent) reality is possible, and that (iv) the best and deepest part of such knowledge is provided by empirically testable scientific theories. An important aim of science is (v) to find true and informative theories which postulate non-observable entities to explain observable phenomena. Scientific realism is thereby in opposition to doctrines like idealism, phenomenalism, positivism, instrumentalism, scepticism, relativism, and social constructivism.

Critical scientific realism can be distinguished from naive forms of realism by two additional theses. First, according to *conceptual pluralism*, all inquiry is always relative to some conceptual framework (just as Kant argued in his critical philosophy), but (unlike Kant thought) such frameworks can be changed, revised, and enriched. Secondly, according to the principle of *fallibilism*, all factual human knowledge is uncertain or corrigible. Even the best results of science may be false, but still they may be truthlike or approximately true.

Conceptual pluralism and fallibilism are characteristic features of the pragmatist tradition as well. However, there is a tension between scientific realism and those forms of classical pragmatism and neo-pragmatism which emphasize that ontology and truth are always relative to human practices (see Pihlström, 1996). This tension was visible when in 1905 Peirce himself attacked some forms of pragmatism in the name of "pragmaticism" (CP 5.411-434). Scientific realists combine fallibilism with the correspondence theory of truth, and thereby reject the so called "pragmatist theory of truth" which *defines* the truth of a belief by its success or utility. Historically, this notion of pragmatist truth was based upon a literal reading of formulations like "an idea is 'true' so long as to believe it is profitable to our lives" in William James's *Pragmatism* (1907), but it can be debated whether James intended this as a definition of truth (see Putnam, 1997; Pihlström, 2008).

Peirce can be regarded as an exponent of critical scientific realism, in spite of his ontological inclination to objective idealism. In his account of the method of science, Peirce emphasized that "real things" affect our senses causally, and in the long run the community of investigators will or would reach "the one True conclusion" (CP 5.384). In my reading, Peirce was not a "convergent realist" in the sense that he would define truth as the limit of inquiry, since he realized that such convergence takes place at best with probability one (CP 4.547n; cf. Niiniluoto, 1984, p. 82). Still, he found it useful to try to characterize the method of science by its ability to "approach to the truth". This was in harmony with Peirce's vision of science as a "self-corrective process" (CP 5.575): "the successful sciences" follow the experimental method which is an application of the rule "By their fruits ye shall know them" (CP 5.465).

Later critical scientific realists have argued – *pace* opponents like W.V.O. Quine and Larry Laudan (see Laudan, 1984) – that it indeed makes sense to say that one hypothetical (even false) theory is "closer to the truth" than another theory. By the same token, it is meaningful to state that a sequence of theories "approaches to the truth", even when the final limit is not reached. Since 1974, after Karl Popper's 1960 attempt to define verisimilitude turned out to fail, the notion of similarity between states of affairs has been employed to give a precise definition of *degrees of truthlikeness* of scientific statements (see Niiniluoto, 1987).

In his fallibilist analysis of inference, Peirce argued that science uses, besides deduction, also two ampliative forms of reasoning: induction and abduction. *Abduction* is reasoning from effects to causes, or from observational data to hypothetical explanatory theories:

(1) 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. CP 5.189

According to Peirce, abduction is "the only logical operation which introduces any new idea" (EP 2:106). It frequently supposes "something which it would be impossible for us to observe directly" (CP 2.640). Against Comte's positivism, Peirce urged in the spirit of scientific realism that science should not be restricted to hypotheses "verifiable by direct observation" (EP 2:225).

Many scientific realists have suggested that the strongest reasons for scientific theories are abductive. Sometimes this idea is connected with a probabilistic account of scientific inference: empirically successful theories are probable. But even when in schema (1) A is the best available theoretical explanation of fact C, it need not generally be the case that A is probable given C. If a fallibilist acknowledges that our strongest theories in science are at best truthlike, then estimated "closeness to the truth" or verisimilitude appears to be a more realistic aim for science than probable truth. Therefore, it is interesting to study the idea that abductive inference (1) can be reformulated by taking its conclusion to concern the *truthlikeness* of a hypothetical theory on the basis of its success in explanation and prediction.

This modification of abduction is also relevant to the so called "ultimate argument for scientific realism". As we have seen, for Peirce the success of science as a fallible cognitive enterprise is based on its method. The most characteristic feature of the scientific method is its ability to bring the scientific community to a final opinion which is close to the truth. So for Peirce there is an important relation between the success of science and approach to the truth. After the 1950s, when scientific realism became a tenable position after the dominance of empiricism and instrumentalism, several philosophers of science (among them Jack Smart, Hilary Putnam, Grower Maxwell, and Richard Boyd) have defended realism as the best hypothesis which explains the practical (empirical and pragmatic) success of science. The ability of scientific theories to explain surprising phenomena and to yield correct empirical predictions and effective rules of action would be a "cosmic coincidence" or a "miracle" unless they refer to real things and are at least approximately true or truthlike (see Psillos, 1999). It is clear that the form of this "no miracle argument for scientific realism" is abductive (see Niiniluoto, 1984, p. 51).

3. The justification of abduction

Peirce insisted that abduction or "inference to an explanation" has a significant role in science. Often this role has been interpreted as the heuristic function of the *discovery* of new theories, or alternatively as the motive for suggesting or *pursuing* testworthy hypotheses (N. R. Hanson). This is in line with Peirce's methodological characterization of abduction as an "inferential step" which is "the first starting of a hypothesis and the entertaining of it, whether as a simple interrogation or with any degree of confidence" (CP 6.525). The conclusion of (1) states that "there is reason to suspect that A is true". Thus, abduction "only infers a *may-be*" from an actual fact (CP 8.238).

On the other hand, Peirce himself regarded perceptual judgments as "extreme cases" of abduction (CP 5.181). Other examples of abduction, also mentioned by Peirce (CP 2.714), include retroductive historical inferences. Peirce further pointed out that in science the abductive step is followed by severe observational and empirical tests of the deductive or probable consequences the hypothesis (CP 2.634; EP 2:114). The examples of abduction thus range from compelling everyday observations to the tentative adoption of theoretical hypotheses in science by virtue of their explanatory and predictive power. In these cases, it appears that abductive arguments can sometimes serve in providing a fallible *justification* of a hypothesis (see Niiniluoto, 1999b).

Peirce's own account of the *truth-frequency* of inference was later followed by many frequentist theories of probability and statistics in the 20th century. By this standard, the general reliability of abductive inference may be relatively high in some kinds of circumstances.

The *Bayesian* theory of inference uses epistemic probabilities: $P(H/E)$ is the rational degree of belief in the truth of hypothesis H given evidence E. The notion of confirmation is defined by the *Positive Relevance* criterion: E confirms H if and only if $P(H/E) > P(H)$. According to Bayes's Theorem, $P(H/E) = P(H)P(E/H)/P(E)$. If H logically entails E, we have $P(E/H) = 1$. Hence,

(2) If H logically entails E, and if $P(H) > 0$ and $P(E) < 1$, then $P(H/E) > P(H)$.

This result gives immediately a Bayesian justification for the Principle of Converse Entailment

(CE) If hypothesis H logically entails evidence E, then E confirms H

which has been taken to be characteristic to "abductive inference" (see Smokler, 1968; Niiniluoto & Tuomela, 1973). More generally, as positive relevance is a symmetric relation, it is sufficient for the confirmation of H by E that H is positively relevant to E. If inductive explanation is defined by the positive relevance condition, i.e., by requiring that $P(E/H) > P(E)$ (see Niiniluoto & Tuomela, 1973; Festa, 1999), then we have the general result:

(3) If H deductively or inductively explains E, then E confirms H.

The same principle holds for empirical predictions as well. Hence, by (2) and (3), *empirical success confirms the truth of a hypothesis*.

The notion of abductive confirmation is weak in the sense that the same evidence may confirm many alternative rival hypotheses. A confirmed hypothesis need not be rationally and tentatively acceptable on evidence. A stronger notion of inference is obtained if one of the rival hypotheses is the *best* explanation of the facts. The strongest justification is obtained if the hypothesis is the *only* available explanation of the known facts. In such cases, abduction might be formulated as a rule of *acceptance*. In 1965 Gilbert Harman formulated *inference to the best explanation* by the following rule:

(IBE) A hypothesis H may be inferred from evidence E when H is a better explanation of E than any other rival hypothesis.

Comparison with Peirce's schema (1) suggests the following version of IBE:

(IBE′) If hypothesis H is the best explanation of evidence E, then conclude for the time being that H is true.

Already in his early account of hypothetic or abductive inference, Peirce discussed *deductive* and *probabilistic* explanations. But one should also allow *approximate* explanations: H approximately explains E when it is possible to derive from hypothesis H a statement E′ which is close to E. Approximate explanation includes the problem of curve-fitting where the original observational data E is incompatible with the considered hypotheses H, so that $P(E/H) = 0$. For this case, the probabilistic link $P(E/H)$ between the explanans H and the explanadum E has to be replaced by a measure of *similarity* or *fit* between E and H (see Niiniluoto, 1999b). However, here the evidence may still indicate that the best hypothesis is *truthlike*. This principle might be called *inference* to the best approximate explanation:

(IBAE) If the best available explanation H of evidence E is approximate, conclude for the time being that H is truthlike.

If degrees of truthlikeness are introduced (see Niiniluoto, 1987), then there is a natural addition to IBAE: the greater the fit between H and E, the larger the degree of truthlikeness of H in the conclusion. A variant of IBAE could replace truthlikeness by the weaker notion of approximate truth:

(IBAE′) If the best available explanation H of evidence E is approximate, conclude for the time being that H is approximately true.

More technically, approximate truth can be defined by the minimum distance of the possibilities allowed by H from the truth, while the notion of truthlikeness combines the ideas of closeness to the truth and information about the truth (see below).

By combining the ideas in IBE′ and IBAE, *inference to the best theory* can be defined by

(IBT) If a theory has so far proven to be the best one among the available theories, then conclude for the time being that it is truthlike.

(See also Kuipers, 1999; 2000.)

As we have already seen, many attempts to defend scientific realism by the "no miracle argument" appeal to forms of abduction which conclude that successful scientific theories are approximately true (e.g., Putnam, Psillos). In other words, they involve something like the principle IBAE′ (but without making the notion of approximate truth precise).

To save the no miracle argument against the charges of circularity (Fine, 1986) and incoherence (van Fraassen, 1989), one needs to defend abduction in the form of IBAE, IBAE′, or IBT (cf. Niiniluoto, 2007a).

Let us first note that the Bayesian approach immediately shows that $P(H/E)$ may be close to 1 and $P(-H/E)$ close to 0, when H is the only explanation of E. Bas van Fraassen's (1989) objection that it is incoherent to give an extra bonus to a theory for its explanatory success fails, as such a bonus is not needed to prove (2) and (3). Van Fraassen's "bad lot argument" is not convincing as such, either (see Niiniluoto, 2004, p. 74), but it points out that sometimes the best available explanation is not yet "good enough" to be acceptable (cf. Lipton, 1991). Instead of accepting a weak theory, it may be rational to suspend judgment and continue searching for a better one. On the other hand, the same idea has been included in IBT in the phrase "for the time being": for a fallibilist realist, the attempt to improve our so far best theory is always a viable option which can be expected to be successful at least in the long run.

Van Fraassen's point that the Bayesian justification (2) does not hold for hypotheses H with zero probabilities is relevant – even though the decision to assign $P(H) = 0$ for *all* genuine theories postulating unobservable entities is a questionable form of scepticism. There are, indeed, interesting cases where $P(H) = 0$ seems reasonable: H is a sharp point hypothesis with a zero measure or H is known to be a false idealization. Hence, for such cases, new tools from the theory of truthlikeness are needed.

Laudan (1984) in his well-known "confutation of scientific realism" demanded the realists to show that there is an "upward path" from the empirical success of science to the approximate truth of theories – and then a "downward path" from approximate truth to empirical success. It is evident that any "upward" link has to be fallible and corrigible, given the correct core of Laudan's remark that there are non-referring and false but yet to some extent empirically successful theories in the history of science (see also Stanford, 2006). But this "meta-induction" need not lead to the pessimistic conclusion that all present and future theories are far from the truth, if we can argue that later more successful theories are progressively closer to the truth than earlier less successful ones.

In my own work, I have tried to reply to Laudan's challenge by using the concept of truthlikeness (see Niiniluoto, 1984, Ch. 7), i.e., by appealing to something like IBAE and by making it precise with my own account of truthlikeness and its estimation (see Niiniluoto, 1987). Kuipers (2000) also gives a reply to Laudan by his "downward" Success Theorem and "upward" Rule of Success.

The probabilistic account of IBE, given by the results (2) and (3), cannot be directly applied to our problem at hand. These results establish *a probabilistic link between explanatory power and truth*: posterior probability $P(H/E)$ is the rational degree of belief in the truth of H on the basis of E, and thereby confirmation, i.e., increase of probability by new evidence, means that we rationally become more certain of the truth of H than before. But a rule of the form IBAE needs a link between approximate explanation and truthlikeness. The notion of probability (at least alone) does not help us, since the approximate explanation of E by H allows that H is inconsistent with E, so that $P(E/H)$ and $P(H/E)$ are zero. In other words, while high posterior probability is an epistemic indicator of truth, we need corresponding indicators of truthlikeness.

One important approach to IBAE′ is to define the notion of *probable approximate truth* PA (see Niiniluoto, 1987, p. 280). Then probabilistic links between explanation and truth, like (2), induce probabilistic links between explanation and approximate truth as well. It is also possible that $PA(H) > 0$ even though $P(H) = 0$. This helps us to give a reply to van Fraassen's point about hypotheses with zero probability (see Niiniluoto, 1999a; cf. Festa, 1999). But this kind of result does not yet justify IBAE′, since here H is compatible with E.

Another challenge concerns the justification of IBAE and IBT. My own favorite method of connecting objective degrees of truthlikeness and epistemic matters is based on the idea of estimating verisimilitude by the expected degree of truthlikeness $\mathrm{ver}(H/E)$ (see Niiniluoto, 1987, p. 269). Let $\mathrm{Tr}(H, C^*)$ be the degree of truthlikeness of H relative to target C^*, where C^* the complete truth expressible in a given framework. Hypothesis H is itself a disjunction of complete theories C_i, $i \in I_H$. According to the min-sum measure, $\mathrm{Tr}(H, C^*)$ is a weighted average of the minimum distance of the disjuncts of H from C^* and the (normalized) sum of all distances of the disjuncts of H from C^*. The minimum distance alone defines the notion of *approximate truth*. When the target C^* is unknown, the *expected degree of verisimilitude* $\mathrm{ver}(H/E)$ of H given evidence E is obtained by going through all potential candidates C_i, $i \in I$, for C^* and by balancing the likeness $\mathrm{Tr}(H, C_i)$ of H to C_i by the inductive probability $P(C_i/E)$ of C_i on E:

(4) $$\mathrm{ver}(H/E) = \sum_{i \in I} P(C_i/E)\mathrm{Tr}(H, C_i).$$

The measure (4) of expected truthlikeness gives us an epistemic indicator of truthlikeness. Its definition includes epistemic probabilities but it is not identical with posterior probability. Indeed, $\mathrm{ver}(H/E)$ may be non-zero, and even high, when $P(H/E) = 0$. If $P(C'/E)$ approaches 1, when evidence E increases, then $\mathrm{ver}(H/E)$ approaches $\mathrm{Tr}(H, C')$.

In order to reply to Laudan's "upward" challenge, we can show that at least in some interesting situations a better approximate explanation of E has more expected verisimilitude given E. Further, the expected verisimilitude of H given E can be high, when H approximately explains E (see Niiniluoto, 2005). Thus, explanatory success gives us a rational warrant for making claims about truthlikeness. We can also study under what ideal conditions the estimated degree $\mathrm{ver}(H/E)$ equals the objective degree $\mathrm{Tr}(H, C^*)$ (see Niiniluoto, 2007b). Thereby the notion of expected truthlikeness, explicated by the function ver, provides *a fallible link from the approximate explanatory success of a theory to its truthlikeness*.

4. Explaining the success of science

To conclude, let us still consider the "downward" explanation of the empirical success of science by the truthlikeness of theories (cf. Niiniluoto, 1999a). For a scientific realist, the truth of a theory means that it gives a correct description of non-observable reality. This explains the success of the theory in describing observable phenomena and guiding our practical action: if theory H is true, then all empirical deductive consequences of H (if any) are also true. The same principle holds for approximate truth as well. For the min-sum measure of truthlikeness, the situation is more complicated, but in any case high truthlikeness of H gives a constraint to the approximate truth of deductive predictions from H. Further, high truthlikeness guarantees high "overall" empirical success.

According to Peirce's principle of pragmatism, the "rational purport" of a theory lies in its "conceivable bearing upon the conduct of life" (CP 5.413). That our best scientific theories should be used in human action and be pragmatically successful is thus an important Peircean idea. But if truth is *defined* by success, as in the so called pragmatist notion of truth, then this idea cannot be turned into an explanation of the success of science – and thereby "the ultimate argument for scientific realism" cannot be formulated as an abductive inference to the best explanation. To see this, note that Arthur Fine (1986) has argued that in the explanatory schema

(5) Theory H is pragmatically successful, because H is true,

an instrumentalist or anti-realist can replace the realist notion of truth by the pragmatist notion of truth. But, as this pragmatist notion defines truth as pragmatic success, Fine's suggestion would turn schema (5) into a non-explanatory tautology. Similarly, if truth is replaced by van Fraassen's notion of empirical adequacy, schema (5) again fails to be explanatory, since then it would "explain" the empirical truth of the consequences of H by their empirical truth.

Gerald Doppelt (2005) claims that scientific realism must explain the "explanatory success" of science rather than its empirical adequacy. But clearly it is too much to demand with Doppelt that the truth of a theory alone would explain its "simplicity, consilience, intuitive plausibility, and unifying power". Such epistemic utilites may very well be additional desiderata that are independent of truth. For example, a tautology is certainly true, but it need not be simple, and it does not have any explanatory power. On the other hand, truthlikeness combines the ideas of truth and information, so that it helps to establish interesting links between the realist virtues of a theory and its explanatory and unifying power (cf. Niiniluoto, 2007).

Laudan and van Fraassen have also suggested that no explanation of the success of scientific theories is needed, since theories are selected for survival by their success (see van Fraassen, 1999). This evolutionary move is not convincing, either, since it fails to point out any characteristic permanent feature of our best theories (such as their truthlike correspondence to reality) which accounts for their ability to yield successful explanations and predictions. It is a different matter to describe the selection processes which give us empirically successful theories and to explain why such theories are (and continue to be) successful.

Non-scientific explanations of the success of science – e.g. appeal to miracles or God's will – are not acceptable. Therefore, we may conclude that scientific realism is the *only* explanation of the empirical success of science.

References

Doppelt, G. (2005). "Empirical Success or Explanatory Success: What Does Current Scientific Realism Need to Explain?" *Philosophy of Science*, 72, 1076–1087.

Festa, R. (1999). "Bayesian Confirmation." In M. C. Galavotti & A. Pagnini (Eds.), *Experience, Reality, and Scientific Explanation* (pp. 55–87). Dordrecht: Kluwer.

Fine, A. (1986). "Unnatural Attitudes: Realist and Instrumentalist Attachments to Science." *Mind*, 95, 149–179.

Kuipers, T. (1999). "Abduction aiming at Empirical Progress or even Truth Approximation leading to a Challenge for Computational Modelling." *Foundations of Science*, 4, 307–323.

Kuipers, T. (2000). *From Instrumentalism to Constructive Realism: On Some Relations between Confirmation, Empirical Progress, and Truth Approximation*. Dordrecht: Kluwer.

Laudan, L. (1984). *Science and Values*. Berkeley and Los Angeles: University of California Press.

Lipton, P. (1991). *Inference to the Best Explanation.* London: Routledge.

Niiniluoto, I. (1984). *Is Science Progressive?* Dordrecht: D. Reidel.

Niiniluoto, I. (1987). *Truthlikeness*. Dordrecht: D. Reidel,

Niiniluoto, I. (1999a). *Critical Scientific Realism*. Oxford: Oxford University Press.

Niiniluoto, I. (1999b). "Defending Abduction." *Philosophy of Science* (Proceedings), 66, S436–S451.

Niiniluoto, I. (2004). "Truth-seeking by Abduction." In F. Stadler (Ed.), *Induction and Deduction in the Sciences* (pp. 57–82). Dordrecht: Kluwer.

Niiniluoto, I. (2005). "Abduction and Truthlikeness." In R. Festa, A. Aliseda, & J. Peijnenburg (Eds.), *Confirmation, Empirical Progress, and Truth Approximation* (pp. 255–275). Amsterdam: Rodopi.

Niiniluoto, I. (2007a). "Abduction and Scientic Realism." In F. Keskin (Ed.), *The Proceedings of the Twenty-First World Congress of Philosophy*, vol. 12 (pp. 137–142). Ankara: Philosophical Society of Turkey.

Niiniluoto, I. (2007b). "Evaluation of Theories." In T. Kuipers (Ed.), *Handbook of Philosophy of Science: General Philosophy of Science – Focal Issues* (pp. 175–217). Amsterdam: Elsevier.

Niiniluoto, I. & Tuomela, R. (1973). *Theoretical Concepts and Hypothetico-Inductive Inference.* Dordrecht: D. Reidel.

Pihlström, S. (1996). *Structuring the World: The Issue of Realism and the Nature of Ontological Problems in Classical and Contemporary Pragmatism.* Acta Philosophica Fennica 59. Helsinki: Societas Philosophica Fennica.

Pihlström, S. (2008). *"The Trail of the Human Serpent is over Everything": Jamesian Perspectives on Mind, World, and Religion*. Lanham: University Press of America.

Psillos, S. (1999). *Scientific Realism: How Science Tracks Truth.* London: Routledge.

Putnam, H. (1997). "James's Theory of Truth." In R. A. Putnam (Ed.), *The Cambridge Companion to William James* (pp. 166–185). Cambridge: Cambridge University Press.

Smokler, H. (1968). "Conflicting Conceptions of Confirmation." *The Journal of Philosophy*, 65, 300–312.

Stanford, P. K. (2006). *Exceeding Our Grasp: Science, History, and the Problem of Unconceived Alternatives*. Oxford: Oxford University Press.

van Fraassen, B. (1989). *Laws and Symmetry*. Oxford: Oxford University Press.

Complementary Strategies in Scientific Discovery: Abduction and Preduction

Andrés Rivadulla
Universidad Complutense, Madrid

1. Introduction

Since the beginnings of the theory of knowledge nearly two and a half millennia ago, philosophers have tried different ways of reasoning in order to find out *the method of science*. This issue raised the question of whether this method should be unique for all the sciences, or whether each natural, social and human science should have its own method. Closely related to this discussion was the question – which I shall not address here – of the existence of a demarcation criterion between science and non-science.

After Peirce, deduction, induction and abduction were the primary ways of scientific reasoning employed by philosophers. This was until Hans Reichenbach pointed out that the whole issue of the methodology of science should to be analyzed from two different perspectives: that of the context of discovery and that of the context of justification. This distinction is of fundamental importance for the purpose of this paper.

Induction had traditionally been conceived of as a kind of truth conserving and content ampliative inferential form leading from the particular to the universal principles of science.[1] In the 20th century, Pierre Duhem and Albert Einstein, and later Karl Popper, began systematically to question

[1] In different forms, induction has persisted as *the method* of science for the twenty-four centuries in Western scientific thought since Aristotle: From the philosopher-scientists of the Oxford Franciscan School in the 13th century until John Stuart Mill in the 19th, taking in Francis Bacon and Isaac Newton, William Whewell and Herbert Spencer, among others. Especially important were inductive probability, developed as inductive logic by Rudolf Carnap in the fifties, and extended by Jaakko Hintikka in the sixties, as well as the contemporary Bayesian approaches to induction.

induction. Earlier, at the turn of the century, Charles Peirce proposed *abduction* as a complement to induction.

For Peirce, abduction was "the process of forming an explanatory hypothesis. It is the only logical operation which introduces any new idea; for induction does nothing but determine a value, and deduction merely evolves the necessary consequences of a pure hypothesis" (CP 5.171). This means that for him, both deduction and induction belong to the context of justification, whereas only abduction belongs to the context of discovery. Indeed, according to Peirce, induction "never can originate any idea whatever. No more can deduction", and "All the ideas of science come to it by the way of Abduction. Abduction consists in studying facts and devising a theory to explain them. Its only justification is that if we are ever to understand things at all, it must be in that way."

My concern is whether Peirce is right when he claims that deduction can never originate any idea whatever, so that all new ideas come exclusively to science by the way of abduction. My answer is that besides abduction, there is another form in scientific discovery, which I call *theoretical preduction*, or simply *preduction*. Indeed, *preduction* is the name I apply to the extension of the deductive way of reasoning to the context of scientific discovery. It consists in resorting to the available accepted results of theoretical physics as a whole, in order to make it possible to obtain, or to *anticipate*, new results by mathematical combination and manipulation, compatible with dimensional analysis, of the accepted results. Preduction is a form of *ars inveniendi* in theoretical physics.

I conceive both of them, abduction and preduction, as reasoning strategies in scientific discovery, abduction taking place, although not exclusively, in observational natural sciences, and preduction in the context of discovery of theoretical natural sciences. The distinction between observational and theoretical natural sciences is important from the viewpoint of the methodology of science. It points to the fact that in certain natural sciences the method of hypotheses testing is *not predominant*, but the method of guessing is. Since these natural sciences are basically grounded in observation, I call them observational sciences. Darwinism, palaeontology, and Earth sciences are paradigmatic examples. They rely on abduction as a reasoning strategy in scientific discovery, and lead to reasonable hypotheses about the available observational evidence, whereas the testing of the guessed hypothesis merely consists in a refinement of the procedures of collecting data, or simply in the comparison with novel data that contribute to increasing the available empirical basis. On the other hand, in theoretical natural mature sciences, such as mathematical physics, both the context of discovery and the context of justification are of an equal importance. In both, the hypothetical-deductive method is predominant: as hypothesis testing in the context of justification, and as *preduction* in the context of discovery.

The conclusion is twofold. First, the issue of *the* method of science reveals itself as a myth, since it is obvious that there is no one unique method. Secondly, as abduction and preduction complement each other – both of them nearly exhaust the whole work of creativity in the natural sciences – it is justifiable to claim a *complementarity thesis of abduction and preduction* in scientific discovery.

2. *Abduction* in philosophy and in science

That the place of abduction is the context of discovery becomes evident from Peirce's view that "Abduction is the process of forming an explanatory hypothesis. It is the only logical operation which introduces any new idea." Or "Abduction consists in studying facts and devising a theory to explain them." (CP 5.145; CP 5.171).

Although Peirce (CP 5.189), and later on Norwood Russell Hanson, in 1959, devised the logical form of abductive reasoning, the post-positivist philosophy of science in the last century, largely concerned with the problems of induction and inductive probability, widely ignored abduction. This was the case despite the fact that abduction has been thought of by Peirce as an inferential form in scientific discovery, and that Popper had claimed in the 1958 Preface to his *L.S.D.* that the central problem of epistemology is the growth of knowledge.

Nonetheless abduction had been enjoying a wide application in the natural sciences, as the following examples show:

- Ancient astronomy abduced hypotheses in order to account for planetary movements.
- One of the most celebrated abductions was Kepler's postulation of the elliptic character of Mars' orbit (CP 1.72–4; Hanson, 1958, pp. 84–85).
- A particularly interesting case of abduction, to be presented later here, is Alfred Wegener's (1880–1930) *continental drift hypothesis* proposed for the first time in his *Die Entstehung der Kontinente und Ozeane*, 1915.

- Darwin's evolutionary hypothesis in *On the Origin of Species by Means of Natural Selection*, 1859, was abductively postulated on the basis of the available biological and fossil data (This view is defended by Putnam, 1981, pp. 198–200).

- Ernest Rutherford's *atomic planetary model* was abductively postulated in 1911 on the basis of the alpha particles scattering experiments.

But it would not be fair to affirm that abduction has not attracted the interest of philosophers. In recent decades, the use of abduction has been identified in human activities such as medical diagnosis or criminal inquiry; this is evident in the contributions to *The Sign of Three* (Eco & Sebeok, 1983). But it is in artificial intelligence, logical programming, knowledge acquisition and related matters where abduction is being most-widely applied, as Josephson (1994), Magnani (2001; 2006), Flach and Kakas (2000), Aliseda (2006), and also Woods (2004), etc. show.

Moreover, following Harman's (1965) identification of abduction and *inference to the best explanation*, realist philosophers of science have assumed abduction as an argument for scientific realism. Richard Boyd, Peter Lipton, Ilkka Niiniluoto, Stathis Psillos, and Paul Thagard, among others, have contributed to this matter.

3. Abductive discovery in observational natural sciences

What was said in section 2, regarding the reception and acceptance of abduction, and especially the fact that abduction is still neglected in the methodology of science, may explain why philosophers of science have apparently not yet realized that observational natural sciences also constitute an outstanding empirical domain where 'explanation' is achieved almost exclusively by abduction. In this section I intend to fill in this gap.

Indeed, surprising facts, abduction by hypotheses elimination and selection of the most reasonable one, revision of abduced hypotheses by novel facts, etc., are phenomena currently occurring in observational natural sciences. Thus observational natural sciences still constitute an unexplored kingdom of abduction. They offer an excellent *milieu* for the philosophical investigation of scientific discovery. Let me illustrate this by reference to two successful, mature contemporary observational natural sciences: geology and palaeoanthropology.

The interest in the methodological aspects of geology/geophysics is widespread. Together with Robert Parker and Jason Morgan, Dan McKenzie (2001, p. 184) was one of the creators of the plate tectonics hypothesis between 1967 and 1968. He reflects this concern: "Few active scientists take much interest in general models of scientific discoveries, and I am no exception". Indeed, these scientists agree on: 1) the emphasis on the observational character of geophysics; 2) the conviction that the method of Earth sciences is not that of hypothesis testing; 3) the insistence that the context where geophysics develops itself is scientific discovery; 4) the use of terms such as "concept", "hypothesis", "pattern" to refer to what we can interpret as abduction; and 5) the extensive use of phrases like "the data could be explained if...", "this provided empirical evidence that...", "he proposed that ... explaining that...", "his interpretation was confirmed by...", "he interpreted ... as evidence in support of hypothesis...", "scientists now saw it as strong evidence of...", "he preferred to explain this phenomenon by...", "the observation could be interpreted simply with the model...", etc.

Indeed, according to McKenzie (2001, pp. 185–186), the fundamental difference between some branches of physics and Earth science lies in the fact that, whereas for the physical sciences, experimentation contributes to an essential part of the development of new theories, "hypothesis testing in its strict form is not an activity familiar to most earth scientists", and "I certainly would not describe Jason's and my activities in 1967 as hypothesis testing". And Sclater (2001, p. 137) confesses: "I have lost my belief that advances in the earth sciences occur primarily as a result of hypothesis testing. Neither Harry Hess nor Tuzo Wilson was testing a hypothesis". Sclater's view is that "Earth science is an observational discipline (...) Thus, unlike physics or chemistry, earth science is not an experimental discipline. Earth scientists, in most cases, observe and describe phenomena rather than conducting experiments to test hypotheses" (p. 138).

Nonetheless, observational sciences place their emphasis not only on guessing, but also on the rigorous foundation of empirical evidence. This means that hypothesis testing does also play a role in Earth sciences. Bearing in mind the hypotheses of sea floor spreading and plate tectonics, Sclater (op. cit., 144) claims that the process of discovery in the Earth sciences follows three steps: "The first involves the origination of the concept; the second, the construction of a model where the predictions can be compared with a set of observations, the third the application of the model to another set of data." This third step corresponds to hypothesis testing.

But contrary to the theoretical sciences, such as theoretical physics, where hypothesis testing occurs by experimental control of the mathematical consequences derived from the assumed hypotheses, in the observational natural sciences hypothesis testing can occur only by the discovery of new evidence that confirms or refutes the conjectured hypotheses. Seeking new data is the main control activity of abduced hypotheses. To proclaim that Earth sciences are observational sciences thus amounts to recognizing the relevance of the Peircean method of hypothesis in scientific discovery. But this is compatible with the assumption that discovery takes place over two steps: the first that of guessing, the second that of further empirical control.

3.1. Palaeoanthropology

Palaeoanthropology is a young science. Its origin dates back to 1856, when in a cave in Feldhofer, Neanderthal, near Düsseldorf, some hominid fossils were discovered. In 1861 they were identified as a different older species from modern humans: *Homo neanderthalensis*. Since then, interest in human evolution has developed in a spectacular fashion, following the discovery of more and older hominid fossils, with *Sahelanthropus tchadensis* close to being the common ancestor of hominids and chimpanzees.

From a methodological viewpoint, palaeoanthropology follows the procedure of a typical empirical science: surprising facts, hypothesis revision in the light of novel data, abduction by elimination of possibilities, the fallibility of hypotheses, new abduced hypotheses, and the beginning of a new cycle. Palaeoanthropologists are perfectly aware of this. Two examples suffice: in a paper on the comparison of the genomes of Neanderthals and modern humans, James Noonan et al. (2006) claim that "[o]ur knowledge of Neanderthals is based on a limited number of remains and artefacts from which we must make inferences about their biology, behavior, and relationship to ourselves." And Lorenzo (2005, p. 103) points out that "Philogenetic trees are only evolutionary hypotheses built upon a continuously changing empirical basis".

Contemporary palaeoanthropology allows us:

1. To recognize the existence of *surprising facts*. For instance, the discovery in 1978–1979, near the Serengeti National Park in Tanzania, of the *Laetoli footprints* left behind 3.6 million years ago by three biped *Australopitheci afarenses*, some Lucy's relatives. Or the discoveries between 1994–1995, in Sierra de Atapuerca, Burgos, Spain, leading to the abductive proposal of the new species *Homo antecessor*, whose

existence in Southern Europe drew back the presence of *Homo* from 500 000 years to 800 000 years BP.

2. To claim that the existence of all biped hominid genera like *Australopithecus*, *Paranthropus* and *Homo* was undoubtedly *inferred by abduction*.

3. To revise previously accepted hypotheses in the light of new data, for example the Laitman-Lieberman hypothesis, according to which Neandertals didn't speak. On the basis of the comparison of two Neandertal hyoid fossil bones already known with two hyoid bones from the middle Pleistocene, recently recovered in the Sierra de Atapuerca, Ignacio Martínez (2008) and the other members of the Atapuerca research group claim that both specimens "as well as the Neandertal hyoids, fall inside the modern human distribution, and all of the *Homo* fossils are clearly different from *A. afarensis* and the African apes."

4. To acknowledge the co-existence of *incompatible hypotheses* about the origin of our species: Franz Weidenreich's *multiregional hypothesis* vs. the *Out of Africa* hypothesis.

5. To accept that there are sometimes *insufficient available data for abductions*. For instance: there is insufficient evidence for the hypothesis that *Australopithecus garhi*, who lived 2.5 million years ago, preceded *Homo habilis* in the production of stone tools. Or there is insufficient available evidence for the inclusion of *Sahelanthropus tchadensis*, discovered in 2001, and *Ardipithecus ramidus*, discovered in the 1990s, in the family of biped hominids.

3.2. Earth sciences

3.2.1. *The continental drift* hypothesis

The empirical basis of the reasoning that led Alfred Lothar Wegener (1880–1930) to the *continental drift* hypothesis consisted of an enormous amount of observational data of different character:

1. *Geodetic data*: Observation, on the basis of astronomical, radiotelegraphic and radio-emission measures, of the continuous separation of Europe and America.

2. *Geophysical data*: Agreement of the Fennoscandian rebound with the isostasy hypothesis.

3. *Geological data*: Affinities between the plateaus of Brazil and Africa, and between the mountains of Buenos Aires and the Cape region, etc.

4. *Palaeontological data*: The distribution of the Glossopteris flora in Australia, South India, Central Africa and Patagonia, and of Mesosaurus in Africa and South America

5. *Palaeoclimatical data*: In *Pangea*, the Poles did not coincide with the current ones. Tropical and subtropical regions today were covered with ice 300 million years ago, whereas the Spitzberg Islands, nowadays affected by a polar climate, enjoyed a much warmer climate in the Mesozoic and in the Palaeozoic.

Wegener (1966, p. 167) himself recognizes that "The determination and proof of relative continental displacements … have proceed purely empirically, that is, by means of the totality of geodetic, geophysical, geological, biological and palaeoclimatic data … This is the inductive method, one which the natural sciences are forced to employ in the vast majority of cases." These data suggested both the hypothesis that the continents had built a super-continent, *Pangea*, in earlier times, as well as the continental drift hypothesis.

3.2.2. The *plate tectonics* model

Continental drift is not the whole truth. What causes it? How can it be explained? Since 1968 the answer has been: the plate tectonics dynamics, according to which the lithosphere consists of plates moving above an astenosphere formed of plastic materials.

Even the hypothesis of the dynamic of plate tectonics can be *abduced* itself on the basis of much new data that came to support the continental drift theory during the period 1955–1968:

1. The discovery in 1959 of the mid-ocean ridge with a rift valley, or medial rift, running along the crests of the ridges, and Harry Hess's (1906–1969) and Robert Dietz's (1914–1995) *sea floor spreading* hypothesis.

2. Motonari Matuyama's 1920s discovery of the Earth's magnetic field reversion in the Pleistocene (some 10 000 years ago), and the establishment of a chronology of the epochs of normal and inverse polarity.

3. Jim Heirtzler's discovery of the 'magic' magnetic anomaly profile, obtained over the 600-mile South Pacific ridge crest, that led to the confirmation of the *Vine-Matthews hypothesis*: "if the sea floor spreads while Earth's magnetic field reverses, then the basalts forming the ocean floor will record these events in the form of a series of parallel 'stripes' of normal and reversely magnetized rocks" (Oreskes, 2001, pp. 22–23).

Based on these discoveries, Daniel McKenzie, Robert Parker and Jason Morgan established in 1967–1968 the *plate tectonics model*: "crustal motions could be understood as rigid body rotations on a sphere". This model was completed by Le Pichon (2001, p. 216): *"a unique solution could only be obtained* by using six plates … This six-plate model accounted for most of the world's seismicity, as Bryan Isacks and his colleagues would later show."

4. Preduction in the context of discovery of *theoretical* natural sciences

For the sake of the argument, I start with Peirce's view that deduction can never originate any idea whatever. I disagree with Peirce that all "the ideas of science come to it by the way of Abduction" (CP 5.145). Thus my main aim during the rest of this paper is to answer to the question: *Can deductive reasoning be used in the context of scientific discovery?* My thesis is that it can.

If I am right, then the alleged *weakness* of the hypothetical-deductive method, which Medawar (1974, p. 289) pointed to – "The weakness of the hypothetic-deductive system, …, lies in its disclaiming any power to explain how hypotheses come into being" – would be overcome. In opposition to Medawar, I affirm that *in theoretical physics* we can extend the application of deductive reasoning to the context of discovery. Thus a new form of reasoning, preduction, becomes acceptable. This confirms Thomas Nickles's (2008, p. 446) suspicion that "even an ordinary deductive argument need not be sterile: it may be epistemologically ampliative even though it is not logically ampliative". But because of its deductive nature I prefer to conceive of preduction as an *anticipative* inference. *Anticipative inference* is not a logical concept. It merely points out that preduction deductively anticipates or puts forward some not yet acknowledged possible empirical and theoretical results.

Preduction is the way of reasoning that consists in resorting to previously accepted results *of the whole of physics*, in order to anticipate new ideas by mathematical combination and manipulation of the used results, provided that the undertaken substitutions and combinations are compatible with *dimensional analysis*. This is on the understanding that 'previously accepted results' does not mean 'accepted as true'.

A very simple example is Einstein's theoretical deduction, i.e. *preduction*, of the dual character of photons by *combination of two previous results of different theories*, special relativity and Planck's quantum physics. Indeed, from $E = cp$ (*special relativity*), and $E = h\nu$ (quantum physics), we obtain the result $p = h/\lambda$, or $\lambda = h/p$, i.e. the formulas expressing the dual behaviour of radiation.

Two more examples may be sufficient to illustrate the preductive way of reasoning in mathematical physics.

A. The critical density of the Universe.

1. Let us assume a symmetrically spherical Universe of radius R and mass $M = (4\pi R^3 \rho)/3$.

2. Let us assume now a galaxy of mass m located on the surface of the Universe. Its *Newtonian* potential energy is $E_p = -(G_N Mm)/R$, and its kinetic energy is $E_c = mv^2/2$.

3. Let us now take *Hubble's law* from *astrophysics*, which applied to present situation has the form $v = H.R$. Following this, the galaxy's kinetic energy would be $E_c = mH^2R^2/2$.

4. Thus the total energy of the galaxy, substituting the value of M in 1., becomes $E_T = mR^2(H^2/2 - 4\pi G_N \rho/3)$.

5. Now, if $E_T = 0$, then $H^2/2 = 4\pi G_N \rho/3$, whereof we obtain the value of the *critical density of the Universe*: $\rho_c = 3H^2/8\pi G_N$.

B. Schrödinger's equation

1 We start with wave theory, where a non-relativistic free particle has associated a plane wave:
$\Psi(x,t) = A_e{}^{i(kx-\omega t)} = A[\cos(kx - \omega t) + i\,\sin(kx - \omega t)]$

2.1 Then we differentiate this expression with respect to x, and apply De Broglie's postulate of *quantum physics* $\lambda = h/p$ to the wave number $k = 2\pi/\lambda$ in order to obtain $k = p/\hbar$, and finally the *momentum operator* $-i\hbar\partial/\partial x$.

2.2 We now differentiate the same expression with respect to t. Then we divide $\omega = 2\pi\nu$ by the wave number $k = 2\pi/\lambda$, and apply Planck's *quantum hypothesis* $E = h\nu$, in order to obtain $\omega = Ek/p$, and finally the *energy operator* $i\hbar\partial/\partial t$.

3 We resort now to the *classical* equation of the total energy of a non-relativistic particle as the sum of its kinetic and potential energies: $E = p^2/2m + V$.

4 Finally, we insert the values of momentum and energy operators, and obtain *Schrödinger*'s equation:
$-\hbar^2/2m.\partial^2\Psi(x,t)/\partial x^2 + V(x,t)\Psi(x,t) = i\hbar.\partial\Psi(x,t)/\partial t.$

As the above examples show, the following are the main features of preduction:

- Preduction is the way by which new factual hypotheses, theoretical laws and theoretical models can be postulated in physics by combination, compatible with dimensional analysis, of previously accepted results.

- Preduction starts with previously accepted results of the whole theoretical background that are postulated *methodologically* as premises of the inferential procedure. Since these premises have only a hypothetical character, *accepted* does not imply *accepted as true*.

- As the premises of preductive inferences are accepted results proceeding from different theories, preduction is transverse or inter-theoretical deduction. This is what makes it possible to introduce new ideas in physics.

- To preduce a new theoretical model or a novel hypothesis amounts to deductive-mathematically generating an equation or a set of coupled equations, whose consequences should fit with observations.

- Preduction is an implementation of the hypothetic-deductive method. The *specificity of preduction* lies in that it is an extension of this method to the context of discovery.

5. Some conclusions on the relationships of abduction and preduction

Preductive reasoning differs radically from abduction in that the preduced hypotheses are not suggested by the data, but they are instead deductively obtained from the available theoretical background. Abduction and preduction complement each other. Whereas abduction is the way of reasoning in observational sciences, preduction is the predominant, although not exclusive, form of discovery in theoretical sciences. Thus both ways of reasoning nearly cover the whole spectrum of discovery in the methodology of natural sciences. I call this the *complementary thesis between abduction and preduction*.

Abductive and preductive inferences are both intrinsically inconclusive. Indeed, in the case of abduction, new facts might emerge to the detriment of the conjectured explanations, thus making it reasonable to revise or even to replace them by new ones, compatible with the old and the new data. In the case of preduction, since the hypotheses, theoretical models and other preduced results depend on the available theoretical background, and since it is assumed that this one can be not true, preduction itself also becomes a fallible way of reasoning as a way of dealing with Nature.

Rather than talking about *the* method of science, I claim that it would better fit with the procedure of real science to take into account the existence of different practices or strategies in scientific discovery.[2]

References

Aliseda, A. (2006). *Abductive Reasoning. Logical Investigations into Discovery and Explanation*. Dordrecht: Springer.

Eco, U., & Sebeok, T. A. (Eds.) (1983). *The Sign of Three. Dupin, Holmes, Peirce.* Bloomington: Indiana University Press.

Flach, P. A., & Kakas, A. C. (Eds.) (2000). *Abduction and Induction. Essays on their Relation and Integration*. Dordrecht: Kluwer.

Hanson, N. R. (1958). *Patterns of Discovery. An Inquiry into the Conceptual Foundations of Science*. Cambridge: University Press.

[2] This paper is a part of my research project FFI2009-10249, supported by the Ministry of Science and Innovation of the Kingdom of Spain, and of my contribution to the research group of reference 930174, financed by the Universidad Complutense of Madrid. I am very grateful to an anonymous referee for helpful comments on an earlier version of this paper.

Harman, G. H. (1965). “The Inference to the Best Explanation.” *The Philosophical Review*, 74(1), 88–95.

Josephson, J. R., & Josephson, S. G. (Eds.) (1994). *Abductive Inference. Computation, Philosophy, Technology*. New York: Cambridge University Press.

Le Pichon, X. (2001). “My Conversion to Plate Tectonics.” In N. Orestes (Ed.), *Plate Tectonics*. Boulder: Westview Press.

Lorenzo, C. (2005). “Primeros homínidos. Géneros y especies.” In E. Carbonell (Ed.), *Homínidos: Las primeras ocupaciones de los continentes.* Barcelona: Ariel.

Magnani, L. (2001). *Abduction, Reason and Science. Processes of Discovery and Explanation.* New York: Kluwer/Plenum Publishers.

Magnani, L. (Ed.) (2006). *Model Based Reasoning in Science and Engineering.* London: College Publications.

Martínez, I. et al. (2008). *Human Hyoid Bones from the Middle Pleistocene Site of the Sima de los Huesos* (Sierra de Atapuerca, Spain). *J. Hum. Evol.* 54(1), 118–124.

McKenzie, D. (2001). “Plate Tectonics: A Surprising Way to Start a Scientific Career.” In N. Oreskes (Ed.), *Plate Tectonics.* Boulder: Westview Press.

Medawar, P. (1974). “Hypotheses and Imagination.” In A. Schilpp (Ed.), *The Philosophy of Karl Popper.* La Salle: Open Court.

Nickles, T. (2008). “Scientific Discovery.” In Psillos, S. & Curd, M. (Eds.), *The Routledge Companion to Philosophy of Science.* London: Routledge.

Noonan, J. P. et al. (2006). “Sequencing and Analysis of Neanderthal Genomic DNA.” *Science*, 314, 1113–1118.

Oreskes, N. (2001). “From Continental Drift to Plate Tectonics.” In N. Oreskes (Ed.), *Plate Tectonics.* Boulder: Westview Press.

Putnam, H. (1981). *Reason, Truth and History.* Cambridge: University Press.

Sclater, J. G. (2001). “Heat Flow under the Oceans.” In N. Oreskes (Ed.), *Plate Tectonics.* Boulder: Westview Press.

Wegener, A. L. (1966). *The Origin of Continents and Oceans.* New York: Dover.

Woods, J. (2004). *The Death of Argument. Fallacies in Agent Based Reasoning.* Dordrecht: Kluwer.

Towards a Complex Variable Interpretation of Peirce's Existential Graphs

Fernando Zalamea
Universidad Nacional de Colombia

1. Background

Peirce's existential graphs were introduced in the period 1890–1910, as alternative forms of logical analysis. The three basic characteristics of the graphs lie in their specific ways to transfer logical information: *diagrammatic*, *intensional*, *continuous*. Peirce's systems of existential graphs contrast thus with the usual logical systems, whose algebraic, extensional and discrete emphases are closer to the specific conceptual combinatorics of set theory.

For almost a century, Peirce's graphs were forgotten, and only began to be studied again by philosophy Ph.D. students oriented towards logical research. Roberts (1963) and Zeman (1964) showed in their dissertations that Peirce's systems served as complete axiomatizations for well-known logical calculi: Alpha equivalent to classical propositional calculus, Beta equivalent to first-order logic on a purely relational language, fragments of Gamma equivalent to propositional modal calculi between S4 and S5. On another path, Burch (1991) showed that a relational fragment of Beta represented a genuine intensional logico-topological calculus, not reducible to an extensional relational calculus inside set theory.

The "standard" presentations of the graphs (see for example Roberts, 1973; Shin, 2002) have underlined the visual interest of the systems, but have just emphasized their originality as a diagrammatic *language*. The combinatorial syntax of the graphs has been described recursively in

Shin (2002), and a classical semantical interpretation has been proposed in Hammer (1998). On the other hand, the topological potentialities of the graphs were explored in Kauffman (2001), and their ties with game theory were studied in Pietarinen (2006).

Nonetheless, the profound connections of the graphs with *central areas in mathematics* have just beginning to be unravelled, thanks to two groundbreaking papers by Geraldine Brady and Todd Trimble. Inserting the graphs in the context of *monoidal categories*,[1] Brady & Trimble (2000a) have showed that *(a)* every Alpha graph gives rise to an algebraic operation in an algebraic theory in the sense of Lawvere (a particular case of a monoidal category); *(b)* Alpha's deduction rules can be obtained through factorization of "forces".[2] These are important results which open the way to a new combinatorial handling of the graphs, profiting from advanced techniques in categorical logic (Borceux, 1994; Jacobs, 1999). On the other hand, Brady & Trimble (2000b) have indicated how to represent Beta graphs by means of a category-theoretic relational calculus associated to a first-order theory. The representation does not use Freyd's allegorical calculus, nor Lawvere's hyperdoctrines, but a medium-complexity representational calculus, with "logical functors" which create quantifiers and which verify a "Beck-Chevalley" condition.[3] The free relational category which allows the representation is put in correspondence with a (monoidal) category of chord diagrams, using ideas from Joyal & Street (1991).

In spite of the preceding work, the advances obtained in a mathematical understanding of Peirce's graphs do not contemplate two of their main features: **intensionality** and **continuity**. The combination of the *intensional*

[1] Monoidal categories are categories equipped with a tensor functor, thanks to which a natural notion of abstract monoid can be defined. Monoidal categories are ubiquitous: cartesian categories (in particular, the category of sets), free word-category over *any* category, endofunctors category over *any* category, category of R-modules over a commutative ring R, etc. The abstract monoids definable in the monoidal category incarnate in the usual monoids, triples (or monads), R-algebras, etc.

[2] Given a monoidal category $\mathbf{C}$ with tensor product $\otimes$, and given a contravariant functor $F\colon \mathbf{C} \to \mathbf{C}$, a force for F is a natural transformation $\theta_{ab}\colon F(a) \otimes b \to F(a \otimes b)$. The forces, introduced by Max Kelly in the 1980's to solve difficult coherence problems (reduction of the commutativity of an infinity of diagrams to the commutativity of finite of them), have emerged afterwards in domains farther apart: curvatures in grassmannians, sub-riemannian geometry, weak forces in subatomic physics, counting operators in linear logic, etc. Here, the forces appear in another unexpected context: intuitionistic logic and existential graphs.

[3] Beck-Chevalley is a categorical expression of the syntactical idea that substitution of bound variables does not affect a logical formula. It corresponds to type uniformization in rewriting rules, and it also appears in mathematics around ideas of uniformization in some classes of algebras (algebraic groups: Chevalley; algebraic functors: Beck).

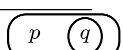
character of the graphs, expressed by the fact that an Alpha cut around p is just the opposite[4] of a Venn (extensional) diagram around p, and of its *topological* character, expressed through the continuity calculus (iterations and deiterations) of the line of identity, show that Peirce's graphs should be closer to a logic akin to intensional and topological considerations, that is, in fact, closer to intuitionistic logic (on this, the forthcoming papers Oostra (2011) and Zalamea (2011) should produce new lights).

On the other hand, if one considers the continuous plane where evolves Beta information, and the book of sheets where may evolve Gamma information, one can see that Peirce's graphs may be treated with some tools of complex analysis: *residues* for Alpha, *analytic continuation* for Beta, *Riemann surfaces* for Gamma. Moreover, since one of the natural models for the *logic of sheaves* (see Caicedo, 1995) is the fibration of germs of analytic functions, a natural connection between existential graphs and the logic of sheaves should emerge. In this case, Peirce's existential graphs would enter into the very core of mathematical knowledge, and could even help to understand the elusive "logic of complex variables".[5]

In the remaining parts of this paper, we provide some advances, but mostly guesses and conjectures, around what has been announced in our last paragraph.

2. A complex variable interpretation of Peirce's graph

The usual model for Peirce's Alpha and Beta graphs is imagined as a "sheet of assertion", where, on one hand (Alpha), nested cuts are marked in order to represent combinations of classical propositional formulas built on negation ("cut") and conjunction ("juxtaposition"), and, on the other hand (Beta), continuous lines are marked in order to represent existential quantification. In this *modus* of representation, a *superposition* between continuity (Beta) and discontinuity (Alpha) is *essential* for the good sake of the calculus: while Alpha is restricted to non over crossing, nested diagrams, Beta requires *crossing*, *not nested* diagrammatical procedures to obtain its full capability of representation. In fact, all the power of the *line of identity*

[4] If a graph of the form  represents in Peirce's view the implication $p \to q$, the Venn extensional reading of the diagram produces exactly the opposite inclusion (implication): $\{x : q\} \subseteq \{x : p\}$.

[5] The *stability* of the complex additive-multiplicative plane (C, +, . , 0, 1) has been a source of many developments in model theory. On the other hand, the *instability* of the complex exponential is now under careful study (Zilber) and may hold some of the profound secrets of the logic of complex variables.

(the continuous line which represents existential quantification) rests in its ability to cross Alpha cuts, since the iterations and deiterations of the line correspond *precisely* to the use of *normal forms* in the associated underlying first-order logic.

This Beta superposition or crossing has not been sufficiently considered in its full, central, importance for the machinery of the graphs. If one would take it seriously, it would lead to *(i)* a study of the forms of continuity (Beta) and discontinuity (Alpha) present on the sheet of assertion, and, more significantly, to *(ii)* a study of forms of logical transfers (possibilities of proofs) and obstructions (impossibilities of proofs) as forms of *topological transfers (continuations) and obstructions (singularities)*. In a sense, this would lead then to a sort of homological bridging between the logical and the topological, but in an *inverse way* to the direction that usual homological machineries are produced.[6]

If the sheet of assertion is viewed as an infinite plane, the usual understanding of the sheet identifies it with the cartesian plane $\mathbf{R}^2$, an identification which helps to understand program *(i)* just indicated. But then, the topological transformations of the plane $\mathbf{R}^2$, viewed as transformations of two real variables, are highly artificial, fortuitous, hazardous – far from being "tame" in Grothendieck's sense –, and it would be very astonishing that the natural, universal, structural, logical *calculi* encoded in the graphs could be surfacing in some real variable calculations. Another *completely different* perspective is obtained if we view the infinite sheet of assertion as the **complex plane C**. If, extensionally, looking just as sets, the cartesian plane $\mathbf{R}^2$ and the complex plane $\mathbf{C}$ are identical, *intensionally*, with their extremely different *calculi* of real variables and complex variables, the two planes differ in profound ways. Since the graphs do involve intensional logical information, it seems from the outset that the distinction may be fruitful. We will see that many additional technical ingredients support this view.

Program *(ii)* may in fact be well-founded on the theory of functions of complex variable. The analytical (also called holomorphic) functions can be described both locally (through power series expansions: Weierstrass)

[6] A *homology* is usually constructed to be able to understand the topological through the algebraic: *given* a topological space, a homology for the space is a chain of abelian groups which captures parts of the continuous information (deformations) of the initial space. A *cohomology* of the space is a homology with the order of the chain reversed, which gives rise to easier constructions in the chain: pullbacks, products, etc. In our proposal, instead of evolving *from* topological data, we would be going *towards* the topological, profiting in first instance from the known logic behaviour of the graphs (Roberts, 1963; Zeman, 1964).

and globally (through elliptic partial differential equations: Cauchy, Riemann), and the *good solidarity* between the local and the global explains their excellent (not artificial, not fortuitous, not hazardous) behaviour. Many technical accomplishments in the theory express this solidarity. A qualitative breakthrough is obtained when we observe, not only the *recto* of the **analytical functions**, but also its *verso*: the **meromorphic functions**, which are analytical functions with (well controlled) singularities. Two main results which express the transitions between the holomorphic and the meromorphic are particularly important in our perspective: **analytical continuation** and **Cauchy's residues theorem**. An analytical continuation allows to extend ("iterate") a given analytical function (on a well-behaved region of the plane **C**) to a meromorphic function (over a larger region, with singularities allowed). Cauchy's theorem allows expressing the value of an analytical function at a given *point*, through the calculation of values ("residues") of a small meromorphic variation of the function in the *boundary* of a region enclosing the point (for details and a wonderful *diagrammatical* presentation, see Needham (2004)).

As can be guessed from the preceding discussion, the *recto* and *verso* of Peirce's sheet of assertion may be modelled by the *analytical realm* and the *meromorphical realm* on the complex plane. This allows to model the *discontinuous Alpha cut* (which, in Peirce's original intuition, allows to pass from the *recto* to the *verso* of the sheet) as a (complex variable discontinuous) *operation* which allows to pass from analytical functions to meromorphic functions. Examples of such operations abound (the most natural being $f(1/z)$ or $1/f(z)$, which produce natural meromorphic functions associated to the analytical $f(z)$), and a specific choice of the operation depends on the additional Alpha rules that are required on the cut. Juxtaposition can also be modelled in different ways, for example through the product of functions, or through the product of its exponentials ($exp(f+g)$). Truth ("blank" in the *recto*) can be modelled by some sort of "smoothest" analytical function, for example $exp(z)$, and Falsity ("pseudograph" in the *verso*) by some sort of "wildest" meromorphic function, for example $exp(1/z)$[7].

[7] The singularities of the meromorphic functions are usually controlled by their negative degrees in power series expansions; if the degree is finite, the singularity is called a *pole*; if the degree is infinite, the singularity is called an *essential singularity*. The meromorphic function $exp(1/z)$ possesses an *essential singularity* at 0. An outstanding theorem in the theory of functions of complex variable (Picard's big theorem) asserts that $exp(1/z)$ attains all values (except at most one) in **C**, an *infinite* number of times, around *any* neighborhood of 0, however small. This *extreme* meromorphic behaviour can thus be very well related to Falsity. *Between* the extremes (Truth – Falsity), that is between $exp(z)$ and $exp(1/z)$, lies a profound hierarchy of

Alpha erasure (on a *recto* side inside a nest) corresponds to an identification of a product of analytical functions with an analytical one, while Alpha insertion (on a *verso* side) corresponds to the identification of a product of analytical and meromorphic with meromorphic. Finally, one can conjecture that the fundamental[8] Alpha iteration and deiteration rules originate a calculus of *homotopy classes* which is yet to be precisely explored.

The heuristics behind a complex variable interpretation of Beta depends on the understanding of the iteration of the line of identity *across Alpha cuts* as an analytic continuation of the line in the complex plane. The geometrical insight seems to be the correct one, since analytical *complex* continuation is *precisely* a specific procedure to pass from the analytical realm to the meromorphical realm, in perfect analogy with the procedure of extending the line of identity from regions with less cuts ("more" analytical) to regions with more cuts ("more" meromorphic). Here, the conjecture is that some (complex variable, topological) *calculi* related to analytical continuation may capture the (logical) deformations of the line of identity. A guide to a formalization of these *calculi* may be provided by Cauchy's residues theorem, *if* one can interpret a (logical) region with an Alpha cut as a (complex variable, topological) region with a *pole*. The lines of identity can then be modelled by affine bounded linear functions, and their crossings through Alpha cuts as meromorphic deformations of the line near the poles attached to the cuts. Then, on one hand, a calculus of singularities (residues) may provide a discrete rendering of the nested Alpha cuts, and, on the other hand, the Beta iteration of the lines of identity may be related to their analytical continuation around the boundaries of the regions with prescribed poles.

Going beyond classical first-order logic, Peirce's Gamma graphs help to diagram modal *calculi*. Peirce imagined two completely original ways to picture the modalities: using "tinctures" on the sheet of assertion, or constructing a "book of sheets" to enlarge our possible worlds. Since (an adequate) modal propositional logic is known to be equivalent to monadic first-order classical logic (modalities represented by monadic predicates), the *spreading* of regions (that is, extensions of predicates) in the complex

analytical and meromorphic functions which should be used to model a logic of continuous truth-values beyond the classical discrete dichotomy. For a discussion of the philosophical issues that hinder our understanding of the passages between the continuous and the discrete, and for a study of the role of the existential graphs to facilitate that understanding, see Zalamea (2007).

[8] Caicedo has shown that iteration/deiteration is *the* fundamental adjointness that defines a general intuitionistic connective. See Caicedo & Cignoli (2001).

plane may then help to understand the *hierarchy* of modalities. Thus, beyond iterating the lines of identity (Beta), a spreading of regions (Gamma) encompasses some valuable underlying logical information, usually not considered. Here, in the theory of complex variables, many tools are available for the understanding of those "spreadings", and a connection between the logical aspects of the situation (modalities) and its geometric ones (representations, modulations, modularities) could provide astonishing new perspectives.

But perhaps the most promising path in the unravelling of a global complex variable interpretation of the graphs lies in interpreting Peirce's "book of sheets" as a full **Riemann surface**.[9] Beyond the *discrete* interpretation of the "book of sheets" as a Kripke model, on which the modalities receive their usual possible worlds semantics, the interpretation of the Book as a *continuous* Riemann surface provides many additional advantages. First, the Riemann surface *unifies in a single mathematical object* the various partial complex variable models for Alpha, Beta and Gamma. Second, a Riemann surface inherits a calculus of projections (see figure 1) which expresses, with new mathematical *content*, some logical correlations between propositional, first-order and modal levels. Third, a Riemann surface is a natural context for *blowing up*[10] in fibrations (see Petitot, 2003), which corresponds to constructing infinitesimal disks around blowed-up

[9] The concept of a Riemann surface (1851) answers in technical terms, in the complex variable situation, the general (philosophical) problem of glueing a Multiplicity into the One. In simple terms, the basic idea beyond a Riemann surface consists in representing a multivalent algebraic relation $r(z, w) = 0$ between a complex variable z (in the domain of the relation) and a complex variable w (in its codomain), thanks to a covering of the complex plane by a pile of planes, corrugated and holomorphically "glued", that represent the different possible values of w for given values of z. If, for a given $z0$, the equation $r(z_0, w) = 0$ has n roots, then n corrugated planes emerge ("sheets" of the Riemann surface) that cover the z-plane in a neighborhood of z_0. For some exceptional values of z ("ramification points"), the sheets are fused when the roots coincide, and the local expansions of w behave as fractionary powers of z (corresponding to the algebraic resolutions of the relation). Using the representations of the relations $w = z^{n/m}$ all usual Riemann surfaces (compact and oriented) can then be classified. Instead of working with the usual complex plane $\mathbf{C}$, it is easier to handle the projective plane $\mathbf{P}$ (adding a point at infinity), and, in that case, the Riemann surface of $w = z^{1/2}$ is homeomorphic to a sphere, while the Riemann surface of $w = z^{3/2}$ is homeomorphic to a torus. For a modern introduction (accessible and complete) to Riemann surfaces, see Fulton (1995), part X ("Riemann surfaces"), pp. 261-311.

[10] *Blowing-up* is a process to eliminate singularities in singular curves, introduced in projective algebraic geometry at the beginning of XXth century. If a curve in the complex plane possesses a singular point with ramification (different tangents at the point), the ramification comes to be *separated* in the blowing-up, and in the associated fibration the singular crossing is overcome.

points (an idea of Cartier), which in turn may correspond to infinitesimal spreadings of modal (that is, monadic first-order) properties.

Last but not least, the Riemann surface interpretation supports the understanding of logic that has emerged in the second part of XXth century. In fact, if a logic must be understood as a class of structures (Lindström) for which some logical axiomatizations serve as coordinatizations, and if the work of the contemporary logician lies in her tendency to look for fine invariants for classes of models (Shelah, Zilber), the unravelling of some mathematical *calculi* behind logical representations (as the complex variable *calculi* here suggested) explains also the *precedence of the geometrical under the logical*: a feature that Peirce constantly advocated, and that model theory and category theory are now proving with an extended range of new tools.

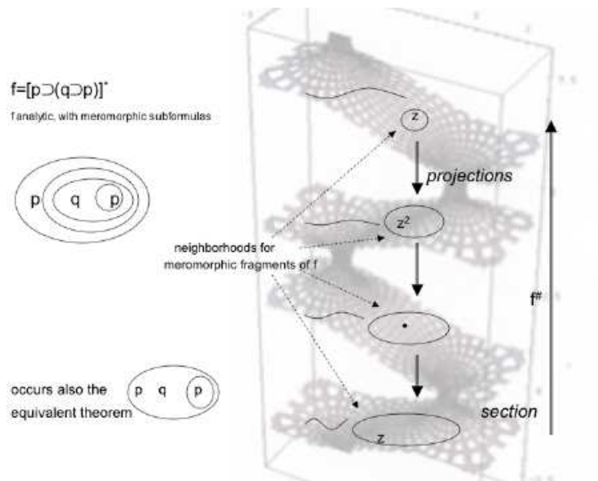


Figure 1: A Riemann surface for an existential graph

3. A category-theoretic perspective

The correspondence between the sheet of assertion with its logical transformations (codified in Alpha, Beta, Gamma) and the complex plane with its meromorphic transformations (along residues, analytic continuation and Riemann surface projections) is constructed over a deeper level of logical/topological correspondences, which becomes explicit when the logical viewpoint becomes **intuitionistic**. In fact, on the one hand, from a logical perspective, Peirce's graphs, which were constructed classically,[11] can be better understood intuitionistically (Oostra, 2011). And, on the other hand, from a topological perspective, the graphs capture some continuous combinatorics that cannot be reduced to discrete ones (Burch, 1991).[12] Thus, the *natural* surrounding where the graphs evolve is intuitionistic, both for logical *and* topological reasons.[13]

Brady & Trimble (2000a; 2000b) propose fine categorical models for *classical* Alpha and Beta, but nothing in their construction prevents to extend their ideas to the intuitionistic case (Zalamea, 2011). The boolean functors appearing in the proofs can be modified, and, instead of working in the category of Boolean algebras, their targets can be redirected to take values into three alternative categories: *(a)* the category of Heyting algebras (natural algebraic models for intuitionism), opening the way to intuitionistic fibrations; *(b)* the category of Stone spaces (natural topological models for intuitionism and modalities), opening the way to topological fibrations; or, *(c)* the category of subalgebras of meromorphic functions, opening the way to *complex variable fibrations*.

A functorial approach to these three alternatives, looking for their category-theoretic connections, is also related to the understanding of the intrinsic logic of sheafs of germs of holomorphic functions, a particular case of the **logic of sheaves** of first-order structures studied in Caicedo (1995). Caicedo has shown in fact that the logic of sheaves is intrinsically *intuitionistic*, and that it becomes classic only on very particular cases, depending on the structures at hand. In the case of the monoidal category of algebraic operators studied by Brady & Trimble, the sheafs definable over its natural *site* (in Grothendieck's sense) should turn out to be intuitionistic (Zalamea, 2011).

[11] Peirce's construction of the graphs is classical, mainly because classical logic was the logic emerging in Peirce's time (the influence of De Morgan on Peirce was determinant, for example, and De Morgan laws are a classical paradigm). Nevertheless, beyond the diachronic moment, Peirce's *natural* interest for a logic akin to topological considerations (continuity, synechism, neighborhoods, modalities) is permanent in his writings (see Havenel, 2006; Zalamea, 2001; 2003), and, in fact, well-behaved *intuitionistic diagrams* (without the name, but including the spirit) appear explicitly in Peirce's handwriting (see Oostra, 2011).

[12] Peirce's *theorematic* "reduction thesis" (as proved by Burch), with his *need* of the three categories, shows that the relational bonding of the graphs *cannot* be treated just as set-theoretic composition (where, using Kuratowski pairs, only two categorical levels are needed to reproduce the third).

[13] Since Tarski's Polish years, it is well known that the collection of opens sets in a topology is a sound and complete model for the intuitionistic propositional calculus. Lawvere showed many years later that the natural underlying logic of an elementary topos is also intuitionistic.

In that case, *a full circle of natural conceptual approaches to Peirce's graphs* would then be achieved, merging together the logical-topological-analytical-categorical, and inserting Peirce's graphs in the very core of mathematical knowledge (sheaf theory and complex analysis).[14]

Departamento de Matemáticas
Universidad Nacional de Colombia
`http://www.matematicas.unal.edu.co/~fzalamea`

References

Borceux, F. (1994). *Handbook of Categorical Algebra.* Cambridge: Cambridge University Press.

Brady, G. & Trimble, T. (2000a). "A Categorical Interpretation of C. S. Peirce's Propositional Logic Alpha." *Journal of Pure and Applied Algebra*, 149, 213–239.

Brady, G. & Trimble, T. (2000b). "A String Diagram Calculus for Predicate Logic and C. S. Peirce's System Beta." Preprint.

Burch, R. (1991). *A Peircean Reduction Thesis. The Foundations of Topological Logic.* Lubbock: Texas Tech University Press.

Caicedo, X. (1995). "Lógica de los haces de estructuras." *Revista de la Academia Colombiana de Ciencias Exactas, Físicas y Naturales*, 19(74), 569–585.

Caicedo, X. & Cignoli, R. (2001). "An Algebraic Approach to Intuitionistic Connectives." *Journal of Symbolic Logic*, 66, 1620–1636.

Fulton, W. (1995). *Algebraic Topology. A First Course*. New York: Springer.

Hammer, E. (1998). "Semantics for Existential Graphs." *Journal of Philosophical Logic*, 27, 489–503.

Havenel, J. (2006). "Logique et mathématique du continu chez Charles Sanders Peirce." Ph. D. Thesis, EHESS (Paris).

Jacobs, B. (1999). *Categorical Logic and Type Theory*. Amsterdam: North-Holland.

Joyal, A. & Street, R. (1991). "The Geometry of Tensor Calculus I." *Advances in Mathematics*, 88, 55–112.

Kauffman, L. (2001). "The Mathematics of Charles Sanders Peirce." *Cybernetics and Human Knowing*, 8, 79–110.

Needham, T. (2004). *Visual Complex Analysis.* Oxford: Clarendon Press.

Oostra, A. (2011). "A Lattice of Intuitionistic Existential Graphs Systems" (Forthcoming).

[14] Acknowledgment (2010). Corrections suggested by an anonymous referee have improved the paper. Some remaining obscurities are due to the yet programmatic character of our proposals.

Petitot, J. (2003). "The Neurogeometry of Pinwheels as a Sub-Riemannian Contact Structure." *Journal of Physiology*, 27, 265–309.

Pietarinen, A. V. (2006). *Signs of Logic. Peircean Themes on the Philosophy of Language, Games, and Communication.* Dordrecht: Springer.

Roberts, D. (1963). *The Existential Graphs of Charles S. Peirce.* Ph.D. Thesis, University of Illinois.

Roberts, D. (1973). *The Existential Graphs of Charles S. Peirce.* The Hague: Mouton.

Shin, S. J. (2002). *The Iconic Logic of Peirce's Graphs.* Cambridge: MIT Press.

Zalamea, F. (2001). *El continuo peirceano. Aspectos globales y locales de genericidad, reflexividad y modalidad.* Bogotá: Universidad Nacional.

Zalamea, F. (2003). "Peirce's Logic of Continuity: Existential Graphs and Non-Cantorian Continuum." *The Review of Modern Logic*, 9, 115–162.

Zalamea, F. (2007). "Ostruzioni e passaggi nella dialettica continuo / discreto. Il caso dei grafi essistenziali e della logica dei fasci." Dedalus. *Rivista di Scienza, Filosofia e Cultura*, 2–3, 20–25.

Zalamea, F. (2011). "Category-Theoretic Models for Intuitionistic Existential Graphs Systems" (Forthcoming).

Zeman, J.J. (1964). *The Graphical Logic of C. S. Peirce.* Ph.D. Thesis, University of Chicago.

Challenges and Opportunities for Existential Graphs

Ahti-Veikko Pietarinen
University of Helsinki

1. Introduction

In 1896–1911, Peirce developed a number of novel systems of diagrammatic logic, commonly known as Existential Graphs (EGs). He divided them to the alpha, beta, gamma and delta parts. They contain, among others, the diagrammatic counterparts to propositional logics (alpha), fragments of first-order logics with identity (beta), modal and quantified multimodal logics, higher-order logics, meta-assertions similar to Gödel numbering, and logics for non-declarative assertions (gamma/delta).

Despite obviously being ahead of their time, EGs have played an unusual role in the early development of modern symbolic logic. I will deal with this curious history in a sequel to the present paper. I will confine the present study in what I take to be the major challenges as well as opportunities this recently resurrected diagrammatic and iconic logical method faces from the points of view of contemporary philosophy of logic, reasoning and cognitive representation.

Hammer's (2002) review of some basics of EGs ends with a dissuading note: "a diagrammatic logic is simply a logic whose target objects are diagrams rather than sentences. Other than this, diagrammatic logics and logics involving expressions of some language are not different in kind" (Hammer, 2002, p. 421). The purpose of the present paper is also to demonstrate that the relationship between diagrammatic and sentential approaches to logic is not at all as straightforward and simple minded as Hammer would have us believe.

I will assume that the basics of the theory of EGs are known to the reader (see, e.g., the bibliography of Liu, 2008).

2. The iconicity of logical constants

Peirce desired EGs to function as a new way of expressing logical notions in a diagrammatic, spatial, topological and iconic instead of the unilinear and symbolic manner. However, he did not come to contemplate them merely to create an alternative notation by means of which to do logical modeling, linguistic representation or deductive reasoning. He was simply not well versed to grasp the meaning of linguistic expressions if one has to stick to the symbolic and serial modes of expressions:

> I do not think I ever *reflect* in words: I employ visual diagrams, firstly because this way of thinking is my natural language of self-communion, and secondly, because I am convinced that it is the best system for the purpose. MS 619:8 [1909], "Studies in Meaning"

Earlier, he had defined such schematizations to be diagrams that are certain iconic representations of facts and which may, but need not be, visual:

> We form in the imagination some sort of diagrammatic, that is, iconic, representation of the facts, as skeletonized as possible. The impression of the present writer is that with ordinary persons this is always a visual image, or mixed visual and muscular; but this is an opinion not founded on any systematic examination.
> CP 2.778 [1901], "Notes on Ampliative Reasoning"

It was essential towards realizing his goals that all logical notions and conventions are given a solid philosophical justification. In 1902, Peirce published the article "*Symbolic Logic* or *Algebra of Logic*", co-authored with his former student Christine Ladd-Franklin, in the influential and widely referenced Baldwin's *Dictionary of Philosophy and Psychology* (Peirce 1902, pp. 640-651, printed, with omissions, in CP 4.372-4.393). That article presents a comprehensive exposition of the propositional (alpha) and the first-order (beta) parts, including a complete proof system for the alpha graphs, and not only. Diagram logics are subsumed under the wider notion of an "analytical" method for representing logical ideas, the purpose of which is "simply and solely the investigation of the theory of logic, and not at all the construction of a calculus to aid the drawing of inferences" (Peirce, 1902, p. 645). The article recognizes it "as a defect of a system intended for logical study that it has two ways of expressing the same fact" (ibid., p. 645), whereas diagrammatic notions can unify what under the calculus conception would involve different logical constants for the expression of the same facts.

For example, the soon-to-be-emerging design of formalized conception of logic has the defect of ripping apart one underlying fact of the logical universe of discourse, turning the parts into the separate notations for existence (existential quantification), predication (predicate terms and bound variables) and identity (a special two-place relation). In EGs these are all expressed by the same, iconic sign of the line of identity. The result is said to be "by far the best *general* system which has yet been devised" (Peirce, 1902, p. 649) and "the only perfectly analytic method of logical representation known" (MS 284 [1905], "The Basis of Pragmaticism"). Other notions of symbolic logic, which were soon to find their foundational value in being able to ape mathematical calculi, would have to be rated not "as much higher than puerile" (MS 499 [1906], "On the System of Existential Graphs Considered as an Instrument for the Investigation of Logic").[1]

Yet soon after Peirce's death, the focus on logic had already turned to other matters. Fueled by the reception of Wittgenstein's *Tractatus* (1921), Bertrand Russell had launched a new campaign promoting the idea of uninterpreted, purely formal languages. It turned its back on the algebraic tradition, the birthplace of diagrammatic logic, in its redefinition of symbolic logic. Peirce's 1902 entry on symbolic logic in Baldwin's *Dictionary* conjoined "symbolic" with "diagrammatic" and thus with algebraic thinking.[2]

And so symbolic logic came to take a different turn from the prospectus set out in the dictionary article. That article placed a great importance

[1] The allusion is to Peano's pasigraphy: "Peano's system is no calculus; it is nothing but a pasigraphy; and while it is undoubtedly useful, if the user of it exercises a discrete freedom in introducing additional signs, few systems of any kind have been so wildly overrated, as I intend to show when the second volume of Russell and Whitehead's *Principles of Mathematics* appears" (MS 499). For Peirce logic is "not intended for a plaything"; it is neither any universal system of expression nor a calculus in its limited sense: "This system [of logical algebras and graphs] is not intended to serve as a universal language for mathematicians or other reasoners, like that of Peano. [And this] system is not intended as a calculus, or apparatus by which conclusions can be reached and problems solved with greater facility than by more familiar systems of expression" (CP 4.424 [c.1903]). To these two requisites Peirce adds that he has excluded any considerations of human psyche that may have been involved in those traits of thinking that led to the inventions of the signs employed in his systems of EGs.

[2] A singular reason for Russell's sea change seems to have been Peirce's dismissive October 1903 book notice in the Nation on his *Principles of Mathematics*, which according to F. C. S. Schiller had driven him "hugely annoyed" at once (Schiller to Welby, 26 November 1903; see Pietarinen 2009).

on the iconic nature of logical thought – not that different from contemporary semantic and model-theoretic perspective (Pietarinen, 2006a) – while the soon-to-be-prevailing Frege–Russell conception was calculated to begin the theory development with uninterpreted constants and rules of inference. Peirce surely recognized the interest in such purely formal rules as such. At one point he termed them the "Code of Archegetic Rules" of transformation (MS 478:151).[3] He then delineated the "purely mathematical definition" of EGs "regardless of their interpretation" (MS 508), which will be useful to portray the proof-theoretic components of the general theories of the alpha, beta and gamma parts.[4] But such an uninterpreted language alone would not meet the ends and purposes of *theorematic* logical reasoning. Likewise, any unrestrained acceptance of uninterpreted non-logical vocabularies to logical studies would have countered his entire project of being able to conceive "logic as the theory of semeiotic", without which genuine scientific discovery would not be possible at all (MS 336 [c.1904], "Logic viewed as Semeiotics"; cf. MS 337).

In sum, EGs imply the failure of what Hintikka (1979) has termed the Frege-Russell ambiguity thesis. The thesis states that the verb for *being* is multiply ambiguous and that the logic should reflect the underlying logical difference between the multiple uses the verb for *being* has. However, in EGs, the line of identity represents predication, identity, existence, and class-inclusion, all in one go. Consequently, it is the one logical sign of a line that is able to capture all the varieties of *being*.[5]

The tendency towards greater unification and simplification in logical notation has not only the benefit of greater cognitive economy and efficiency of expression and communication of diagrammatic assertions but is also something necessitated by the age-old Aristotelian understanding of

---

[3] The systems of transformation rules is sound, since "the rules are so constructed that the permissible transformations are all those, and all those only, by which it is logically impossible to pass from a true graph to a false one." This explanation "is no part of the rules, which simply permit, but do not say why" (MS 478:150). The system of rules is announced to be complete by virtue of the fact that "none of its rules follows as a consequence from the rest, while all other permissibilities are consequences of its rules" (MS 478:151).

[4] That part of the gamma part I have in mind here concerns the "potentials" and not the broken-cut modal logics, the former of which give rise to higher-order graphs in which the quantificational lines refer not to individuals but to what according to Peirce's curious remarks are the "strange kinds" of "proper names" that are "substantive possibilities" and devoid of individualities (MS 508, "Syllabus B.6").

[5] We can add anaphora here, too: "A dean dances in the park. He sings" = "A dean dances in the park and is singing". So aside from predication, identity, and existence, the same notation takes care of coreference, too.

being qua being, represented as lines qua lines and not through anything else. However, the fact that there are multiple yet logically equivalent readings of graphs does not imply ambiguity in such representations. Unlike Shin (2002), we need not puzzle over what the "visually clear" and "intuitive" ways of "reading off" these graphs may be. Ambiguity is a natural-language phenomenon and as such does not carry over to the iconic realm of diagrammatic expressions.

My argument above is thus merely to accentuate the importance of understanding the meaning of EGs as icons, not through translation to sentences of propositional, first-order or modal logics. Diagrams appear to enjoy such cognitive economy that is hardly encountered in the convention-based symbolic systems of logical languages.

What, then, is the meaning of logical constants? Where does their meaning come from? A new answer could be sought for in the diagrammatic iconicity of logical expressions. Negation, conjunction, implication and quantification are iconic signs and hence capable of expressing their own meaning. Negation is an operation of incision of an area of a graph from the space of assertion in question followed by a reversal of that area; conjunction is juxtaposition of assertions in the space; given two nested cuts, implication is ability to continue a passage from the area of an outer cut area to the area of the inner cut; quantification is a dot or a continuous line the extremities of which hit upon certain elements in the domain of discourse of the topological manifold of all potential assertions. Hence the meaning of logical constants is not something that follows from inference or transformation rules.

A further argument supporting my result is that it is impossible to diagrammatize the infamous TONK connective by any transformation rules. That connective takes the introduction side from the disjunction rule and the elimination side from the conjunction rule and merges these into the one mock rule for the TONK connective. However, there is no way of erasing a negated graph from a negative area which is not a result of any iteration.[6] As far as the meaning of logical constants is concerned, therefore, the iconicity of logical signs in EGs makes use of the nature of the space within which they are scribed and hence is a feature that has to precede any conception of the deductive component of transformations.

The fact that logical constants may be spatial arrangements that need not follow the linearity of time was much later reaffirmed by Enderton:

[6] At least not in two or three-dimensional, instead of four or higher-dimensional sheets of assertions.

> We speak in real time, and real time progresses linearly. [...] But formal languages are not spoken (at least not easily). So there is no reason to be influenced by the linearity of time into being narrow-minded about formulas. And linearity is the ultimate in narrowness.
>
> Enderton, 1970, p. 393

Enderton refers here to partially ordered quantifiers, which as noted may well provide a symbolic counterpart to those "stereoscopic" graphs Peirce's alluded to in a June 1911 letter (MS L 231). In the letter, he in fact maintains that the rational parts exhibited in diagrammatic syntax "are really related to one another in terms of relations analogous to those of the assertions they represent," and hence, "in studying this syntax we may be assured that we are studying the real relation of the parts of the assertions and reasoning," which is not the case "with the syntax of speech" (MS L 231:10). He notes the syntax of speech to be restrictively linear, much like two-dimensional algebra is in comparison with, say, the topological higher-dimensional algebras.

At present we certainly have the 'heterogeneous' logics at our disposal (Barwise & Etchemendy, 1995; Shin, 2004). But they are not iconic in the full sense of the term. They combine diagrammatic with symbolic signs, and replace some of the constituents, such as predicates, which in EGs are non-diagrammatic icons of images, with symbolic notations. Conversely, symbolic logic is heterogeneous in the sense that for instance algebraic, model-theoretic, and inferential thinking all appeal to diagrammatic conceptualizations. At the same time, EGs do not claim to be completely and purely iconic, either, but to strive to be "as iconic" representations of logical thought "as possible". Iconicity is needed to represent relations by "visible relations analogous" to the intended, actual relations in the model (MS 492:22). Such profound iconicity is further related to the idea of diagram construction and assertions as utterances employing "any method of graphic communication" (MS 492:24). Peirce operationalizes this communicative aspect of the meaning of graphs by imagining a dialogue that takes place between the utterer and the interpreter, an idea taken from his algebra of relatives and explicates in terms of a new 'interactive' semantics for EGs (Peirce, 1906; MS 280; Pietarinen, 2006a).

Here emerges our first challenge, then:

> **Challenge A:** *Tackle the current question of the meaning of logical constants from the point of view of the diagrammatic-iconic method, capable of unifying the signs of logic.*

3. The logic of cognition

Peirce's goal was to develop a comprehensive logic of cognition through iconic means. To accomplish this, the workings of the information processes in cognition need analysis in a rigorous and structure-preserving fashion even when symbolic expressions fall short of fulfilling that purpose. And they shall fall short, Peirce avers, since "there are countless Objects of consciousness that words cannot express; such as the feelings a symphony inspires or that which is in the soul of a furiously angry man in the presence of his enemy" (MS 499).

The possibility of an iconic logic of thought means that the essential representational and inferential aspects of the processes of the mind can be articulated by certain specific kinds of diagrams. According to Peirce, logical diagrams are precise snapshots of thoughts mind produces. On the contents of minds diagrams give "rough and generalized" pictures (CP 4.582), which nevertheless are logically as precise as any conceptual or abstract framework can possibly reveal. The reason is, he explains, that diagrams are icons that reflect continuous connections between "rationally related objects" (MS 293:11). Our knowledge about rational connections comes not from experience or mathematical certainty, but from something "which anybody who reasons at all must have an inward acquaintance with" (MS 293:11; Pietarinen, 2005b).

With EGs, one is equipped to represent and investigate analytically "all that is in any way or in any sense present to the mind" (CP 1.284). Interestingly, EGs live at the core of the principle of pragmaticism and Peirce appealed to them in his attempts to prove that pragmaticism is in fact the true theory of meaning: "The study of that system must reveal whatever common nature is necessarily shared by the significations of all thoughts. [EGs] furnish a test of the truth or falsity of Pragmaticism [by disclosing] what nature is truly common to all significations of concepts" (MS 298 [1905], "Phaneroscopy").[7]

EGs thus provide grounds for Peirce's announcement that they are the real representations of our "moving pictures of thought". But exactly how do they do it? EGs seem to deal with some vital aspects of information flow and information processing. Two aspects are worth highlighting here.

[7] The detailed reconstruction of the intended argument is beyond the scope of the present paper (see Pietarinen, 2010a; Pietarinen & Snellman, 2006). It ties in with Peirce's game-theoretic conception of semantics and his notion of habits as stable, self-controlled tendencies.

First, understanding the fundamental nature of deductive reasoning in terms of EGs seems to be lurking in the iconic structure of graphs. We would thus be well advised to ask whether the graphs may be an aid in drawing deductive inferences over and above those accomplished by symbolic rules of inference? Peirce believed that reasoning is iconic, and in making inferences we are experimenting with diagrammatic representations. But even the simplest deductive inferences may involve creative considerations of *where* and *what* new individuals to add into the course of the proof, as for instance applying existential instantiation in countermodel constructions aptly demonstrate. We should expect deductive inferences to be facilitated when presented in the diagrammatic form of transformation rules. That this may indeed be the case is illustrated by some optimisation problems in automated theorem proving in which diagrammatic forms prove to be beneficial, though they are unlikely to solve the fundamental limits of what can be accomplished by mechanical traits of reasoning. According to Peirce, satisfactory deductive inference, let alone ampliative modes of reasoning, cannot at the end be accomplished by anything else than a "living intelligence" (MS 499).

Second, Peirce sought for the simple, "indecomposable elements of thought" that could constitute the primary building blocks of the complexes of our cognitive systems (MS 284:43 [1905], "The Basis of Pragmaticism"; MS 325:3 [n.d.], "Pragmatism Made Easy"). I have argued that, logically, indecomposable elements are the atomic graphs, "spots" in Peirce's terminology (Pietarinen, 2005a). The spots are nevertheless not diagrams but *images*, firstnesses of iconic signs that live on the *phaneron* (Pietarinen, 2010b). The interpretation of images is, unlike the interpretation of diagrams, singular and physiognomic. But Peirce emphasizes that the result need not be a simple quality (MS 280:17 [1905], "The Basis of Pragmaticism"). We can take these remarks to mean that indecomposable elements, as represented by the spots in EGs, are the iconic counterpart to what the interpretation of non-logical constants of the logical alphabet is in the symbolic realm. Spots, as specific bounded regions of the space of assertion and having some specific qualities by which they are distinguished from the surrounding space, are thus iconic just as logical constants are, but not in terms of being involved with observations of diagrammatic structures but in terms of being involved with qualitative imagery. Their intended interpretations are made possible precisely by virtue of them being such images. These interpretations provide the boundary conditions according to which the semantics for graphs may then be built. The intended interpretations may change following the changes in spots defined in terms of spatial and metric and not merely in terms of topological regions.

It would nevertheless be an error to take the theories of EGs to ally with the class of theories variously termed as mental models (Lakoff & Turner, 1989; Johnson Laird, 2002), cognitive spaces (Gärdenfors, 2000) or image schemas (Hampe, 2005), for example. Such cognitive theories take various spatial arrangements of conceptualizations to be the meanings of our expressions or assertions. According to the iconic language of logical diagrams, however, meaning is not confined to representations, because diagrams are signs, that is, representations that make themselves interpretable. Understanding complex expressions of diagrams requires semantic and pragmatic interpretation. To take meanings of complex assertions to somehow be located in those representations would imply a nominalist and internalist account according to which meaning *is* conceptualization in schemas, image-like qualities or mental models. But then there is nothing distinguishing such images being right or wrong about something or being true or false in a model.

Instead, EGs are externalist in that strong pragmatist sense of meanings as extra-linguistic, general habits of actions. There thus is a world of difference between, on the one hand, the presently popularized cognitive theories of semantics and cognitive semiotics, and on the other, the semantic/pragmatic theories of meaning planted by Peirce and developed further by Paul Grice and a few others (Pietarinen, 2004).

Consequently, the so-called 'Language of Thought' hypothesis is ready to be taken off the board. A postulation of internal, symbolic language beneath the logical level is from the point of view of the theory of EGs implausible: a brain-wired internal code cannot be relied on to determine which of the multiple readings of icons would be the intended ones. From the point of view of Peirce's theory of signs, it does not even make sense to pose the possibility of a symbolic level beneath an iconic one, because symbols are bound to involve indexical signs, and indexical signs are bound to involve iconic signs. That is to say that icons – images, diagrams and metaphors alike – are the closest we get at in terms of a rigorous logical representation of our cognitive thought operations. To claim otherwise is really to subscribe to the wide separation of cognition and meaning, which indeed had radicalized 20th century thought not only in the realm of symbolic logic in terms of its formal purification but also in those structuralist and formalist traditions in the studies of arts, culture and semiotics that attempted to create ideological barriers between language, thought and the world instead of attempting to unite them.[8] To put logic and cognition together again is to forever close the door to those lost paths.

> **Challenge B:** *Put logic and cognition together again by tackling the question of* EGs *as the dynamic, logical representation of intellectual cognition from the perspective of contemporary cognitive sciences.*

4. The disparity between logical diagrams and symbolic logic

Moving on towards the specifics of the logic of the beta part of the EGs, there are a couple of issues that have not been pointed out before. What the corresponding fragment of first-order logic is hinges a great deal on the details of how the theory and language of beta graphs are actually set up. For example, the usual presentations, including most of Peirce's own writings on the matter, assume all relation terms (graphically "the spots") to be symmetric. Peirce is aware of the need of adding a special proviso to be able to speak about all relations, including asymmetric ones. The 1902 dictionary entry observes that, "in taking account of relations, it is necessary to distinguish between the different sides of the letters" (Peirce, 1902, p. 649). When we do linguistic analysis, the lines connected to spots in beta graphs are normally to be read not only from outside in but also from left to right just as natural language is read. By 1905 Peirce acknowledges that relations would be widely conceived as soon as we give "relative significations to spots", so that "if a spot signifies an asymmetric relation it is necessary to distinguish connection with one part of it as meaning something different from connection with another side", adding that "colors or other qualities of lines" could be recognized to build up "a corresponding variety of asymmetric relations" (MS 284:90).

In the alpha part, there is no need for the operation of commutation, because we need not recognize "any order of arrangement [of propositional terms] as significant" (Peirce, 1902, p. 645). However, in beta graphs with specific spots and lines denoting asymmetric relations the sheets of assertion upon which these graphs are scribed must have orientation. Therefore we will lose the property of isotopy-equivalence according to which graphs can be observed from any angle in a meaning-preserving way.

Second, in beta there are no free variables. They could be introduced by fiat as certain selectives, but it is more recommendable to have a way of

[8] Greimas and Courtés (1982) should function as a warning sign. It is not an occupational hazard, for example, that their entry on "Semiotics" has no reference to Peirce at all.

doing so that is as iconic as possible. I suggest that free variables are taken as dots attached to the hooks within the interiors of the spots. They are not the dots or lines attached to the hooks at the peripheries of the spots that lie outside the boundaries of the spots. These are bound variables, according to Peirce's way of setting up the system of beta graphs: an attachment to the hooks outside the boundary refers to predication, and free variables do not predicate anything. When variables become bound, they will be extended from the hooks inside the spots to the corresponding hooks outside of the boundary.

Third, the theory of beta graphs does not distinguish well between proper names and singular terms, which are both treated by Peirce as predicate terms (spots) having some specific quality in terms of being regions of space in the sheet of assertion. This necessitates a complication in the transformation rules, as we do not want to infer from, say, "Barack Obama is a man" that "It is not the case that something is a man", in other words that "Everything is not a man". We come across such illicit inference if we are allowed to substitute the free end of the identity line within a negative area for a proper name that attaches to a singular term, as we can then apply the standard erasure and deiteration rules to the line which at once would permit the inference. A natural solution is to keep apart the notions of names ("selectives") and singular terms ("spots") and never substitute spots for names.

Fourth, in beta graphs the notion of scope is not a separate notion at all. The 'binding' scope is denoted by the directionality of identity lines spanning from outside-in and connecting different areas and spots. On the other hand, the nesting of areas corresponds to the 'priority' scope of quantificational constants. Unlike in first-order logic that makes heavy use of parentheses, these two notions do not go hand in hand in the iconic formation of logical constants. One might go as far as to say that there is no need for the primitive notion of scope in many-dimensional logical diagrams in the first place.

One particular consequence is worth mentioning here: the 'syntax' of iconic forms alone cannot tell us whether a dynamic or non-dynamic interpretation of quantification and its binding scope is intended. Consequently, beta graphs that dispense with the parenthetical notation can make use of such kinds of binding scopes that can reach beyond priority scopes, similarly as what can happen in dynamic extensions of first-order logic but what cannot be achieved in traditional first-order logic with more stringent scope conventions.

Challenge C: *Redefine the beta part so as to correspond not only to fragments of first-order logic but to full first-order logic and beyond.*

5. The gamma and the delta

Within the gamma realm we encounter a host of important issues which I will mostly forego here. Peirce occasionally referred to the planned delta part, which one needs "to add in order to deal with modals" (MS 500:3 [December 1911], "A Diagrammatic Syntax"). What was the delta part intended to be? Peirce had several systems of modal logics already in place, including quantification and multi-modal logics. But they were all introduced intermittently, and he was not able to expose their fundamental nature. He probably envisioned a unifying graphical account for all modality types, one that would encompass the tinctures, identity lines (quantification), and potentials, together with a feasible interpretation that would agree with his tenet of scholastic realism – which in contemporary terms is for all practical and logical purposes a suitably understood possible-worlds semantics (Pietarinen, 2006b). Presumably it was that unificatory challenge which was to be relegated to the delta part. However, we need to keep in mind that, even if all the modal notions were to be cut off from the gamma part, it would still leave that part to deal with graphs whose logical behavior is very different from one another, including higher-order logics, logic of collections, imperatives, erotetic logic, and even metaphors (Pietarinen, 2010c).

Challenge D: *Sort out the various gamma parts and recover the hidden delta.*

6. Non-classical and deviant EGs

The preceding issues deal with the background and general significance of the diagrammatic logic of EGs. Might we view Peirce's attempt as an early logic of our cognitive processes? Can it teach us something about the notion of information and information processing? Do the systems yield new perspectives to the meaning of logical constants? How to expand the method of representing logic using icons? Finally, let us summarize a couple of key logical matters pertinent to these questions.

The issue that naturally arises with regard to recent logical developments concerns the relationship between non-classical and deviant logics as well as the possible extensions and variations of the standard systems of EGs. Here is an abridged list of such lines of developments:

1. Intuitionistic versions take the *cut*, which is the icon of negation, to be an *incision* and not a *reversal* (Pietarinen, 2006a, p. 169). Thus a doubly cut proposition does not yield the proposition itself. Zalamea (2008) offers an alternative proposal as to how to get at an intuitionistic version of EGs by changing the iconic representation of the conditional. Which way to do it?

2. New modal systems for the gamma part can be developed by systematic variation of transformation rules. Some of them were studied long ago in Zeman (1964) but never taken much further. We need to place generic constraints on the transformation rules in order to generate different systems, and to study the relationship of such transformation rules to the accessibility relation in modal logic (Pietarinen, 2006b).

3. Peirce proposed representing higher-order notions, such as the relations of *anteriority* and *succession*, and which still are routinely considered to be Frege's sole discoveries, by a modification of gamma graphs to have spots as "potentials" that use abstraction and lines of identities as "objective possibilities" (MS 508, "Syllabus B.6"). Suggesting then some transformation rules for such higher-order graphs, he notes that they appear to result in incomplete systems of rules (ibid.) – as we know now second-order logic is indeed semantically incomplete. Since the semantics can be modified to weaker versions for semantically incomplete logics (Krynicki & Mostowski, 1995), the search for useful proof systems for higher-order languages need not be a dead end, however.

4. We ought to inquire about strict impossibility proofs as well. Is there something that cannot be represented by an iconic logic of EGs but is indispensable in symbolic languages? One candidate is the use of fixed points in logics, such as modal μ-calculus – it is not at all obvious what would be the essentially iconic component in recursion and fix-point operators. Another realm difficult to diagrammatize is provided by the multiplicative connectives familiar from linear logics. On the other hand, it is worth keeping in mind that these are both paradigm examples of such systems that may be born when the formal assails the semantic.

Challenge E: *Examine the issues 1–4 and assess their relevance with respect to Challenges A–D.*

7. Conclusion

Existential Graphs have a good claim to be the logic of our cognitive workings of reasoning and representation, along the lines of providing "a moving picture of the action of the mind in thought" (MS 298:1 [1905], "Phaneroscopy") as well as a "system for diagrammatizing intellectual cognition" (MS 292:41 [1906], Draft of "Prolegomena"). Their untapped logical potential is at the same time representative of the capacity of EGs becoming, as Peirce firmly believed, "the logic of the future". That potential has only been begun to be touched upon, and to fully argue for my bid calls for a continuing study of a combination of a number of logical and cognitive issues. Some of them have been raised here, such as the role of icons and images in logical theories, the meaning of logical constants and their cognitive economy, the reasons for the failure of the Frege–Russell thesis, and the reasons for the insufficiency of the mental model types of theories.[9]

References

Barwise, J. and Etchemendy, J. (1995). "Heterogeneous Logic." In B. Chandrasekaran, J. Glasgow, and N. H. Narayanan (Eds.). *Diagrammatic Reasoning: Cognitive and Computational Perspectives* (pp. , 209–232). Cambridge, Mass.: MIT Press.

Enderton, H. B. (1970). "Finite Partially Ordered Quantifiers." *Zeitschrift für Mathematische Logic und Grundlagen der Mathematik*, 16: 393–397.

Greimas, A. J. and Courtés, J. (1982). *Semiotics and Language: An Analytic Dictionary.* Bloomington: Indiana University Press.

Gärdenfors, Peter (2000). *Conceptual Spaces: The Geometry of Thought*. Cambridge, Mass.: MIT Press.

Hammer, Eric M. (2002). "Diagrammatic logic." In D. Gabbay and F. Guenthner (Eds.), *Handbook of Philosophical Logic 4* (2nd edition) (pp. 395–422). Dordrecht: Kluwer.

Hampe, B. (Ed.) (2005). *From Perception to Meaning: Image Schemas in Cognitive Linguistics.* Berlin: Mouton de Gruyter.

Hintikka, J. (1979). "Is, Semantical Games, and Semantical Relativity." *Journal of Philosophical Logic*, 8, 433–468.

[9] This work has been supported by the University of Helsinki 'Excellence in Research' Grant (2023031, "Peirce's Pragmaticistic Philosophy and Its Applications", 2006–2008, Principal Investigator A.-V. Pietarinen).

Johnson Laird, P. (2002). "Peirce, Logic Diagrams, and the Elementary Operations of Reasoning." *Thinking and Reasoning*, 8, 69–95.

Lakoff, G. & Turner, M. (1989). *More than Cool Reason: A Field Guide to Poetic Metaphor*. Chicago: University of Chicago Press.

Liu, X. (2008). "The Literature of C. S. Peirce's Existential Graphs." Institute of Philosophy, Beijing: Chinese Academy of Social Sciences. `http://philosophy.cass.cn/facu/liuxinwen/01.htm`

Krynicki, M. & Mostowski, M. (1995). "Henkin Quantifiers." In M. Krynicki, M. Mostowski and L. W. Szczerba (Eds.), *Quantifiers: Logics, Models and Computation 1* (pp. 193–262). Dordrecht: Kluwer.

Peirce, C. S. (1902). "Symbolic Logic or Algebra of Logic." In J. M. Baldwin (Ed.), *Dictionary of Philosophy and Psychology, Vol. 2* (pp. 640–651) New York and London: Henry Holt.

Peirce, C. S. (1906). "Prolegomena to an Apology for Pragmaticism." *The Monist*, 16, 492–547.

Pietarinen, A.-V. (2004). "Grice in the Wake of Peirce." *Pragmatics & Cognition*, 12, 295–315.

Pietarinen, A.-V. (2005a). "Compositionality, Relevance and Peirce's Logic of Existential Graphs." *Axiomathes*, 15, 513–540.

Pietarinen, A.-V. (2005b). "Cultivating Habits of Reason: Peirce and the Logica Utens versus Logica Docens Distinction." *History of Philosophy Quarterly*, 22, 357–372.

Pietarinen, A.-V. (2006a). *Signs of Logic: Peircean Themes on the Philosophy of Language, Games, and Communication*, Synthese Library 329. Dordrecht: Springer.

Pietarinen, A.-V. (2006b). "Peirce's Contributions to Possible-worlds Semantics." *Studia Logica*, 82, 345–369.

Pietarinen, A.-V. (2009). "Significs and the Origins of Analytic Philosophy." *Journal of the History of Ideas*, 70(3), 467–490.

Pietarinen, A.-V. (2010a). "Moving Pictures of Thought II: Graphs, Games, and Pragmaticism's Proof." *Semiotica*.

Pietarinen, A.-V. (2010b). "Peirce and the Logic of Image." *Semiotica*.

Pietarinen, A.-V. (2010c). "Iconic Logic for Metaphors." *Journal of Cognitive Science*.

Pietarinen, A.-V. and Snellman, L. (2006). "On Peirce's Late Proof of Pragmaticism." In T. Aho & A.-V. Pietarinen (Eds.), *Truth and Games* (pp. 275–288), Acta Philosophica Fennica 79. Helsinki: Societas Philosophica Fennica.

Roberts, Don D. (1973). *The Existential Graphs of Charles S. Peirce*. The Hague: Mouton.

Shin, S.-J. (2002). *The Iconic Logic of Peirce's Graphs*. Cambridge, Mass.: MIT Press.

Shin, S.-J. (2004). "Heterogeneous Reasoning and Its Logic." *Bulletin of Symbolic Logic*, 10, 86–106.

Sowa, J. (2006). "Peirce's Contributions to the 21st Century." In H. Schärfe, P. Hitzler, and P. Øhrstrøm (Eds.), ICCS 2006, *Lecture Notes in Artificial Intelligence 4068* (pp. 54–69). Berlin and Heidelberg: Springer-Verlag.

Wittgenstein, L. (1921). *Tractatus Logico-Philosophicus*. London: Kegan Paul.

Zalamea, F. (2008). "Intuitionistic Graphs." Manuscript.

Zeman, J. J. (1964). *The Graphical Logic of C. S. Peirce*. Dissertation, University of Chicago. Online edition, 2002, at `http://web.clas.ufl.edu/users/jzeman/`

Typesetting and cover design:
Jukka Nikulainen

Cover picture:
"Whipped Cream Clouds on True Blue Sky" –
D. Sharon Pruitt (Pink Sherbet Photography) (cc) (BY)