

Information in Formation: A Peircean Approach

Informação em Formação: Uma Perspectiva Peirciana

André De Tienne

Indiana University at Indianapolis - USA
adetienn@iupui.edu

Abstract: Two conceptions of information weave their way through Peirce's writings. The first one emerges in 1865 in the famous formula "comprehension x extension = information," and tightly connects information with the newborn interpretant. The second conception emanates from Peirce's late definition of a sign as a medium that "communicates forms," which entails a more dynamic and processual conception of information. After discussing the potential relevance of Peirce's contribution to information theory, I show how Peirce's early recalculation of the two logical quantities of breadth and depth led him to define the third quantity as information. The meta-role of the interpretant is then clarified to explain what makes that third quantity special. Mihai Nadin's conception of anticipation is then introduced and a case is made for its pertinence in understanding the telic nature of information. Once this is accomplished, I turn to Peirce's later writings and discuss his conception of "genuine information," before proposing an analysis of the three types of "influence" or determination that constitute information.

Keywords: Information. Anticipation. Breadth. Depth. Interpretant. Proposition. Symbol. Final causation.

Resumo: *Dois conceitos de informação entrelaçam seus caminhos pelos escritos de Peirce. A primeira surge em 1865, na famosa fórmula "compreensão x extensão = informação" e liga fortemente informação com o recém-nascido interpretante. A segunda concepção emana da definição peirciana tardia de signo como um meio que "comunica formas", que acarreta uma concepção de informação mais dinâmica e processual. Depois de discutir a relevância potencial da contribuição de Peirce à teoria da informação, mostro como o precoce re-cálculo, por Peirce, das duas quantidades lógicas da largura e da extensão levaram-no a definir a terceira quantidade como informação. O metapapel do interpretante é, então, esclarecido para explicar o que torna especial aquela terceira quantidade. A concepção de antecipação de Mihai Nadin é, então, introduzida, e discuto sua pertinência no entendimento da natureza tética da informação. Isso feito, volto aos escritos tardios de Peirce e discuto sua concepção de "informação genuína", antes de propor uma análise dos três tipos de "influência", ou determinação, que constituem a informação.*

Palavras-chave: *Informação. Antecipação. Largura. Profundidade. Interpretante. Proposição. Símbolo. Causação final.*

1. Peirce's Relevance

Peirce's pragmatistic theory of information is indissolubly connected to his semiotic theory of propositions, itself an elaborate outgrowth of the traditional subject-predicate propositional logic and of the logic of relatives. Although Peirce may not appear to offer an extensive and comprehensive theory of information in his writings because only a few of them seem to discuss it mostly in passing, terminological appearances are deceiving and one should have no doubt that such a theory actually pervades his writings from the mid-1860s to the last years of his life. The development of his theory shows remarkable continuity through an evolving vocabulary stimulated by the refinement of his analysis. This paper wants to recall some of the steps in that development and comments on their significance,¹ with the aim of showing that many of Peirce's suggestions may help clarify what is entailed in the concept of information at a time when contemporary information theorists of different stripes are facing problems stemming from having adopted incomplete or simplified definitions decades ago.² It may well be that Peirce's semiotic logic provides a general theory capable of unifying all existing information theories, notably by showing exactly what function each fulfills within a common spectrum of concerns.³

Since Claude Shannon's 1948 foundational paper "A Mathematical Theory of Communication," information and communication theorists alike have been struggling with how best to define the two interrelated but distinct objects of their science. Many of their theories, and applications thereof, depend upon such definitions and the motives that drive their formulation. The ever-important economic motive of conceptual manageability and technological implementability naturally demands that working definitions be kept simple, and one way of doing so is to translate them into mathematical formulas. Once Shannon determined that information could be reduced to the minimal set of signals without which adequate understanding of a message would not obtain — thus a set of signals so formed and ordered that their reception allowed the message to be reconstructed without lingering uncertainties — it became accepted that information could be reduced to those message-essential signals that a receiver could not be counted on to make out on its own, that is, those signals that were indispensable to remove unallowable (message-endangering) uncertainty⁴. This new theory, which quantitatively

¹ See BROCK (1969) for a more systematic and thoroughgoing retracing of these steps.

² Among information theorists well aware of the advantage of paying close attention to Peirce's semiotic logic, there is João Queiroz who has been actively collaborating with a number of other theorists (Claus Emmeche, R. Gudwin, C. N. El-Hani, W. Hofkirchner, A. Gomes, to name a few). These scholars regularly share the result of their research at international semiotic and information science conferences. That by turning to Peirce's semiotic suggestions they are on the right track is a belief that accompanies this paper.

³ This hypothesis, however, is not one that this paper will seek to demonstrate. But whether information is understood in terms of message, bits, data, sensory input, pattern imaging, formal determination, quantum state, or otherwise, the fact that it is sign-dependent calls for such a hypothesis.

⁴ That type of uncertainty, however, has little to do with the much richer Peircean notion of vagueness or indeterminacy, which can only be understood within the complexity of the triadic sign relation. The departure between a Peircean and a Shannonian notion of information is parallel to that between Peircean vagueness and Shannonian uncertainty.

equated information with uncertainty, quickly became a fertile paradigm that opened the door to statistical analysis of information and began generating countless technical devices capable of channeling information signals with ever-increasing efficiency. One stripe of information theory then became the theory of how best to break down, encode, transmit “noiselessly,” and preserve such signals so that the probability of their corruption at decoding time be minimized — thus a theory enabling engineers to meet the challenge of how to reduce signs (and their channeling devices) to their smallest possible size without losing essential signifying power.⁵

What is today called informatics or information science has recently evolved beyond the realm of computer science and information technology, at least at some institutions, to become a confluence of studies in artificial intelligence, cognitive science, formal logics, and other related activities that study how natural or artificial systems represent, process, transform, and communicate information, taking into account epistemic, sociological, computational, graphic, and even economical dimensions. Information is then viewed in terms of recorded or recordable knowledge, and informatics is the science of how best to gather, manipulate, classify, store, retrieve, disseminate, reproduce, and interact with the record of that knowledge. The word “knowledge,” of course, is too broad to convey a specific understanding of the word “information,” and circle-loving dictionaries routinely use either one to define the other, often creating other circles in the process. In the computing realm, for instance, information is viewed sometimes as whatever “collection of facts or data” can be broken down into bits and recombined with no loss in between. But “data” gets in turn defined as “factual information organized for analysis” and “facts” are defined as “information presented as objectively real.”⁶ Wherever circularity manifests itself, there is a difficulty worth thinking about.⁷

Part of the difficulty comes from the fact that current usage of the vocabulary of information and communication, in its nominalistic reductionism, has bounced back into ordinary language and affected the general understanding of such words. The many successes the field of informatics has accumulated in transforming “meaning”-carrying signals so that they become embedded in a variety of physical media that preserve

⁵ Mihai NADIN has written extensively on computational semiotics and has been defending the view that computers are “semiotic engines” (almost) as much as human beings are.

⁶ See for instance the *American Heritage College Dictionary*, third edition.

⁷ “Communication” also comes with its share of circular definitions since it is often associated with the transmission of information to some entity capable of processing it, while transmission is defined in terms of communication and passing along of information. Communication(s) science has become the art of assembling a technology capable not only of delivering uncorrupted information, but of making sure that such information be received in a form optimally suited to a receiver’s specialized configuration, so that receiver-initiated transformations of the transmitted data remain consistent with their initial form, minimizing interpretational errors. Here, too, preoccupation with electronic bits of information and their successful exchange is central. For a fresh look at what Peirce’s views on communication may amount to, see Ahti-Veikko Pietarinen’s chapter 13 on “Peirce’s Theory of Communication and Its Contemporary Relevance” in his *Signs of Logic: Peircean Themes on the Philosophy of Language, Games, and Communication* (Springer: Synthese Library, v. 329, p. 421–40, 2005).

these signals and open them to search-and-retrieval operations, formatting, and even visual and rhetorical enhancements, have been such that metaphors now abound that seek to understand the life of the mind according to similar paradigms. This has created certain optimistic expectations regarding the possibility of conceiving and designing so-called intelligent systems capable not only of processing raw data, but also, at a higher level, of processing the “meaning” those data are “carrying” in ways that are genuinely inferential. The challenge has naturally become that of generating a Shannonian kind of definition of meaning that can then be successfully implemented. Many such definitions have been generated, with great sophistication, but the lack of their success (beyond Turing effects of intelligence simulation that remain “degenerate” in the mathematical sense) has brought such scholars as Queiroz and his colleagues to turn to Peirce.

2. Peirce’s Recalculation

Peirce’s technical/logical concept of information appears for the first time in the tenth and eleventh Harvard lectures of 1865, and subsequently in the seventh and eleventh Lowell lectures of 1866, and a number of key 1867 texts, including the Logical Notebook, “On a New List of Categories,” and most centrally “Upon Logical Comprehension and Extension” (ULCE).⁸ These are the years when Peirce had fastened himself like a bulldog to the fundamental investigation of the structure of synthetic propositions. Extensive study of the Aristotelian, scholastic, and modern logical traditions brought him to a closer understanding of the essential internal dynamic of proposition-formation than any other logician before him had managed to attain. The “new list of categories,” for one thing, reflected his finding that, no matter how one would analyze a proposition, there were certain elements in it that were not only irreducible to one another, but also universally present in any proposition no matter its genealogical (or inferential) history or the mode of its statement, and ordered according to a law of non-reciprocal dependency (or “gradation,” couched in terms of precision), the discovery of which was Peirce’s most original contribution to the subject.

Part of Peirce’s analysis of propositions rested on his patient “recalculation” of two quantities long associated with propositions: those of extension and comprehension. In ULCE Peirce retraced the history of their usage and definitions in order to pinpoint the nature of his own contribution: disentangling a web of confused meanings and terminology, identifying the exact extent of the inverse proportionality of the two quantities, and identifying precisely the third quantity, vaguely suspected by Überweg and otherwise misunderstood by the few who had thought about it. Peirce made it clear that this third part of his contribution rested on the results of his three-category analysis of the formation of a synthetic proposition.⁹ That analysis showed that any proposition (whether relying

⁸ See W1: 276–89, 302, 340–43 (1865); W1: 459–67, 479 (1866); W2: 1–10, 56–59, 70–86 [= “ULCE”] (1867); W2: 175, 182–83 (1868); W3: 37, 98–102 (1873). Many relevant passages from the early writings have been liberally posted on Internet forums and discussed by Jon Awbrey, an enthusiastic student of Peirce’s theory of information.

⁹ W2: 59 and 82 (1867).

on a monadic, dyadic, or triadic predicate) consisted of an ordered triplet of references: a direct reference to its object (the real things that it represents), an indirect reference to the characters common to these real things, and an indirect reference to an interpretant defined as the totality of facts known about its object. Peirce showed that the first of these references was pointing to the “informed breadth” of the proposition, the second, to the “informed depth” of the proposition, and the third, to the “information” concerning the proposition.

Exact understanding of these distinctions and several others that are related requires a thorough reading of Peirce’s ULCE. There is no room in this paper, nor is it its goal, to provide a full explanation of them. But since Peirce’s 1867 analysis is one that he still considered to be correct in the main and, therefore, continued to use forty years later, some explanation is needed.¹⁰ Of paramount importance to Peirce is that logic is concerned with truth, and that truth is not a disembodied property of arbitrary definitions,¹¹ but a consequential measure of a proposition’s capacity to represent “real things,” that is, things rooted in an actual world of action and reaction. Information is a concept that cannot be divorced from such a logical concern.

Any synthetic proposition of consequence must have matter to matter at all, and form to mean anything. This may be an Aristotelian way of putting it, but it is one that

¹⁰ See for instance Peirce’s definition of “Quantity” (among many other relevant definitions) in Baldwin’s *Dictionary of Philosophy and Psychology* (1902, reprinted in CP 2.362-6) or his 1904 statement in “New Elements” published in EP2: 305, where he refers back to his 1867 article. Few scholars have paid serious attention to ULCE (which Peirce revised in 1893: see R421 and CP 2.391–430). Thomas Goudge well perceived its significance in the last part of his 1952 paper on “Peirce’s Theory of Abstraction,” in which he concluded (cautiously) that Peirce’s many distinctions represented “not only an original, but also a basically sound contribution to logical doctrine,” and that his analysis of informed breadth and depth was “a particularly useful piece of work” with “important connections to his general theory of inquiry” (GOUDGE, 1952, p. 132). R. M. MARTIN (1980, p. 79), too, saluted the exceptional importance of the article while regretting that he couldn’t devote to it the careful study it deserved. In her 1999 paper on “Extension, Intension, and Dormitive Virtue,” Cathy LEGG has pertinently noted that questions regarding Peirce’s intensionalism or extensionalism are not as anachronistic as one might think, and she has suggested one way (through Peirce’s understanding of the nature and semiotic function of a hypostatic abstraction) of seeing how Peirce moved beyond that distinction in a fashion that neither Carnap (with his two-level extensionalism) nor Quine (with his one-level extensionalism) could have envisioned. The present paper follows Legg’s direction, I think, by suggesting that Peirce’s “move beyond” landed him in what might be called (a bit too easily, perhaps) “informationalism.” A few scholars who have studied Peirce’s logic of vagueness have also referred to this aspect of Peirce’s research: preeminent among them is Jarrett Brock, who has rightfully noted and demonstrated that the discussion of the indeterminacy or determinacy of any kind of symbol should be conducted in terms of the triad of breadth, depth, and information (BROCK, 1969: 23). See also NADIN (1980) and TIERCELIN (1992: 66).

¹¹ See EP2: 278 (1903) where Peirce explains that nominal definitions are propositions in the imperative mood, and thus not real propositions, which require the indicative mood: a real anchor is a *sine qua non* condition.

Peirce consistently favored. From the simplest to the most complex propositions, each one of them must minimally consist of, first, some component that represents that which the proposition is about — ultimately, some individual thing(s) that the proposition is itself singling out as its own occasion of “proposing” or stating something. That component will constitute the subject-matter, or “subject” (the set of objects constituting it) of the proposition. Second, any proposition needs to reveal some character, relational property, or form, that is somehow connected to the subject; whether we call it quality, attribute, modifier, relative, or otherwise, such a character must really belong to the subject in order to be predicated of it. And third, any proposition must actually bring the subject and predicate together and state that it is bringing them together with “good reason.”¹²

For a propositional term to be a predicate, it must have “informed breadth,” that is, it must be predicable of real things, “with logical truth on the whole in a supposed state of information” (W2: 79 or W3: 100). Peirce explains that what this means is that “all the information at hand must be taken into account” and that no part of the informed breadth can be something for which there is no reason to believe that the term is truly predicable of it. Attribution of a predicate to a subject is therefore not an arbitrary affair: logic demands that experience or acquired knowledge, i.e., the set of all synthetic propositions that have already been formed about the subject, not only does not contradict the possibility that the new term offered in the proposition represents a character that really belongs to the subject, but even more so provides the suggestion of that possibility through known correlations (this is an argument from the “New List”). The force of that suggestion varies according to the degree or extent of the relied-upon experience, or actual prior acquaintance with the kind of objects represented, so that the informed breadth may be more or less certain or doubtful, more or less actual or potential.

For a propositional term to be a subject, it must have “informed depth,” that is, it must have real characters that can be predicated of it also “with logical truth on the whole in a supposed state of information.” The informed depth is measured not according to the number of “mere names” that can be attached to the subject, but to the number of distinct properties a devotee of the pragmatic maxim could sincerely distinguish as really belonging to the subject of the proposition. This implies the possibility of testing comparable objects and subjecting them to an inductive inquiry. Peirce indeed shows that induction, by enlarging the breadth of predicate terms, actually increases the depth of subject terms — by boldly generalizing the attribution of a character from selected objects to their collection — while hypothesis, by enlarging the depth of subject terms, actually increases the breadth of predicate terms — by boldly enlarging their attribution to new individuals. Both types of ampliative inferences thus generate information.

The “supposed state of information” consists in the complete set of premises that support the stating of a given proposition in the indicative mood (the genuinely synthetic

¹² The distinction between subject and predicate has often been questioned by contemporary logicians. Peirce was well aware of the danger posed by its seemingly arbitrary grammatical (even metaphysical) root but insisted that the logical function of either subject or predicate was irreducible to the other, if only for categorial reasons. See CHAUVIRÉ (1995: 220–26) for a complementary explanation.

mood).¹³ Once the new proposition is stated, it adds itself to the stock of information, but, in so doing, it may or may not affect the “supposed state” of that information according as the latter’s depth or breadth got increased or not. Information is not a quantity that automatically increases or decreases following each new statement of a distinct synthetic proposition. The reason is that information is not a mere sum of quantities, but a product, and that this distinction harbors a profound insight.

When Peirce began defining, in 1865, information as the multiplication of two logical quantities, breadth and depth (or connotation and denotation, or comprehension and extension), it was in recognition of the fact that information was itself a higher-order logical quantity not reducible to either multiplier or multiplicand. Unlike addition, multiplication changes dimensionality. Information belongs to a different logical dimension, and this entails that, experientially, it manifests itself on a higher plane as well. Attributing a predicate to a subject within a judgment of experience is to acknowledge that the two multiplied ingredients, one the fruit of denotation, the other of connotation, in their very multiplication or copulative conjunction, engender a new kind of logical entity, one that is not merely a fruit or effect of their union, but one whose anticipation actually caused the union. Pragmatically, every proposition in expressing itself partially fulfills the purpose that drives its formation.

3. Meta-Agency

For this to be possible, one needs to remember a crucial outcome of the argument of Peirce’s 1867 “New List of Categories.” As he was describing the multifaceted role played by the interpretant within the comparison process that allows a proposition to emerge, Peirce distinguished two aspects of how the interpretant exercises its mediation. We need to recall that for a predication to occur three elements are necessary: first, a representational candidate (or ground, whether it be monadic, dyadic, or triadic) with a claim that it is attachable to something (one or more subjects); second, a successful history of having been so attached on previous occasions (the correlate); and third, a mediating entity that compares the representational claim (the relate under supposition) with previous occurrences (correlate) and confirms that the current claim belongs to the same class as the other ones and that it is therefore valid. Such validation seals the claim, the copula is allowed to exert its representative function, and the proposition gets expressed.

¹³ In W2: 79, Peirce explains that a supposed state of information is one that lies somewhere on a continuum whose limits are two imaginary extremes: one of complete factual ignorance (in which there are no propositions, just unpropositioned meanings — a state of “essential” breadth and depth), and one of omniscience (in which there are no more propositions to generate — a state of absolute intuition, in which breadth and depth have both turned “substantial”). In Peirce’s later writings, that same continuum involves the principle of fallibilism, as Kelly PARKER (1998: 185) makes clear: “our current state of information is always incomplete, and possibly altogether wrong. The current state of information is but a stage in a great continuum of inquiry, carried on by an infinite community that is far broader than the human community.”

The modestly mediating interpretant fulfills two distinct functions: one is to recognize that a representational claim is being offered for validation and continuation; and the other is to identify the potential predicate by correlating it with previously sealed representations, determining that the current situation is actually akin to them, and stating that kinship to future interpretants by blessing the copulative union of subject and predicate. Couched in terms of Peirce's mature semiotic theory, it means that, first, the interpretant is being determined by the sign to represent the object in the same triadic fashion that the sign itself claims to be doing (i.e., the interpretant is being determined by the sign to determine other interpretants relative to the object); and second, the interpretant must also represent, not the sign's object merely, but the very relation of the sign to its object — thus turn that relation into its own object, and offer it to another interpretant.¹⁴

There are thus two overlapping triadic relations within semiosis, one that is first-intentional, and the other second-intentional. Within the first-intentional relation the interpretant collaborates to represent the object, while within the second-intentional relation it is busy representing the representation itself. The interpretant is both an agent and a meta-agent. It is a sign solicited by the first sign in order to facilitate the representation of the object, but this (assenting to solicit yet other interpretants for the object's cause), the interpretant can agree to do only conditionally: that it first confirm that the requested representation stands on good ground, "taking all the information at hand into account." As Peirce put it in 1906, "that the thought should have *some* possible expression to some possible interpreter is the very being of its being" (R 298: 8), and that is what needs to be ascertained second-intentionally through the interpretant. Because every sign "stands to" or addresses itself to an interpretant, every sign — at least, every symbolic sign — is *anticipating* another sign.

4. Anticipation

In a remarkable programmatic paper titled "Anticipation: A Spooky Computation" Mihai Nadin has written that "every sign is in anticipation of its interpretation." He explains (NADIN, 2000: § 5.1.1):

Signs are not constituted at the object level, but in an open-ended infinite sign process (semiosis). In sign processes, the arrow of time can run in both directions: from the past through the present to the future, or the other way around, from the future to the present. Signs carry the future (intentions, desires, needs, ideals,

¹⁴ Such a claim can be found for instance in the "Syllabus" of 1903 (see EP2: 273) and also appears in Peirce's letter to Lady Welby in EP2: 477–78: "the sign not only determines the interpretant to represent [...] the *object*, but also determines the interpretant to represent [...] how this very sign itself represents that object." I thank Éric Chaput for having brought into relief this crucial distinction in a recent discussion. Joseph RANSDALL was the first scholar to make much ado about it in his 1966 dissertation on "Charles Peirce: The Idea of Representation" (New York: Columbia University). See also De TIENNE (1996: 186-8).

etc., all of a nature different from what is given, i.e., all in the range of a final cause) into the present and thus allow us to derive a coherent image of the universe. Actually [...], a semiosis is constituted in both directions: from the past into the future, and from the future into the present, and forward into the past. [...] The two directions of semiosis are in co-relation. In the first case, we constitute understandings based on previous semiotic processes. In the second, we actually make up the world as we constitute ourselves as part of it. This means that the notion of sign has to reflect the two arrows.

Although Nadin's discussion goes beyond the scope of our paper, his suggestion is worth paying attention to. Anticipation is a process through which the representation of a future state determines a present semiotic event, and this implies a teleological dimension, not of an Aristotelian, but of a Peircean kind.¹⁵ Put briefly, one simply needs to remember that for Peirce every symbol is teleological in the sense that, being preoccupied with its own development into new interpretants, some of which are dynamic and thus instantiating, it adopts a conditional (would-be) form that orients it toward the future. As legisigns, symbols are partly general, partly vague enunciations of what could happen in the future given certain antecedent conditions that they spell out to some degree. Such an evolving, self-correcting outlook toward the likely future is structurally embedded within symbols and distinguishes them from other types of signs. In addition, all symbols are signs that seek to "replicate" themselves, since there is no law that governs no event. Replicated symbols are a special kind of sinsigns: they are rule-bound semiotic events whose instantiation occurs under the rule's guidance. Each instantiation thus anticipates the rule that it replicates, and in doing so it anticipates the future: the instantiation takes it into account, and thus is determined by it, although that determination is, as Nadin says, in the range of a final cause rather than of an efficient cause. Semiotic events are vectorized, they happen not at random but within an inferential continuum that ensures that propositions that conclude arguments, especially ampliative ones, become themselves premises to new arguments, in the same way as any symbolic sign has first been an interpretant before serving as a sign solicitor of new signs. Signs come into representational being not haphazardly but because they are wanted. They have a role to play, a favor to do some other sign. Signs continue threads of thought, never for their own sake, and never for the mere sake of those previous signs that gave rise to them, but for the shared sake embedded within the continuum itself. That shared sake cannot but be second-intentional, a sort of afterthought that is actually a forethought.

A semiotic continuum cannot be merely a chance accumulation of semiotic events branching chaotically in unforeseeable directions; it has to build on its own identity, and identity, as Peirce understood since 1865, is a matter of logical consistency. Every proposition is subject to a "condition of consistency," Peirce wrote, because "its elements must be capable of being brought to unity"; that consistent unity, he added, "belongs to the judgments of all mankind," and thus "we may be said to belong to it."¹⁶ That condition

¹⁵ I do not have room to discuss at any length Peirce's semiotic notion of teleology and thus must ask readers to bear with this limitation. The notion has been frequently discussed in recent literature; see especially HULSWIT (2002).

¹⁶ First Harvard lecture of 1865, W1: 167.

of consistency is teleological through and through, and it presides over all representations — a symbol's symbol, as it were. Personal identity is one of its tributaries, but truly all general purposes flow down from it. When Nadin says that “we make up the world as we constitute ourselves as part of it,” he implies that the world as order or cosmos emerges out of myriad constitutions of identities (whether personal, social, cultural, or natural), each one of which contributes to the greater identity-in-process of that cosmos while at the same time deriving its own plan of growth from that larger process — by anticipation. Hence, when Nadin also writes (in the same section quoted earlier) that “the interpretant as a sign refers to something else anticipated in and through the sign,” he conveys the idea that there is a continuum or continuous history of anticipation that traverses any sign process from its origin within the dynamic object to its end in the (teleologically) final interpretant. Interpretants carry that inferential, self-adjusting, self-correcting history throughout: they inherit it, and they add their own modicum to it by exerting their own anticipation (their own listening to the continuum ahead of them) while “taking into account all the information at hand.”

If the latter phrase keeps coming back, it must be because it helps anticipate the direction of the argument here unfolding. Information, it is now suggested, is the collection of synthetic propositions that allow anticipation to take place. Since information is measured (to use Peirce's 1865 vocabulary) in terms of “superfluous comprehension” (in abduction) or “superfluous extension” (in induction), thus in terms of a logical supplement that does not decrease the other quantity, information consists of interpretants that are themselves “equivalent representations,” that is, ampliative conclusions that increase knowledge without affecting the essential definitions of the terms involved.¹⁷ Anticipation cannot take place if it does not rest upon a stock of ampliative propositions that it can trust — a stock that is open to verification, testing, refinement, possible rejection, but one also whose each component was once itself an object of anticipation that survived the vicissitudes of continued inference. This implies that informative propositions (and arguments) are those that carry a second-intentional stamp all over them, one that testifies to their validity and fruitfulness within the ongoing semiotic continuum. They bear the second-intentional sign of being the non-arbitrary product of first-intentional quantities.

To become and remain informative, propositions need to be evaluated or monitored regarding the trustworthiness of their source, the inferential history that led to their formulation, the purpose that drove the manner and timing of their expression, their ability to maintain coherence with new propositions, their potential usefulness for future inferences, and their aptness to remain interpretable and “actable” upon. Information is thus a proposition or an ordered set of propositions that must lead to other ones, a conclusion whose function is to act as a premise. Information is thus inherently processual — not in a mechanical sense, but in a semiotic sense — precisely because it must be anticipatory. It is not itself anticipation in the making, but a “good reason” or good ground to anticipate the future and so provide both direction and consistency to subsequent inferences. Information is a cumulative process driven by a sense of what needs to get expressed “next” in view of an overarching purpose. That overarching

¹⁷ W1: 465–67. See also De TIENNE (1996: 152-3, 264-5).

purpose, because of its symbolical nature, is never determinate but vague to some extent and general to some other extent, and what gives it telic power is its logical — but also natural — demand for continuous determination or “replication.” It will be found that informative propositions are those that record factual observations of events or phenomena that occur, whether consciously or not, in anticipation of real future possibilities or states of things or conditions of action or conduct.

5. Genuine Information

Let's make a jump here to Peirce's late writings. In the fall of 1903, while he was busy drafting the Lowell lectures, Peirce came to ponder about what constituted *genuine information* (genuine in Peirce's mathematical sense of non-degenerate). Here is how we find him musing (R463: 9–10):

If anything is *true*, definitely and decidedly true, that of which it is said to be true may be in some sense a creation of the mind. Still, once created, it must be in a measure independent of thought, so that merely denying the truth of what is asserted shall not destroy its truth. Otherwise, it does not mean anything to say it is true. [...]

Now if you inform me of any truth, and I know it already, there is no information. If it is something that I shall never have any further reason to believe, you are speaking of a universe with which I have no concern, and what you say signifies nothing to me. If it is genuine information, it must amount to this, that whenever and wherever in the future such and such circumstances may occur, then I *shall* experience something. I beg you to notice that any information which ostensibly relates to the present condition of things really signifies what the person addressed *will* experience provided an opportunity occurs.

I emphasize this in order to prevent you from thinking that because a truth [is] related to what can be done, it does not relate to the actual state of things. Of course it does not say that what can be done has been done; but in saying what can be done it says precisely what all genuine information about the present state of things really limits itself to saying. [...]

I say of a piece of chalk that it is soft. If somebody objects, “No! It *can* be scratched; but at present, nobody is scratching it,” I say to him “My dear sir, you forget that the *purport* of words is nothing but their *purpose*.”

From this excerpt it is possible to extract several conditions that synthetic propositions must meet to be considered “genuine information.” In the first place, an informative proposition needs to convey some truth in the sense of being connected to a reality that is “in a measure independent of thought.” For that to be the case, that reality must have been a real event (an actual happening), one that no amount of reinterpretation can erase from history's blackboard, and thus one that, no matter how minutely, actually modified the attributes of a consequential state of things. “Connection to reality” implies that a large part of the information reflects or reports about a state of affairs that was in direct reaction with the original observation at the source of the

information. In Peirce's terms, there has to have been genuine secondness: reactional modifications have taken place that the informing mind did not simply make up, and they can in principle be distinguished from that mind's subsequent interpretation of them (however erroneous the latter might be), if only because they fall outside its range of interpretational control. By independence of thought Peirce means no more than this condition that is at the root of synthetic propositions: "superfluous" depth or breadth must "flow in over and above" what gratuitous contemplation of conceptions may extract from them through analysis; only experience, the kind that asks us to open our mouth while closing our eyes, can teach that kind of ampliative interpretant. Such a condition is not one that can be reduced to an "agreement about what actually happened" on the part of a cohesive group of interpreters whose opinions happen to statistically converge (as suggested to me by João Queiroz).¹⁸ Sometimes that kind of statistical convergence may be an appealing indication of the event's having actually taken place, but no amount of convergence can serve as, or measure up to, an "equivalent representation" of the event itself—it could measure up at the most to a definition, perhaps, but definitions are not "equivalent representations" since they are not ampliative. Besides, one should also note that Peirce holds that the interpretant of a proposition represents it to be a genuine index of a real object, "independent of the representation" (EP2: 278, 1903). That independence is therefore imparted through the very statement of the proposition, albeit at a second-intentional level.

In the second place, the truth conveyed must be so to some mind that had not experienced, and thus not been modified by, that truth previously. Information is consequential utterance: the listening or interpreting mind must be non-trivially affected by it when it comes. For that to be possible, the conveyed information should noticeably interfere with the listening mind's settled habits, otherwise it would simply fall on deaf ears. This novelty aspect (which implies a secondness of thirdness) is a phenomenal manifestation of the logical requisite that there be an increase of one logical quantity without a decrease of the other.

¹⁸ The notion of collective behavior of interpreters suggests that of a general entity that transcends any individual or subgroup within the collection. A collective behavior has to be the behavior of the collection, not the behavior of the sum of individuals within the collection. The collection should therefore be taken, not in its distributive sense, but in its general (indeed collective) sense. This distinction assumes that the collective behavior is not reducible to those common elements shared by each individual behavior with every other one within the collection, because such common elements could only be selected by someone looking in outside the collection (an external observer). The collective behavior, put differently but equivalently, is not one generated by any individual or subset of individuals, but one generated by the collection itself, which effect then is transmitted to each individual who begins to conform, in individual and idiosyncratic ways, to the collection's general idea. If that is the case, then "cohesiveness" would be a symptom of the reality of the collection, not of what the members of that collection happen to agree about. And here again we are dealing with how a "third" (in Peirce's categorial sense) manages to replicate itself within the realm of experience and confer its general form to singular or particular components of events. No nominalistic take on this matter can comprehend this, but only a realist semiotic standpoint à la Peirce can.

In the third place, the truth conveyed should relate to a universe that actually concerns the listening mind. Such a concern should be rooted in that part of the mind's past experience that has not already become obsolete but that still remains connected to the future. Indeed, information is a set of premises directed, not to the present self of the listening self, but to its future self. It must actually appeal to an interpretant, i.e., attract sustainable attention, awaken interest — connect to something that actually matters to the interpretant because it falls within its active purview. The interpretant must feel the logical urge to welcome that proposition as a premise for further inference that it is competent to produce. An empty proposition cannot be informative. This means that not only should it be able to connect with the interpretant's "collateral experience," but it also needs to be pragmatically meaningful.

Indeed, in the fourth place, the truth conveyed must have the power to signify something and not nothing to the future self. Thus the semiosis that is taking place must be well targeted, with a real power to generate actual interpretants that will themselves be fertile. It must not only concern the interpretant, but actually drive it to generate further interpretants sharing a similar purpose: this implies that the concern be genuine. Genuine information cannot be ignored without potentially adverse consequences.

Lastly, and most crucially, the truth conveyed must involve a real possible, that is, a conditional *shall be* (not to be confounded with a would be) even though it addresses a present state of things. The present state of things is not being stated for its own sake, otherwise the statement would be empty, but for the sake of the future consequences that are actually entailed by it. Hence, to Peirce's saying that a given piece of chalk is soft, it is no objection to counter-state that as long as no one has scratched it, one cannot be sure about it. What makes "This piece of chalk is soft" informative is precisely that it implies that it *will* be scratched if you bring a harder element into contact with it. Information is anticipatory only to that extent: it does not seek to evoke false fears or false hopes, but simply states that which must be taken into account for successful negotiation with future events. It has to provide good ground, once again. In Peirce's pragmatic words: "every kind of proposition is either meaningless or has a real Secondness as its object" (EP2: 279, 1903); its interpretant must refer to a possible individual experience that is not a fiction. For it is not fiction, but fact that every sign purposes to express, and a fact is "something having the structure of a proposition, but supposed to be an element of the very universe itself" (EP2: 304, 1904).

6. Information in Formation

A discussion of Peirce's conception of information cannot omit his 1906 definition of the sign as a "medium for the communication of a form."¹⁹ Such a formulation sheds significant light upon the telic nature of information as that which gives a form to a form in order to determine some other sign to take that same form. That other sign, Peirce tellingly

¹⁹ See the beginning of Peirce's spring 1906 letter to Lady Welby in EP2: 477, and also R793: 2–3 & 6–7, quoted in EP2: 544, n. 22. Pages from R283 printed in EP2: 389–92 are also connected to this discussion.

spelled it out once as the Interpretant (EP2: 477, 1906), in homage to the Latin gerund whose purport is often purposive. When information is viewed as a process of conveying a form, not mosquito-wise or indiscriminatingly (EP2: 391), but in highly specialized and effective fashion, it becomes more important to distinguish the roles played by the three partnering components of the sign's triadic relation in turning an ampliative conclusion into an ampliative premise for a further argument, which is what information as a process is tantamount to: in this active sense, information is a continuous transition from the genealogy of a symbol to its sphere of anticipation. Although the constitution of information is not the whole of the semiotic process since it stops short of anticipation itself, it is certainly at its core, and it should thus be possible to analyze more closely the components constitutive of it.

When Peirce defined *semiosis* in 1907, he made it very clear that this was a non-dyadic process, but “on the contrary, an action, an influence, which is, or involves, a cooperation of *three* subjects, such as a sign, its object, and its interpretant, this tri-relative influence not being in any way resolvable into actions between pairs” (EP2: 411). There are several ways of describing that “tri-relative influence,” and I will suggest one that fits the present discussion.²⁰

Within semiosis there are three ranges of simultaneous influences, all of which exert themselves in the name of the form: first, the influence that emanates from the object — let us call it exformation; second, the influence that emanates from the sign — properly called transformation; and third, the influence that emanates from the interpretant — which we might call metaformation. The combination of these three influences, I suggest, make out information in its processual sense.

Exformation is the emanation of a form by the object of the sign relation for the proximate purpose of attracting attention to it, the object, and for the remote purpose of fueling the semiotic telic engine. The forms that signs convey are not arbitrarily created out of nothing. Some of them are forms of firstness, and the type of sign that objects can determine in that regard are iconic. Others are forms of secondness, they are *agents provocateurs*, and bring other entities to react to them, turning them into indices. The third kind of forms, as Peirce puts it in R793, are truths of conditional propositions: “under certain favorable circumstances, this or that type of event would be bound to take place or be the case”; these are forms of thirdness, forms that can only be captured through symbols. Only this third type of forms matters as far as genuine informational signs are concerned. Peirce's elaborate discussion of dicisigns or propositions in the Syllabus of 1903 (EP2: 275–85, 294–99) and in “New Elements” (EP2: 308–24) demonstrates clearly how such propositions always involve iconic and indexical elements—elements of depth and breadth — without which they could not inform. At the same time, however, neither icons nor indices have any informative power on their

²⁰ “Influence” is a useful concept by virtue of the vague and/or general kind of determination it evokes. One of its less obvious virtues, especially in the context of this paper, is its serendipitous association with Peirce's juvenile conception of “influx,” a term he used in the early writings to describe the special kind of representational relation between subject and predicate, a relation that combined characters of the two other relations of community and cause-effect without being reducible to either one.

own²¹. They are indispensable “fragments of completer signs” (EP2: 306), completer signs that are alone capable of adopting a communicable form. When Peirce writes that “that which is communicated from the Object through the Sign to the Interpretant is a Form,” he implies that the object is that which initiates the communication because the form is entitatively present in the object: “it is literally true of it” (EP2: 544, n. 22). That entitative presence is a demand for representational embodiment: the object is effete symbol, a concrete embodiment of a law, and that law is what it offers, without being able to utter it on its own. Fragments of thought is all that it can offer to the discriminating signs, and that continuous offering may be called its exformation. If everything is cognizable for Peirce, it is not only because nothing can escape representation, but even more strongly because everything “wants” to be cognized: not the will of an efficient cause, but the telic will of a final conditional cause.

Transformation is the process of carrying and transmitting forms extracted from the mysterious but (ap)pealing object to the powers able to recognize them so that the law that provides identity to the object can be progressively made out. As mediums, signs are transitory; they act for the sake of the object, not in their own name. They convey the form according to their own capacity, and that depends on their own categorial constitution, whether they are themselves qualities, actualities, or generalities. Sometimes they are faithful to the form and may mimic it effectively, sometimes not. Forms will get transformed, will change clothing, and interpretants will need to take these changes (one of whose guises is encoding) into account: signs themselves need to be learned for proper deciphering of the initial form that hides underneath their veil. Some signs are more efficient or competent than others. Signing is the art of conveying forms through other forms: this particular kind of influencing aims at efficiently determining the right kind of interpretants to adopt the object’s form and increase its recognizability superfluously.

Metaformation, finally, is the influence exercised by the proactive interpretant as far as it concerns the form received from or suggested by the sign. The interpretant needs to reconstitute or get back to the initial form that signs could not but transform. The task is to welcome the form, ascertain that it is one of interest and worth caring for — worth investigating further by drawing the attention of other signs to it. Metaformation is not merely a decoding operation. It consists in a careful examination and evaluation of form-carrying signs (careful because it is risky — signs are easily misleading since they combine relevant with irrelevant forms), in order to recognize what particular role they play within a complex web of signs. Roles are always purposive, and the interpretant needs to identify the purpose, assess whether it is one relevant to the current semiotic process, one compatible with the continuum the interpretant belongs to itself, and thus one worth processing and re-forming so that other interpretants can take a look. In other

²¹ Hulswit has distinguished three types of determination exercised by the object over the sign: one of formal causation (or necessary condition in Hulswit’s words) over an icon, one of efficient causation over an index, and one of final causation over a symbol. Hulswit shows that the object’s determination of the interpretant through the sign is of the same respective kind—while in all cases, the direct determination of the interpretant by the sign is that of an efficient cause. See HULSWIT (2002: 162).

words, the interpretant needs to assess whether the recognized form (inferred, thus concluded) has a future as a premise, and can be trusted to serve as a source of information for interpretants to fulfill their other function of anticipation.

Exformation, transformation, metaformation, these are three distinguishable but entangled dimensions that contribute to the process of information. Truth is their common aim, and care for the form their common concern. That concern is not merely logical: it is also ethical, or more precisely “antethical” in Peirce’s January 1906 sense of “antethics” — the theory of the conformity of action to an ideal (EP2: 377); in the present context it is the theory of semiotic deliberation: (paraphrasing a line from the same page) it implies that each form, or each important form, is reviewed by the interpretant and that its judgment is passed upon it, as to whether it wishes its future conduct to adopt that form or not, and pass it along to other interpretants, for the greater sake of the ideal, the conditional law that the shared continuum seeks to realize.

References

BROCK, Jarrett E. (1969). *Ch. S. Peirce’s Logic of Vagueness*. Ph.D. dissertation. University of Illinois.

_____ (1979). Principal Themes in Peirce’s Logic of Vagueness. In: *Studies in Peirce’s Semiotics. Peirce Studies*, Lubbock (Texas), n. 1, p. 41–9 [1979].

CHAUVIRÉ, Christiane (1995). *Peirce et la signification: Introduction à la logique du vague*. Paris: PUF.

De TIENNE, André (1996). *L’Analytique de la représentation chez Peirce: La genèse de la théorie des catégories*. Bruxelles: Publications des Facultés Universitaires Saint-Louis.

ENGEL-TIERCELIN, Claudine (1992). Vagueness and the Unity of C. S. Peirce’s Realism. *Transactions of the Charles S. Peirce Society*, Buffalo (NY), v. 28, n. 1, p. 51–82 [Winter 1992].

GOUDGE, Thomas A. (1952). Peirce’s Theory of Abstraction. In: WIENER, P.; YOUNG, F. H. (Eds.) *Studies in the Philosophy of Charles Sanders Peirce*. Cambridge, MA: Harvard University Press. p. 121–32.

HULSWIT Menno (2002). *From Cause to Causation: A Peircean Perspective*. Dordrecht: Kluwer.

LEGG, Cathy (1999). Extension, Intension, and Dormitive Virtue. *Transactions of the Charles S. Peirce Society*, Buffalo (NY), v. 35, n. 4, p. 654–77 [Fall 1999].

MARTIN, R. M. (1980). *Peirce’s Logic of Relations and Other Studies*. Dordrecht: Foris Publications.

NADIN, Mihai (1980). The Logic of Vagueness and the Category of Synechism. *The Monist*, v. 63, n. 3, p. 351–63 [July 1980].

NADIN, Mihai (1997). *Signs and Systems: A Semiotic Introduction to Systems Design*. Cambridge: University Press.

_____. (1998). What Kind of Sign is a Bit? Semiotics and the Information Sciences. Lecture delivered at Victoria College, University of Toronto [13–5 October 1998]. Available at: <www.nadin.name/index.html?/lectures/lectures_text/what-kind/what_kind.html>. Visited on: 28 Sep. 2005.

_____. (2000). Anticipation: A Spooky Computation. In: DUBOIS, D. (Ed.) *CASYS, International Journal of Computing Anticipatory Systems*. Partial Proceedings of CASYS '99, Liège, Belgium: *CHAOS*, v. 6, p. 3-47 [2000]. Available at: <www.nadin.name/index.html?/publications/articles_b0.html>. Visited on: 28 Sep. 2005.

PARKER, Kelly A. (1998). *The Continuity of Peirce's Thought*. Nashville & London: Vanderbilt University Press.

PEIRCE, Charles S. *The Century Dictionary and Cyclopedia*. WHITNEY, William D. (Ed.). New York: The Century Company, 1889–91, supplement 1909. 10 volumes. [CD followed by a page number]

_____. *Collected Papers of Charles Sanders Peirce*. V. 1–6, ed. by Charles Hartshorne and Paul Weiss; v. 7–8, ed. by Arthur Burks. Cambridge: Harvard University Press, 1931–35, 1958. [CP followed by a volume and paragraph number]

_____. *The Essential Peirce: Selected Philosophical Writings*. V. 2 (1893–1913), ed. by Peirce Edition Project. Bloomington & Indianapolis: Indiana University Press, 1998. [EP2]

_____. *Annotated Catalogue of the Papers of Charles S. Peirce*. ROBIN, Richard S. (Ed.). The University of Massachusetts Press, 1967. [R followed by a number refers to a manuscript]

_____. *Writings of Charles S. Peirce: A Chronological Edition*. V. 1–6, ed. by Peirce Edition Project. Bloomington & Indianapolis: Indiana University Press, 1982–2000. [W followed by a number refers to distinct volumes]

