

Peirce's Theory
of Communication
and Its Contemporary
Relevance

Introduction

The mobile era of electronic communication has created a huge semiotic system, constructed out of triadic components envisaged by the American scientist and philosopher Charles S. Peirce (1839–1914), such as icons, indices and symbols, and signs, objects and interpretants. Iconic signs bear a physical resemblance to what they represent. Indices point at something and say “there!”, and symbols signify objects by conventions of a community.¹ All signs give rise to interpretants in the minds of the interpreters.

It is nonetheless regrettable that the somewhat simplistic triadic exposé of Peirce's theory of signs has persisted in semiotics as the somewhat exhaustive and final description of what Peirce intended. The more fascinating and richer structure of signs emerging from their intimate relation to intercommunication and interaction (Peirce's terms) has been noted much less frequently.

Despite this shortcoming, the full Peircean road to inquiry – performed by the dynamic community of learning inquirers, or the com-

¹ In fact, according to Peirce (2.278 [1895]): “The only way of directly communicating an idea is by means of an icon; and every indirect method of communicating an idea must depend for its establishment upon the use of an icon.” Peirce's *chef d'oeuvre* came shortly after these remarks into being as his diagrammatic system of existential graphs, a thoroughly iconic representation of and a way of reasoning about “moving pictures of thought”, which encompassed not only propositional and predicate logic, but also modalities, higher-order notions, abstraction and category-theoretic notions. The importance of iconic representation (such as images and pictures) in scientific and everyday communication was since noted many times, starting with the works of Bertrand Russell, Ludwig Wittgenstein and Otto Neurath, although as logics they had to await the heterogeneous systems of the late 20th century. (The references to Peirce are to the *Collected Papers of Charles Sanders Peirce*, 8 vols., ed. by Charles Hartshorne, Paul Weiss and A.W. Burks, Cambridge, MA: Harvard University Press, 1931–1966, by volume and paragraph number.)

munity of quasi-minds consisting of the liquid in a number of interconnected bottles, or the scientific communities of the users of the data that is being provided by Nature or the vastly mounting electronic sources – reflects the contemporary weight put on all kinds of multi-agent systems in computation. However, the weight ought still to be amplified by incorporating the Peircean idea of communication as a dialogue between the interlocutors of a general nature of a mind who are putting forward signs, into the richer semiotic picture emerging from a truly transdisciplinary multi-agent research. The agents are not only abstract communicators but also signs, and thus also minds and in a bona fide relation with objects. As some signs are in a sense phenomenal they are suitable for framing the electronic communication of machine-like quasi-minds. What the correlates of Peirce's concepts of representamen (a sign put forward by the Utterer), interpretant (what the sign determines within the mind of the Interpreter), and various subspecies of interpretant (e.g. the intentional, effectual and communicational ones) in the context of contemporary media-driven communication and learning are, is something that needs to be sought for in the general amalgamation of Peirce's sign-theoretic triadism and the communicational and action-theoretic dyadism. This is yet to be accomplished. Its importance can be seen, for instance, from the perspective of Peirce's unexpected late idea of the *commens* as the locus where the thoughts of all minds participated in the creation of the common ground meet.

The formation of common ground by continuous communication and interaction reflects the computational desire to furnish multi-agent systems with properties that would enable them to entertain appropriate interoperation. Thus the initiatives of semantic and pragmatic webs receive increased semiotic motivation, as soon as they are adjoined with an understanding of Peirce's theory of communication. Above all, the phrase "medium of communication" was taken by Peirce to illustrate a broader notion than just the noun "sign", namely a species of Thirdness, a category of mediation, synthetic consciousness, prediction of the future courses of events, continuity, learning, growth.

The Rationale and the Goal of the Present Paper

In evaluating what is going on in the interplay between technological growth and philosophy, one fruitful approach is to try to draw focal parallels and to do comparisons between the notions used in both fields, rather than to seek some overarching philosophical foundation for some particular set of technological innovations wedding them in one fell

swoop. One reason for this is that technological advancements have often been made, and sometimes rightfully so, completely in ignorance of philosophical problems. But in doing so, these developments have invented as well as reinvented concepts that have already been far and wide in philosophy. In some cases philosophical terminology has just been hijacked by hackers. Such is the case with the all-pervading use of the concept of ontology in computer science, which has hardly anything to do with its metaphysical homograph. In web technology, there is no single ontology, but a library of “possible modes of being”. It is up to the users to make queries and pick relevant ontologies that would work as shared formal specifications of the conceptualisations of what there is. Ontologies tend to reflect interpretations of terms of logical or representational languages, and in that way are dependent on the universes of discourse, or more precisely, on those universes that are in some sense common and shared between the agents who operate on them. There are no self-sustaining substances in user-independent reality.

In the long run, we may witness a convergence of at least some subset of such concepts and vocabulary. For instance, this is likely to happen due to the recently emerged paradigms that aim at new approaches to the organisation, acquisition and evolution of data contained in the web, namely the programmes of the “semantic” and “pragmatic” webs. The aim that has been announced quite openly is that these systems are, or will be, built upon the sign-theoretic principles of pragmatic or pragmaticist philosophy, most notably upon those that Peirce is claimed to have envisioned.

I want to know why. My purpose here is thus to concentrate on two interrelated issues. First, the aim is to understand, not the overall and certainly very complex pragmaticist and sign-theoretic philosophy of Peirce’s, but rather what is going on in his highly interesting concept and theory of communication. Of course, this theory cannot be severed from other parts of Peirce’s thinking, such as his doctrine of categories, pragmaticism, and sign-theoretic and logical semeiotics. But as I hope it will turn out, its essentials can be understood without overkill from Peirce’s phenomenology (“phaneroscopy”), metaphysics, or the later theory of signs.

Second, the purpose is to assess the relevance of Peirce’s theory of communication to some of the emerging contemporary issues in computer science, web technology, and the overall modern era of communicating systems. I have no interest in presenting details of these innovations; I hope that many of them will be familiar. As it turns out, a number of technological and computational innovations will have prob-

ing contacts with Peirce's ideas (or ideals) of scientific inquiry and communication. One of the main reasons is that being semeiotic, his philosophical and logical concepts are very widely applicable and not limited to human users or inquirers. For that reason they are not limited to the linguistic notion of communication either, but reach over virtually anything that one can think of communication to be now and in the future, including notions that one day will emerge from the sciences of artificial intelligence, neuroscience, quantum theory, bioinformatics, and so forth.

The second task is easier. Even though we by no means yet have before us a full picture of Peirce's theory of communication, I believe that we understand it well enough to perceive its relevance to a host of issues in the applied sciences of computation, communication and information.

Triangulate Them All

So, what is Peirce's theory of communication? There is no simple answer to this, and the question has been debated in the literature progressively more during the last decade or so.² It is becoming an increasingly topical issue in attempts to understand his philosophy from the perspective that aims at strengthening the coherence of his writings, and avoids drawing his boundless fields of interests away from each other.

One of the curious aspects of Peirce's communicative approach to signs is its apparently dyadic, two-place nature. *Prima facie*, one may think that his view of communication is related merely to transmissional aspects of signs between two (possibly interpersonal) agents, the utterer and the interpreter of the sign, in a suitable medium of communication – not unlike Shannon's and others' later syntactic theories of communication, which focus on the question of in what media and how information ought to propagate. This, as I hope to be able to communicate, does hardly any justice to Peirce's own intentions.

² See e.g. Mats Bergman, "Reflections of the Role of the Communicative Sign in Semeiotic", *Transactions of the Charles S. Peirce Society: A Quarterly Journal in American Philosophy* 36 (2000), pp. 225–254; Jürgen Habermas, "Peirce and Communication", in Kenneth L. Ketner (ed.), *Peirce and Contemporary Thought*, New York: Fordham University Press, 1995, pp. 243–266; Jørgen D. Johansen, *Dialogic Semiosis: An Essay on Signs and Meaning*, Bloomington: Indiana University Press, 1993; Joseph Ransdell, "Some Leading Ideas of Peirce's Semiotic", *Semiotica* 19 (1977), pp. 157–178.

Second, Peirce's theory of communication is primarily a logical theory. This is the reason why some researchers, among them Richard J. Parmentier, have dismissed it as unsuitable for inquiries involving social and cultural aspects.³ In response to this, it can be noted that the concepts of what is social and what is cultural can be stretched and given Peircean twists; for instance, a broad understanding of socialisability transpires in the currently popular multi-agent systems research in computation.⁴ Whether that is justified, I do not seek to address here. Likewise, the 20th-century concept of logic, pulled apart from its semiotic roots, is exceptionally limited and certainly not representative of Peirce's overall aims. In fact, according to Peirce "logic is rooted in the social principle" (2.654 [1893]). (Cf. the somewhat contrapositive declaration in another place, "the social principle is rooted intrinsically in logic", 5.354 [1893].) It is vital in deciphering these sentiments to recognize that for Peirce, logic takes in also all kinds of considerations of what one's rational action would be in situations that call for moral judgements. This is connected with the fact that for Peirce, logic is a normative science, *viz.* the notion of truth in logic has a normative component in it.

As is well known, Peirce laid practically all his divisions out in the triadic, three-place format. The reasons for this were many. Most notably, there was a mathematical reason: given Peirce's assumptions concerning mathematical relations (he was one of the founders of the algebraic logic of relations), no three-place relation can be constructed out of just one and two-place ones. Because of this, it seems that his overall method of communicating signs is in some way in discrepancy or disagreement with the triadicity of the other parts of his theory of signs.

So, the question is: how does the notion of communication between two agents fit into this triadic picture? The answer is in fact found in Peirce's unpublished MS 318 [1907].⁵ In that manuscript, Peirce explains his sign-theory from the communicational perspective. First of all,

³ Richard J. Parmentier, *Signs in Society: Studies in Semiotic Anthropology*, Bloomington: Indiana University Press, 1994.

⁴ In my forthcoming paper "Games and Multi-Agent Systems: Limitations, Prospects and Foundational Perspectives" I argue that one rarely noted virtue of multi-agent systems is that they provide much more precise sociological analyses of social codes and practices than the semi-formal notions of "a game" or "games people play" in social inquiries.

⁵ MS references are to Charles S. Peirce, Manuscripts in the Houghton Library of Harvard University, as identified by Richard Robin, *Annotated Catalogue of the Papers of Charles S. Peirce* (Amherst: University of Massachusetts Press, 1967), and in "The Peirce

there are signs that have no utterers. These are the signs found in nature. Then there are signs that have no interpreters, such as encrypted messages, or the golden plate on the side of Pioneer 11 at the moment of uttering this sentence. The utterers and the interpreters associated with these kinds of signs will receive the prefix “quasi”, and they can be thought of as positions, phases of the thinking mind, or semiotic roles in the process of semiosis. In other words, they are theoretical entities devoid of actual minds connected with brains. (Cf. the concept of “natural intelligence” in automated reasoning research.) In the special case of signs being linguistic, that is, symbolic natural language assertions, the utterers and interpreters are characteristically human beings. In that interpersonal situation the utterer and the interpreter are to a degree distinct from those of the object and the interpretant.

But what are we to say about the residual cases? According to Peirce, the object-interpretant axis represents a continuum that is not meant to demarcate objects and interpretants in any non-fuzzy, clear-cut manner. Intertwined with the fact that some utterers can according to him be assimilated or equated with objects, and some interpreters can likewise be assimilated with interpretants, we get two dynamic scales within the triadic division of signs, one representing the object-interpretant continuum and the other representing the utterer-interpreter continuum. Depending on the nature of signs, these two scales may coincide, as is the case for instance with non-linguistic signs that have utterers and interpreters.

The general picture that emerges is schematised in Figure 1. There are two main trichotomies, the sign-object-interpretant one and the sign-utterer-interpreter one. By moving along the base of the latter triangle towards interpretants and the interpreter, the utterer’s state of information increases. Conversely, by moving from the interpreter towards the object and the utterer the state of the information of the interpreter increases. The dashed arrows show the increase and decrease of the states of information of the utterers and the interpreters. The overlapping area is the common ground, where the communicational interpretants are determined. The angle α measures the degree in which the objects and their utterers converge, and the angle β measures the degree

Papers: A Supplementary Catalogue”, *Transactions of the C. S. Peirce Society* 7 (1971), pp. 37–57, by manuscript and, where applicable, page number. See also Charles S. Peirce, “Pragmatism”, *The Essential Peirce* 2, Peirce Edition Project, Bloomington: Indiana University Press, 1993, pp. 398–433, a critical transcription of this complex and multilayered manuscript.

in which the interpretants and their interpreters converge. They thus measure the degree of interpersonality in communicational sign-theoretic situations. From this figure it can be also concluded that it is the breadth of the base of the sign-object-interpretant triangle that measures the distance between objects and their interpretants.

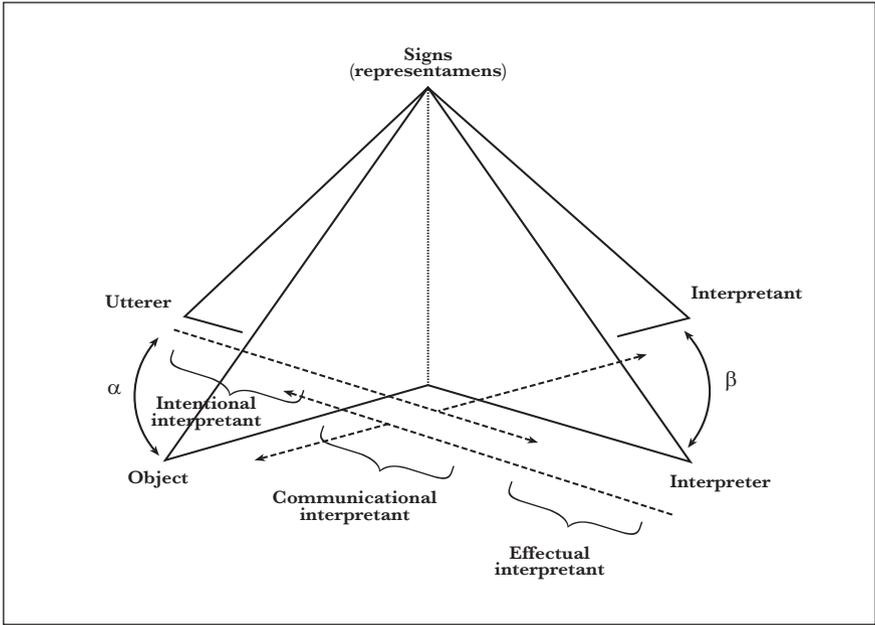


Figure 1
Triadic system of communication in Peirce's sign theory

The affinity of the utterer with its object is called by Peirce “the essential ingredient of the utterer” (MS 318: 21). It is found in the utterer’s job to delineate the class of the universe of discourse understood to be at issue in the dialogue, thereupon choosing the object or its instance from the domain as intended by the utterance and as understood to be predicable by the (uninterpreted) predicate term (termed by Peirce the *rhema*) of the proposition in question. I will not delve into the issue of how such choices are made; I can outrun comprehensive explanation by noting that when the act of uttering and the object intended by the utterance are in fact one and the same thing, there is no factual decision to be made. When they are not, the notions such as the purpose and strategic considerations of the utterer and the interpreter will be of prime

importance. These are in turn related to Peirce's notion of a habit and its cultivation in possibly infinitely repeated runs of semiotic plays.

An open question that has not been noted before is whether Peirce intended this interpretation to supply an *objectual interpretation* of the logical quantifiers Σ and Π in the sense of choosing objects from the domain, and intending the names of these objects to function as values of the rhemas and the quantifiers (the complex rules of such choices plus applications of them to quantification were termed by Peirce *selectives*). Or, did he espouse the *substitutional interpretation*, namely one where the participants of the dialogue would be picking out names that are instances of some given substitution-class of non-logical constants?⁶ Peirce's typical choice of the term was that of choosing "instances" as proper values for logical constants, but in the end he left unspecified what he actually meant by them. To what extent are we justified to take them as corresponding to model-theoretical entities?⁷

Quite another aspect of Peirce's theory of communication is that if the interpretant is what Peirce termed the *ultimate logical interpretant*, then, because it represents a state of perfect knowledge, the ontological and epistemological distinctions make no difference in scientific inquiry. The object merges with its interpretant, disintegrating the triangle into a dyadic relation between the sign and this ultimate logical interpretant. The maximal state of information leaves no latitude of interpretation because there no longer is any difference between objects and interpretants.

There are a number of other notions of interpretants in Peirce's system which I will not go on to review here but which all make negligible distinctions between the interpretant and the object.

It may also be thought that because Peirce was keen to repudiate all psychological influences from the province of logic and semeiotics, he might have wished to altogether eliminate the concept of utterers and interpreters from the dominion of sign action. This may be suggested by his frequent tendency to assimilate, on the one hand, the utterers and objects, and on the other, the interpreters and the interpretants. Upon a closer inspection, this assimilation does not mean reduction. Rather, the concepts of the utterers and the interpreters are, as Peirce puts it, "welded" in one sign (4.551 [1906]), but they move along the distinct

⁶ This is the interpretation that was so named mainly after Saul Kripke, "Is There a Problem about Substitutional Quantification?", in G. Evans and J. McDowell (eds.), *Truth and Meaning*, Oxford: Clarendon Press, 1976, pp. 325–419.

⁷ Some passages suggest that Peirce came close to the "discourse referent" idea of the discourse representation theory of Hans Kamp and others.

scale from that of the objects and the interpretants, because the bases of the triangles may have independently variable breadth.

Since every thought is a sign, no thought can evolve unless conceived as dialogic, either between multiple, interpersonal parties or as a quasi-dialogue within one mind. This quasi-dialogical perspective presents us with a useful method of assigning semantic values to logical propositions, whereas the former person-to-person dialogue is practical for various pragmatic linguistic theories of communication and discourse.⁸

However, it is worth pointing out that Peirce's opinion was that there is little difference between multi-party interaction in, say, a social setting, and the intrapersonal reasoning and action in logic, because "a person is not absolutely an individual" (5.421 [1905]).⁹

There are further important issues. As remarked, Peirce's theory of communication comes extraordinarily close to the dialogical and game-theoretic interpretations of logic. These interpretations can be viewed as formal (logical) and strategic regimentations of relevant parts of Peircean semiosis. Although invented quite independently,¹⁰ they follow suit and endorse elements of communal or social approaches to meaning.¹¹ Their idea is to check the truth-values of propositions of a logical language. For the most part, they lurk behind Peirce's diagrammatic and iconic systems of existential graphs, and point towards ways of extending these

⁸ The fully strategic versions of such dialogues give rise to, among other things, the game-theoretic semantics of Hintikka (Jaakko Hintikka, *Logic, Language-Games and Information*, Oxford: Oxford University Press, 1973), optimality-based theories for phonological, syntactic, semantic and pragmatic inquiries in linguistics (Paul Dekker and Robert van Rooy, "Bi-directional Optimality Theory: An Application of Game Theory", *Journal of Semantics* 17 [2000], pp. 217–242), and various conversational and dialogue games for actual language users (Lauri Carlson, *Dialogue Games: An Approach to Discourse Analysis*, Dordrecht: D. Reidel, 1983). These theories provide major frameworks from which expressions – not only logical ones but also those coming from the domain of natural language semantics/pragmatics interface – derive their meaning.

⁹ The multi-agent nature of communities has multiple contact points with Peirce's theological, cosmological, evolutionary and agapistic metaphysics. That he was caught between the two fires of exact sciences and religious thought was one of the reasons of why his time frittered away, hindering him of presenting his logical systems in a sustained, unitary form.

¹⁰ Risto Hilpinen, "On C. S. Peirce's Theory of the Proposition: Peirce as a Precursor of Game-Theoretical Semantics", *The Monist* 65 (1982), pp. 182–188.

¹¹ Ahti-Veikko Pietarinen, "Some Useful Social Metaphors in Logic", in *Proceedings of the Second International Workshop on Computational Models of Scientific Reasoning and Applications*, CSREA Press, 2002.

systems.¹² The difference between dialogical and game-theoretic semantics is that dialogues address proof-theoretical validity, whereas games are semantic in the sense of establishing when the propositions are true in a model and when they are false in a model. These theories distinguish players' roles in terms of the polarity of the logical constant encountered in the formula, including logical connectives, and switch the roles when negation is encountered. They are both strategic in that the notion of a winning strategy represents the concrete concept that agrees with the notions of validity (dialogues) and truth (semantic games) of propositions. Peirce had most of these features incorporated into his system of logic, although he did not come to endorse any unequivocal game-theoretic terminology.

However, Peirce's communication theory is somewhat richer still. Its all-important concepts of the *common ground* and the *universe of discourse* (not limited to what we recognise as logical and model-theoretical domains) make it applicable beyond proof theories and ordinary semantics, placing pragmatic and discourse-related phenomena in linguistics under logical and semiotic scrutiny. Because of this, one may see the origins of speech-acts and theories of relevance in it, too.

The notion of the common ground is exceptionally important. It is the very core for the success of the communicational view of semiotic dialogues. It refers to what is common and shared between the dialogue participants, determined in their common mind as the common communicational interpretant (*cominterpretant*), which gets them to understand each other's utterances. This common mind was once given a special name of the *commens*.¹³

¹² Ahti-Veikko Pietarinen, "Diagrammatic Logic and Game-Playing", in Grant Malcolm (ed.), *Multidisciplinary Studies of Visual Representations and Interpretations*, Elsevier Science, to appear.

¹³ See Peirce's remark on pp. 196–197 in C.S. Hardwick (ed. with J. Cook), *Semiotics and Significs. The Correspondence Between Charles S. Peirce and Victoria Lady Welby*, Bloomington: Indiana University Press, 1977, explaining the *commens* as "that mind into which the minds of utterer and interpreter have to be fused in order that any communication should take place". This is the mind that determines a dynamic object of cominterpretant in a meaningful communication. They are not objects located outside the minds, yet are capable of representing a shared element of communication. Their determination, the *commens*, is also an ancestor of that which in many recent pragmatic theories of language is referred to as the common ground of interlocutors. The significance of the *commens* in the theory of signs is shown by Peirce's omitted remark that it consists of all that is understood between the communicative parties "when the sign in question is just about to be made" (MS L 463: 29 [1906], not preserved in the normalised transcrip-

The overall idea that is emerging but was never explained in full by Peirce is not unlike what ensues from Donald Davidson's triangulation scheme.¹⁴ It permits one to conclude that whereas individually and communally the speakers and hearers of language may be in error and ignorance, in larger respects, for any communication to be successful, the beliefs of others are not to be taken to be radically different from our own. Having a belief must be understood so that the belief is true, even if it may turn out to be false. Peirce's warrant for a similar outcome was the inevitability of collateral observation and mutual experience plus the maxim of *summum bonum* that the communities of inquirers share in communication. The main idea is thus also congenial to Davidson's principle of charity in interpretation.

Secondly, also the concept of the universes of discourse is central in Peirce's theory of communication. In dialogues, they are not just domains in a logician's sense, but presuppositions shared in the conversation and established by the same principles as the existence of mutually gained common ground.

Applications and Complications

Let us then look at what use some of these Peirce's ideas can be put into.

A Night at the Interopera

Interoperability is a show-off boasted in all corners of computing. Dictionaries tend to define it as "compatible software or hardware". But it does not present just a technical challenge of some coding or manufacturing problem. Towards the other end, it has in fact been described as "the ongoing process of ensuring that the systems, procedures and culture of an organisation are managed in such a way as to maximise opportunities for exchange and re-use of information, whether internally or externally".¹⁵

This pragmatic definition places central concern on what goes on in the communities of engineers, researchers, managers, and other users of

tion). This phrase Peirce rejected and amended to the more cautious "in order that the sign in question should fulfill its function".

¹⁴ Donald Davidson, *Subjective, Intersubjective, Objective*, Oxford: Clarendon Press, 2001.

¹⁵ Paul Miller, "Interoperability. What Is It and Why Should I Want It?", *Ariadne* 24 (2001), <http://www.ariadne.ac.uk/issue24/interoperability/intro.html>.

knowledge. It is also a utilitarian definition, where one is to maximise something (here: chances to exchange information). Intentions to do this clearly depend on the scope of common interest to have interoperative systems and products in the first place. Indeed, humans can be stunningly interoperable...

Besides computation, interoperability involves linguistic, social/com-munal, legal and normative aspects, and so it is a good example of Peircean inquiry as an indefinitely extendible and inexhaustible activity. Its goal is to create communicational interpretants in a variety of cases, across the boundaries of what is artificial and what is human, whatever entities the subjects engaged in communication are taken to be.¹⁶

Weave This: Semantic and Pragmatic Webs

The goal of the next-generation web technology is to define meaning into web documents. The increasingly popular albeit not yet very widely implemented approach known as a semantic web uses mark-up methods that instead of plain keywords, define the class and subclass hierarchies and the relations between the concepts that appear on the page.¹⁷ This metadata information provides the “semantics” or “meaning” of the document. According to this project, it is hoped that the increased production of metadata and ontology languages will create the network of documents whose content could be automatically processed in a much more elastic and adaptable manner than in the standard syntax-driven string-matching search methods.

One may think that this approach has really nothing to do with semantics. However, it in fact is a practical present-day version of the Peircean notion of semantics, because it provides meaning of the data or a code by translation. This is because for Peirce, semantics is in fact a theory of translation, a rendition of a given symbolic statement into some other statement, diction, or paraphrase, or into some other language, or perhaps a hyperlink or a dictionary-like definition of it.

However, this understanding of semantics lacks the semiotic components of the utterers and the interpreters of the data. And so one still needs to understand how the metadata, such as one provided by the

¹⁶ Shared ontologies are good examples of cominterpretants in artificial systems.

¹⁷ See e.g. Tim Berners-Lee, *Weaving the Web*, London: Orion Business Books, 1999; D. Fensel and M. A. Musen, “The Semantic Web: A Brain for the Mankind”, *IEEE Intelligent Systems*, March/April 2001, pp. 24–25; The Semantic Web Agreement Group, “What is the Semantic Web?”, 2001, <http://swag.webns.net/whatIsSW>.

newly devised schema of the Resource Description Framework (RDF), will be connected to the interpreters and objects of data. This connection defines the pragmatic meaning of data. However, as such it does not seem to hover at the back of the vision of a pragmatic web.¹⁸ The perspective to the pragmatic web is rather in bringing the community of inquirers, most notably web users, to bear on the issues of the purpose of information. While such intentions and contexts of users surely play a significant role in pragmatic accounts of meaning, and while these researchers are certainly right in criticising the semantic web approach in its limitation to the metadata idea ignoring the communities of human users and engineers, this approach sidesteps the perhaps more profitable possibility of incorporating truly semiotic pragmatics into the automatised and computational level of the web. It correctly notes the insufficiency of the vision of the semantic web that does not think that all human users, not just knowledge engineers in this self-critical approach are indispensable. It asserts that new meanings or concepts do not simply emerge by adding more and more structural features onto the web pages and by linking them more and more efficiently. Even so, there is still a need for methodetic, or semiotic pragmatics, that makes contact with the third main aspect of inquiry beyond grammar and logical semantics, but which would take place solely between computerised agents.

The Hydra of Lerna

One only hopes that from ashes of the vast amount of research done on the multi-agent systemics precisely this pragmatic web challenge springs into life. The challenge involves an attempt of building agents, or pieces of advanced software, which are designed to play the different semiotic roles of the quasi-utterers and the quasi-interpreters. That is, they would play the different positions in the cycles of dialogical semiosis as prescribed by Peirce's theory. This is the way in which they are intended to contribute to the generation of new objects and the evolution of new meanings in the web.

Agent systems still lack the truly goal-directed specifications of processes. Only when that is accomplished, could they be seen to create habits and produce wherewithal for their revision and adaptation. This is a long way off. Autonomous and proactive agents need to build sec-

¹⁸ As announced e.g. by Aldo de Moor, Mary Keeler and Gary Richmond, "Towards a Pragmatic Web", in U. Priss, D. Corbett and G. Angelova (eds.), *Conceptual Structures: Integration and Interfaces*, Lecture Notes in Computer Science, no. 2393, Springer, 2002, pp. 235–249.

ond-order evaluations of their own strategies, noting when a “habit-change” occurs, namely when *logical interpretants* are produced in the quasi-minds of agents as the end products of the process of semiosis that terminates or is about to terminate. They need to learn whenever they “feel” pain; whenever something meaningful happens to one of the individual agents. But to know when that is to happen depends on a correct evaluation of those habits that already are in agents’ possession.

Questioning the Web

Elements of such goal-directed agent systems are emerging with the vision of a knowledge web. According to this vision, one tries to overcome these shortcomings and supersede both the semantic and the pragmatic web enterprises by taking agents as constructors building a huge question-answering system on the web data, and responding queries on an information-need basis. This is certainly a long way off, because one needs to accomplish two things: one needs to (i) have a comprehensive logic of questions and answers, and to (ii) define a workable possible-worlds structure of the web. Neither has been accomplished as yet.

As to the first item, the quest for a logical relation between questions and answers stands upon the edge of the theories of presuppositions. (The task is also related to the extensions of Peirce’s theory of abduction.) This is because requests for information can be viewed as epistemic statements. The query “Bring it about so that S ” has a meaning in the non-imperative epistemic sentence “I know that S ”. As to the second item, the web nodes are to be viewed as knowledge providers, and via that emerging structure the epistemic statements can be translated to mean that “the user knows S in the information state w if and only if S holds in all the web nodes accessible from w ”.

The inquirers of the web information need to start off with mutually agreed initial states representing actual states. But as they are software agents querying other software agents, w codifies the knowledge in the position they have reached within a “model-checking” game on the web.

An alternative, and I believe a complementary way to the building of a knowledge web uses conceptual graphs.¹⁹ They are descendants of Peirce’s existential (beta) graphs put in modern clothing. Their purpose

¹⁹ Guy W. Mineau, “A First Step toward the Knowledge Web: Interoperability Issues among Conceptual Graph Based Software Agents, Part I”, in Uta Priss, Dan Corbett and Galia Angelova (eds.), *op. cit.*, pp. 250–260.

in the domain of a knowledge web is to provide good representational formalisms to describe workings of software agents.

Semantic + Pragmatic Webs = The Semiotic Web

Both semantic and pragmatic web visions share the concern for the inadequacy of the current conceptual scheme of the web. The initiative of a semantic web aims at providing a “logical analysis” of the data, while the initiative of a pragmatic web adds the human perspective to it. Both approaches are somewhat unsatisfactory alone, but their merger, when conceived from the perspective of semiotic and logical outlook on inquiry, has attractive emergent features. The outcome is what could be called the *semiotic web*. It combines both the semantic web and the pragmatic web initiatives but surpasses them in being faithful to Peirce’s pragmatic approach to inquiry. Unlike the proposed semantic and pragmatic webs, one can operationalize the semiotic web by effective multi-agent systems, by a logic of questioning and answering, and by taking agents as roles in a dialogical semiotic inquiry of signs in the universe of the web. The upshot is that not only the weaknesses of both semantic and pragmatic web conceptions become addressed, but also it is seen that these two enterprises cannot and should not be separated from each other.

Pragmaticism in a Communicational Perspective

In the light of previous remarks, the common ground of pragmatically inclined software agents is bound to be quite different from that of humans. It is clear that software agents do not have similar self-awareness properties, such as those telling what it is to be a member of the common genus of *homo*; it is also quite clear that knowledge of the language and knowledge of the universal aspects of grammar or specifications of a code is in the hands of the programmer. It is also clear that the world experience differs. But agents do not need to be taken as fundamentally different from humans in all their aspects. For instance, common knowledge of rationality and common knowledge in general, essential in the creation of cominterpreters, are notions quite efficiently definable at the logical level. To link languages to the world presupposes that there is a great deal of common experience shared by the utterers and interpreters of languages. In Peirce’s system, it is typically the copula that ties predicate terms to the elements of the domains of discourse. In received systems of logic, the interpretation of a language is simply

given by the valuation function that assigns values to its non-logical constants (functions, predicates and symbols). This provides the boundary conditions upon which the semantic clauses are devised. However, in the semiotic perspective such a valuation is itself subservient to a revised dynamic and dialogical interpretation.

To summarise, the preceding discussion suggests that the two components of being pragmatic should be taken equally into account in semantic/pragmatic web enterprises:

First, there is the *contextual/situational/environmental dependency* of signs. There are logical ways of attacking this, as witnessed by the conceptual graph research based on the diagrammatization of propositions by Peirce's theory of existential graphs. Diagrammatic reasoning systems plus other heterogeneous representation formalisms are typically context-dependent by their very nature.

Second, there is the *utterer's meaning* as distinct from that of the literal meaning of the utterance. Recalling the divisions between different notions of interpretants, the utterer's meaning is to be found in the intentional interpretant, intended to be mediated in as meaning-preserving way as possible to the receiving effectual interpretant created in the mind of the interpreter. By contrast, the literal meaning is to be found in the immediate interpretant of the sign. The immediate interpretant is that which is created even if there is no interpreter.

These points relate to the Peircean concept of the universe of discourse, which can be conceived in two ways.

First, there is the *contextualisation task*, which is made easier by there being collateral observation and mutual experience shared by agents. This is the task of "model-building". It is quite explicitly described in the presuppositions of Peirce's diagrammatic and iconic theory of existential graphs as a collaboration between the Graphist and the Grapheus, namely between the agent who proposes modifications to the graphs and the agent who "creates the universe" and decides the truth of atomic expressions.²⁰ There is no opponency or competition in this description.

Second, there is the sign-theoretical *communicative task*, where signs represent objects, their instances being chosen from the mutually observed domain of discourse by the dialogue participants. This is the task of "model-interpreting", which is described by Peirce in the constitutive

²⁰ Ahti-Veikko Pietarinen, "Diagrammatic Logic and Game-Playing", in Grant Malcolm (ed.), *Multidisciplinary Studies of Visual Representations and Interpretations*, Elsevier Science, to appear.

rules of interpretation and considerations pertaining to the education of partakers' habits. The discourse participants will have opposing purposes.

In view of these, the following points are to be noted:

(i) The easier it has become to transmit data through computerised networks, the more difficult it has become to share data for mutual processing and understanding. This is not so much a shortcoming due to technological challenges than a failure to recognize Peirce's concept of a person not absolutely an individual. The multi-agent systems are the proxy forces set out to do what humans have failed to accomplish.

(ii) What is more important than the complex attempt of making incompatible vocabularies of databases and web documents to understand each other is to refurbish methodologies for the sharing of meaningful information. Already Peirce laid emphasis on the importance of methodeutics for the community of inquirers, in order to study "the methods that ought to be pursued in the investigation, in the exposition, and in the application of truth" (1.191 [1903]). This is central in communication, for "it is the doctrine of the general conditions of the reference of Symbols and other Signs to the Interpretants which they aim to determine" (2.93 [1902]). Ultimately, there is then a need for finding a "method of discovering methods" (2.108 [1902]) that would enable inquiries to manage the ever-increasing streams of computerised information.

Conclusions

I have identified some of the main issues and problems involved in a general amalgamation of communicative and triadic viewpoints on signs, and assessed the contribution it makes to the emerging contour of a full Peircean notion of communication, as sculpted by the recent era of intercommunicating computational systems.

What are the implications for a new research agenda for philosophy? Peirce's philosophy represents a drastic departure from the Cartesian view of philosophy, the one-time programme of those who were trying to understand, on the one hand, the discourse of the distinction between mind and matter, and on the other, the discourse of the interaction between them. Peirce presents all interaction as triadic between signs, objects and interpretants. Of late, his philosophy has been reproduced as an open-systems philosophy where systems, be they artifacts or human beings, react upon environments in a non-programmed, habitual manner. For that reason, some may regard it a never-never-philosophy, a Peircean "would-be", hypostatically abstracted metaphilosophical *Erewhon*. My

view is that it is strictly rational, adhering to principles of logic, and keeping a critical eye on other socio-logical principles of inquiry, including the much less logical post-Marxist utopias of global communication communities, or dystopias of all-pervading power relations. It emphasises the role of the community of inquirers, be they quasi-minds of software agents or human interpreters, in creating new objects, developing new meanings and concepts, and ultimately achieving the main goal of scientific inquiry, namely the attainment of truth.

It is remarkable how well Peirce's never-never philosophy has held up its promises in the light of current technological advances – I see this as a self-returning pragmatic maxim. I predict prosperity for Peirce's philosophy in the 21st century, not only because of its pragmatic solutions to ever-increasing pragmatic questions, but also because we are only beginning to see the grave limitations of the last century's conceptions of logic and the *impasse* of analytical philosophy.²¹

²¹ This work has been supported by the Academy of Finland (project no. 104262) and the Ella and Georg Ehrnrooth Foundation.