

The Contemporary Relevance of Peirce's Views on the Logic and Metaphysics of Relations

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Abstract

Independently of Frege or Russell, C.S. Peirce made major contributions to the history of the logic and metaphysics of relations. After presenting his metaphysical interpretation of relations and his emphasis on the reality and irreducibility of relations, the paper shows how Peirce's views are tied to the dispositional realism he defends within a scientific realistic metaphysics, and why they are still relevant for assessing the logical and ontological status of relations, and insightful for the metaphysical agenda to pursue today.

Keywords: Logic of relations, Metaphysics of relations, Dispositional realism

1. Introduction: From Metaphysics to Logic and Vice Versa

For the great American metaphysician Charles Sanders Peirce, logic and metaphysics were going hand in hand. "Metaphysics consists in the result of the absolute acceptance of logical principles not merely as regulatively valid, but as truths of being" (1.487).¹ However, before becoming scientific and realistic, metaphysics had a first therapeutic duty: to make our ideas clear about what counts as a real or a pseudo metaphysical issue, and, in particular, about one's position on the problem of universals: should one side with the nominalists or with the realists? In that respect, Randall Dipert is right when he claims that "logic, especially the logic of relations played a central role in the development of Peirce's philosophy" (2004: 287) and that his logic of relations had a decisive impact on the right realistic metaphysics one should adopt:

My plan for defeating nominalism is not simple nor direct; but it seems to me sure to be decisive and to afford no difficulties except the mathematical toil it requires. For as soon as you have once mounted the vantage ground of the logic of relatives,

¹ (1.487) refers to volume 1, paragraph 487 of Peirce (1931-58) (8 vols.). All references to Peirce will be to this edition.

which is related to ordinary logic precisely as the geometry of three dimensions of geometry of points on a line, as soon as you have scaled this height, I say, you find that you command the whole citadel of nominalism which must thereupon fall almost without another blow (4.1).

Indeed, Peirce thought that the Logic of Relatives had clearly shown that we needed to change our formulation of the problem of universals from “are universals real?” to “are continua real?”. And to operate such a change, he made three main moves in his account of relations: he suggested a new definition of propositional form, stressed the existence of three necessary and sufficient categories, claimed the impossible reduction of triadic relations to dyadic ones.

I shall first remind of Peirce’s main contributions, independently of Frege or Russell, to the history of the logic and metaphysics of relations at the end of the 19th century, before presenting his metaphysical interpretation of relations and the emphasis he put, within his categorial framework, on the reality and irreducibility of relations, and, even more, on the irreducibility of triadic relations. After explaining in what way Peirce’s understanding of relations is part and parcel of the kind of dispositional realism he defends within an overall scientific realistic metaphysics, I shall claim that such a framework is still relevant both for evaluating the logical and ontological status of relations as such, and, more importantly, as a source of inspiration for the right metaphysical agenda to pursue today.

2. Peirce’s Contribution to the History of the Logic of the Relations

Peirce’s contributions to logical theory are numerous and profound. His work on relations, building on ideas of De Morgan, influenced Schröder and, through Schröder, Peano, Russell, Löwenheim and much of contemporary logical theory. Peirce had an extensive development of a symbolic relational logic. As has been underlined, although Frege anticipated much of Peirce’s work on relations and quantification theory, and extended it more, Frege’s work remained out of the mainstream until the twentieth century. Thus, it is plausible that Peirce’s influence on the development of logic has been of the same order as Frege’s (Tiercelin 1991; Dipert 1995). However, in contrast to Frege’s highly systematic and thoroughly developed work in logic, Peirce’s work remains fragmentary and extensive, rich with profound ideas, but most of them left in a rough and incomplete form (Michael 1974; Merrill 1978). Yet, it is possible to highlight some evolution and major influences of such ideas on Peirce.

Indeed, prior to his long *Description of A Notation for the Logic of Relatives, resulting from an Amplification of the Conceptions of Boole’s Calculus* (3.45 ff), in fact prior to his published papers on Boolean algebra and syllogistic of 1867, Peirce had devoted some study to relational terms and to their role in arguments, which had led him, in the early 1860’s, to see the incompleteness of traditional syllogistic and of Boole’s algebra of classes, and the necessity of taking relations into account. Some of Peirce’s discussion of relations is conducted in the context of the deduction of his categories, as spelled out in his now classical paper *On a New List of Categories* (1867), in which he distinguishes three main concepts: the ground, the relate and the correlate. Let us take a quality like “white”: whiteness is the ground, the basis on which a thing is said to be white, that is, x is white on the ground that x embodies whiteness. In a quality like “greater”, the greatness of a

thing by comparison with another is the ground (the basis) of attributing this quality to that thing. A ground is an abstraction, a Form (e.g. greatness, whiteness) that is the basis for attributing a quality to things. Wherever two things are brought into relation, one of them is taken as the relate (or the subject of the proposition), the other as the correlate (or the direct object of the proposition). For example, in "A kills B", A is the subject of the relation (the relate), B is the object of the relation (the correlate). Another important distinction (see Lowell Lectures 1866), concerns two basic kinds of relation: relations of concurrence (agreement, equiparance: "that of relates whose reference to a ground is a prescindable or internal quality") and relations of opposition (difference, disquiparance: "that of relates whose reference is an un prescindable or relative quality"). Any proposition involves one of these. The influence of scholastic views, and particularly of Occam on Peirce's early work on relations (whether through direct reading, or through Mill's System of Logic or Prantl) is more substantial than mere adaptation of terminology (Michael 1974: 48; Tiercelin 1991: 46-55; 188-193). Indeed, Peirce's initial distinction is close to Occam's distinction between connotative (monadic predicates like "white") and relative (dyadic predicates like "father") terms. Such terms are similar in so far as they do not directly refer to individual objects, but rather refer to such objects obliquely or indirectly. As such, they primarily signify a meaning and secondarily signify individual objects on the basis of that meaning. A term like "Socrates" refers to its object (Socrates) directly; a term like "white" refers to its objects (Socrates, Plato, etc.) indirectly through its meaning, namely something having begotten a son. In relative terms, reference to a direct object (the son of Socrates) is required by the meaning of the term itself. In the proposition "Socrates is white", white refers to Socrates on the ground of his having whiteness. In the proposition "Socrates is a father", "father" refers to Socrates on the ground of his having begotten a son. In any proposition that asserts, the character indicated by the predicate term is asserted of the object indicated by the subject term. As such, in a true proposition, the predicate term is said to include in its reference what the subject term indicates. "The same thing is meant by 'the stove is black' as by 'there is blackness in the stove'; embodying blackness is the equivalent of black" (1.551). Black refers to the stove on the ground of its embodying blackness. Hence, it refers primarily to its meaning and secondarily to objects on the basis of that meaning. In Peirce's view and in Occam's view, then, a connotative or relative term refers to objects on the basis of its reference to a meaning (Tiercelin 1993: 188-193).

Peirce's *Description of a Notation for the Logic of Relatives, resulting from an Amplification of the Conceptions of Boole's Calculus of Logic* (1870) is undoubtedly one of the most important works in the history of logic. It is in this paper that a notation for multiplying quantified relations and techniques for manipulating them first appear. A "relative" is viewed as a term in the sense in which it is used by the Aristotelian logicians, that is, the relationship between a relative and a relation. Hence, a relative term does "double duty" (Dipert 2004: 296), semantically representing a certain extension or class, namely the "logical sum" of ordered pairs (n-tuples) of individuals: this is precisely the modern semantic understanding of the extension of a relation of n places as a set of n -tuples. But it also serves as an operation on classes.

However, as Dipert has pointed out, two things should be noted. First of all, this paper of 1870 was not the very first symbolic treatment of relations: credit for this should go to Lambert, or, better known and crucially influential on Peirce, to

De Morgan (*On Syllogism IV*, 1859) to whom Peirce explicitly refers in 1866 and 1867, who fruitfully applied the concepts of Boolean algebra to relations (Thibaud 1975 and Martin 1980). And it is the same idea which Peirce applied in 1870 to what he named “relatives” or “relative terms”. Secondly, the 1870 paper was less a rupture with the preceding framework as viewed by Peirce as an “enriched”, “beautified” and “completed” *generalization* of it (4.5).

This said, “Peirce’s 1870 paper is remarkable for its sheer imaginativeness, but also for its disorderly presentation” (Dipert 2004: 297). In many cases, the development amounts to experimentation with various notations for relations which he never used again, and to the following out of algebraic analogies (such as with exponentiation and a binomial theorem, something Boole too attempted, though not for relatives). However, the basic techniques allowed Peirce to express very complex quantified relational statements and often to show their equivalence to other statements. For example, whatever is lover of or servant to a woman is the same class as the non-relational logical addition of the lovers of a woman and the servants of a woman.

$$(l +, s) = lw+, sw$$

Here relations are indicated by italicized letters, and simple classes by non italicized letters. Juxtaposition indicates a notion of “application” of a relative to a class, and not any sort of ordinary logical multiplication (intersection of classes), showing how a relative behaves more like a function or operator than a class or term. It is an equivocation, however, often made by modern set theory, just as predicates were also conceived as “propositional functions” by Frege, Russell and Whitehead (Martin 1980; Dipert 2004: 296).

3. Three Main Logical and Metaphysical Results

The first result of such an analysis concerns the evolution from a *grammatical* to a *logical* approach of the structure of propositions. In 1867, the list of categories was derived from the functions or logical forms of *judgements*: although the subject predicate form was already greatly re-arranged, in particular, by means of the medieval tools provided by the theory of *suppositio* (Tiercelin 1993: 48-55). We now have a new way of characterizing a proposition and several original definitions of *rhemes*, *relatives*, *relationships*, and *relations*:

An assertion fulfilling the condition having been obtained, let a number of the proper designations of individual subjects be omitted, so that the assertion becomes a mere blank form for an assertion which can be reconverted into an assertion by filling all the blanks with proper names. I term such a blank form a *rheme* (4.354).

In a complete proposition, there are no blanks, and it is called by Peirce a *medad*, or *medadic relative*:

A non-relative name with a substantive verb, as ‘—is a man’, or ‘man that is—’ or ‘—’s manhood’ has one blank; it is a *monad*, or *monadic relative*. An ordinary relative with an active verb as ‘—is a lover of—’ or ‘the loving by— of—’ has two blanks; it is a *dyad*, or *dyadic relative*. A higher relative similarly treated has a plurality of blanks. It may be called a *polyad*. The rank of a relative among these

may be called its adinity, that is, the peculiar quality of the number it embodies (3.465).

Hence a *relative* may be defined as “the equivalent of a word or phrase which, either as it is (when I term it a complete relative), or else when the verb ‘is’ is attached to it (and if it wants such attachment, I term it a nominal relative), becomes a sentence with some number of proper names left blank”. A *relationship*, or *fundamentum relationis*, is said to be “a fact relative to a number of objects, considered apart from those objects, as if, after the statement of the fact, the designations of those objects had been erased”. A *relation* is a relationship considered as something that may be said to be true of one of the objects, the others being separated from the relationship yet kept in view. Thus, for each relationship there are as many relations as there are blanks. For example, corresponding to the relationship which consists in one thing loving another, there are two relations, that of loving and that of being loved by. There is a nominal relative for each of these relations, as ‘lover of—’, and ‘loved by—’. These nominal relatives belonging to one relationship are in their relation to one another termed correlatives. In the case of a dyad, the two correlatives, and the corresponding relations are said each to be the converse of the other. The objects whose designations fill the blanks of a complete relative are called the correlates. The correlate to which a nominal relative is attributed is called the relate”. Indeed, a relation “is a fact about a number of things”. Thus, the fact that a locomotive blows off steam constitutes a relation, or more accurately a relationship between the locomotive and the steam. We may go so far as to say that “in reality, every fact is a relation. Thus, that an object is blue consists of the peculiar regular action of that object on human eyes”. And, Peirce claims, this is “what should be understood by the ‘relativity of knowledge’” (3.416).

The second important result has to do with Peirce's emphasis on the fact that we need *three* in order to have a relation, hence a relation cannot be reduced to a mere “connexion” between two things:

Is relation anything more than a connexion between two things? For example, can we not state that A gives B to C without using any other relational phrase than that one thing is connected with another? Let us try. We have the general idea of giving. Connected with it are the general ideas of giver, gift, and ‘donnée’. We have also a particular transaction connected with no general idea except through that of giving. We have a first party connected with this transaction and also with the general idea of giver. We have a second party connected with that transaction, and also with the general idea of ‘donnée’. We have a subject connected with that transaction and also with the general idea of gift. A is the only haecceity directly connected with the first party; C is the only haecceity directly connected with the second party, B is the only haecceity directly connected with the subject. Does not this long statement amount to this, that A gives B to C? (3.464).

Indeed, Peirce claims that “*in order to have a distinct conception of Relation, it is necessary not merely to answer this question but to comprehend the reason of the answer*” (italics mine) (3.464). Suppose you thought instead that relations were nothing but *connexions* of two things. Then “all things would be equally connected”, and “nothing could be more connected with one idea than with another”. Now, suppose you make “the relation of any two things consist in their connexion being connected with a general idea”. Then, since “that last connexion is, on your own

principles, itself a relation, and you are thus defining relation by relation; and if for the second occurrence you substitute the definition, you have to repeat the substitution *ad infinitum*". And you will be "guilty of a *circulus in definiendo*" (3.464).

From such observations, Peirce concludes that three categories, in other words, tokens, icons and indices, are both *necessary* and *sufficient*:

A dual relative term, such as "lover" or "servant", is a sort of blank form, where there are two places left blank. I mean that in building a sentence round "lover", as the principal word of the predicate, we are at liberty to make anything we see fit the subject, and then, besides that, anything we please the object of the action of loving. But a triple relative term such as "giver" has two correlates, and is thus a blank form with three places left blank. Consequently, we can take two of these triple relatives and fill up one blank place in each with the same letter, X, which has only the force of a pronoun or identifying index, and then the two taken together will form a whole having four blank places; and from that we can go on in a similar way to any higher number. But when we attempt to imitate this proceeding with dual relatives, and combine two of them by means of an X, we find we only have two blank places in the combination, just as we had in either of the relatives taken by itself. A road with only three-way forkings may have any number of termini, but no number of straight roads put end on end will give more than two termini. *Thus any number, however large, can be built out of triads; and consequently no idea can be involved in such a number, radically different from the idea of three* [italics mine]. I do not mean to deny that the higher numbers may present interesting special configurations from which notions may be derived of more or less general applicability; but these cannot rise to the height of philosophical categories so fundamental as those that have been considered (1.363).

Hence, a third crucial result. Not only are there "no more Kainopythagorean categories than these three. For the first category is non relative experience, the second is experience of a dyadic relation, and the third is experience of a triadic relation", but also and more importantly, "it is impossible to analyze a triadic relation, or fact about three objects, into dyadic relations; for the very idea of a compound supposes two parts, at least, and a whole, or three objects, at least, in all. On the other hand, every tetradic relation, or fact about four objects can be analyzed into a compound of triadic relations" (7.537).

Although Peirce's "remarkable theorem" of the irreducibility of triadic relations was later to be shown as false in terms of the modern logic, and may have to be related, as Dipert has rightly insisted on, both to Peirce's wish to favor a graphical system and to the influence of the chemical framework on many of his views, it undoubtedly contributed to underline the problem of what a logical form is and, in many respects, to come to right metaphysical results. So it is to these that we should now turn.

4. Relations, Dispositions, and Peirce's Metaphysical Defense of Dispositional Realism

Peirce called himself "an Aristotelian of the scholastic wing, approaching Scotism", or "a scholastic realist of a somewhat extreme stripe". By what he meant, first, that, contrary to what is often asserted today, when it comes to the realism/anti-realism issue about universals, the problem is not that of wondering

whether there *exist* universals apart from our ideas or words. For a scholastic realist, reality should not be equated with existence, which is but a mode of reality. Though what exists is real, what is real may not exist; existence is reaction, interaction—the characteristic mode of being of particulars, of seconds (Haack 1992: 22). Peirce thought that there was indeed a “nominalistic Platonism” (8.10) which consisted in conceiving the existence of things “independent of all relation to the mind’s conception of it” (8.13), hence, in viewing universals like “man” or “horse” as referring to abstract particulars or existents. Now, scholastic realism should refuse to take universal or singular entities as *utterly* independent of thought and signification: “The real is that which is not whatever we may happen to think it, but is unaffected by what we may think of it.” (8.12; 1871) “The real is that which *signifies* something real” (5.320). Hence:

Anybody may happen to opine that ‘the’ is a real English word; but that will not constitute him a realist. But if he thinks that, whether the word ‘hard’ itself be real or not, the property, the character, the predicate, *hardness* is not invented by men, as the word is, but is really and truly in the hard things and is one in them all, as a description of habit, disposition, or behavior, *then*, he is a realist (1.27n1).

As a first consequence, individuals can be said to *exist*, but not, strictly speaking, to be *real*:

We can only say, in a general way, that a term, however determinate, may be made more determinate still, but not that it can be made absolutely determinate. Such a term as ‘the second Philip of Macedon’ is still capable of logical division—into Philip drunk and Philip sober, for example; but we call it individual because that which is denoted by it is in only one place at one time. It is a term not absolutely indivisible, but indivisible as long as we neglect differences of time and the differences which accompany them. Such differences we habitually disregard in the logical division of substances. In the division of relations, etc., we do not, of course, disregard these differences, but we disregard some others (3.93).

In particular, as is shown by the logic of relatives, there are

three kinds of terms which involve general suppositions of individual cases. The first are individual terms, which denote only individuals; the second are those relatives whose correlatives are individual: I term these infinitesimal relatives; the third are individual infinitesimal relatives, and these I term elementary relatives (3.95).

As a second consequence of such a realism and by means again of the logic of relatives, in saying that generals are real, Peirce claims, first, that generals do not so much apply to “classes” or “collections” than to “systems” (4.5), and, secondly, *continuity* being the real general, that one should subscribe to real modalities, *real possibilities* and *real necessities* (4.172):

None of the scholastic logics fails to explain that *sol* is a general term; because although there happens to be but one sun, yet the term *sol aptum natum est dici de multis*. But that is most inadequately expressed. If *sol* is apt to be predicated of many, it is apt to be predicated of any multitude however great, and since there is no maximum multitude, those objects, of which it is fit to be predicated, form an

aggregate that exceeds all multitude. Take any two possible objects that might be called suns and, however much alike they may be, any multitude whatsoever of intermediate suns are alternatively possible, and therefore, as before, these intermediate possible suns transcend all multitude. In short, the idea of a general involves the idea of possible variations which no multitude of existent things could exhaust but would leave between any two not merely many possibilities, but possibilities absolutely beyond all multitude (5.102).

As a third and important consequence of adopting such a “scholastic realism” of “real possibilities”, which Peirce clearly intended as a piece of scientific metaphysics, we should start by securing the semantic level and, in particular, be clear about the claim that *there are real dispositions*, the meaning of our dispositional attributions, and the reasons why the reduction of dispositional ascriptions to conditionals does not seem to work (due, for example, to finkish or antidote cases), or why reduction sentences may or may not tell us “all” that dispositional predicates mean. Indeed, as such dispositional realists as Mellor, Ellis or Mumford insist on today, Peirce was convinced that *one should look for real dispositional properties and not mere predicates*, and that properties are not (or are not given) simply by the meaning of our predicates. In other words, we want a conditional and non truth-functional statement such as “if x was dropped, it would break” to have a *truth-maker* (Tiercelin 2011: 279). But how can one explain what that property consists in?

It is at this very point that Peirce’s logical and metaphysical account of relations offers an original agenda for a convincing realistic and scientific metaphysics. It would be impossible, within the scope of this article, to present a detailed analysis of the type of dispositional realism Peirce endorses. Let me just note that it is close to the one I have tried myself to defend (Tiercelin 2011: 247-380), which relies, in a nutshell, on four main assumptions: 1) a basically causal theory of properties; 2) a conditional dispositionalist account of laws; 3) an emphasis not only on efficient causation but also on teleological causation; 4) a defense of some kind of *aliquidditism* (or *thin essentialism*) (Tiercelin 2011: 347 ff). The fourth assumption is of special interest here, in so far as the “relational” (rather than “substantival”) and dispositional realism Peirce endorses allows him to avoid the “holistic” and “idealistic” consequences which threaten any kind of relationism, in which “substances” or “objects” always tend to disappear. Peirce saw the merits of “relational” over “substantival” realism, more in keeping with what contemporary science and logic tend to show, underlining the importance of relations and the limits met by a simple subject-attribute conception, as may be found in the old Aristotelian logic. But such a position, in his mind, was in no way opposed to, on the contrary it implied, some “thin” essentialism. In order to have a better grasp of this, it might be worth taking a quick look at what the scholastics, especially the Scotists, meant by essence, *quidditism* and *haecceitism* (Tiercelin 2011: 348 ff).

Indeed, Scotus did not defend *any* kind of essentialism. In particular, he followed Avicenna more than Aristotle in stressing the *neutrality* or irreducible and positive *indeterminacy* of the “Common Nature”. For Avicenna, essence, as such, can indeed be viewed under two headings, in things and in the intellect, but more importantly, in its pure essentiality, as being *neither* universal *nor* singular. The essence or “Common Nature” is neutral or indifferent to any further possible determinations. There are formal or metaphysical realities which are not to be

viewed as we call today “primitive thisness” (Adams 1979), precisely because they are, so to speak, awaiting further physical and logical determination. Thus, it is less crucial to think of essence independently of the properties which belong to it properly, that is, in distinguishing the essence from what makes it a particular *substance*, than to show how what is more what I have called myself an *aliquid* than a *quidditas* or a *substratum* without substance is necessary in order, then, to ground, on the logical level, logical universality, and, on the physical level, the quiddity of things. So, for both Avicenna and Scotus (and Peirce follows them here), to be a realist means neither to hypostasize platonic essences, nor to develop a form of essentialism simply devoid of the Aristotelian substantialist shape: it is first and foremost to admit, in distinguishing logical reality and real community, the irreducibility of a Common Nature which, in itself, is neither universal nor singular, although it is universal *in the mind*, and singular *in the things* outside the mind (Tiercelin 2011: 351).

Quidditism is not an attractive position to hold nowadays. For causal structuralists, in particular, quiddities are a ‘will o’ the wisp’: or a way to say that I could have been a poached egg, no matter, so long as my haecceity was present (Hawthorne 2001). But the scholastics had a different approach. *Haecceitas* was introduced by Scotus to differentiate the singular from the universal, or the Common Nature *formally*. In order to be clear about the various categories that populate our world and establish the right alphabet of being, we should not confuse the logical, the physical and the metaphysical levels of our investigation (which may reveal more than one or two kinds of “essential properties”). In particular, as Peirce was later to argue, even if material essences are *dispositional*, it does not necessarily follow that *all* dispositional properties are essential. The fact that “X is hard” needs not be essential to X, even though hardness is a dispositional property causing X to behave in certain predictable ways.

Peirce made a “twist” to the Scotistic position: against the too static view of essence as defined by the Subtle Doctor, he argued that it is not the behaviour of a thing but rather its *habit of behavior* that constitutes the *intelligible* nature or real essence (2.664). Such a habit is a general disposition affecting the way that an object *would tend to behave* under certain *types* of circumstances. Both philosophers distinguished between the essence and the activities of a thing. However, Scotus and the medieval logicians were just able to deal with propositions that involved monadic predicates (like ‘—is hard’), not with those involving relational predicates (such as ‘—is a lover of—’, or ‘—gave— to—’) (3.464 ff; Raposa 1984: 151). Hence, they were only able to account for specific *classes* or *collections* of things, each class being comprised of all the subjects bearing a particular monadic predicate, and for the relation of *similarity* (that is, the sharing of a ‘common nature’) existing between the members of a given class. Peirce’s aim with his logical analysis of relations was to go further and to analyze relationships other than that of *resemblance* of a certain object to the various members of its class. For he thought it much more important to make out the way in which laws govern the interactions between objects within a *meaningful* process. Now, the analysis of such a process or “system” involved the use of dyadic and triadic predicates: to claim that “X is hard” is to do more than ascribe a particular quality; rather, it is to assert that under certain specifiable conditions, X will or rather *would* tend to behave in a certain specifiable manner. Thus, “hardness” is to be regarded as a dispositional property, and a real “habit” or “law” must govern the behavior of those

objects within which it inheres. Any monadic predicate is in fact a sort of degenerate relative. So, if we want to make sense of a universe in which there are not mere simple qualities or pure possibilities (*Firstness*, in Peirce's jargon), or mere actualized possibilities in terms of individual events or mere existential reactions (*Secondness*), we have to proceed in that way. In a universe manifesting only *Firstness* and *Secondness*, namely devoid of generality and thus of intelligibility, it might be appropriate to speak of such non-relational monadic predicates. However, even when one is confronted with nothing more than the case of an individual object enduring through time, real continuity is involved, and the properties that inhere in such an object are themselves "general" (1.411 ff; 1.427). If the relationships between a thing and its properties can only be defined by a real habit, a "would-be" operating within the actual world of objects and events (Raposa 1984: 152), what is decisive, is not so much to specify the generality that characterizes a collection of objects having some quality in common (what Scotus does), but to account for the infinite number of real possibilities, i.e. the real and continuous relationships that exist between any two members of a class, between an object and its successive actualizations in time, between the interacting fragments of a system. 'X gives Y to Z' is general not simply because the relational predicate ('—gives— to—') can be applied to many different sets of ordered triads, but rather because it ranges over the members of *any* given triad. Thus, the type of relationship Peirce is interested in is different from the 'sameness' that defines the medieval genera and species. More than classes of givers, gifts and recipients, what counts is the *system that encompasses* the giver, the gift, and the recipient, and the laws or habits of behavior that govern their interaction. In all types of relationships however, even in relationships of resemblance, a real continuity exists between *realia*, and predicates must be universalized or 'projected' in order to range over the infinite numbers of possibilities, actualized and unactualized, that make up the continuum (Raposa 1984: 153). What Peirce underlines is not only that there are real relations, but that *relations comprise the real natures of things*. Habits account for an object's essential intelligibility. They govern objects by relating certain types of behavior to specific kinds of circumstances. Hence, the essence of a thing is defined not by any particular relationship or activity within which the thing actually participates, but by a general habit or causal power that determines those relations and activities to which, given the appropriate conditions, that thing would be disposed. Such a habit is not simply essential to, but rather, must be of the essence of the thing, namely it must be predicated of the thing *per se primo modo* (2.361; Raposa 1984: 154; Tiercelin 2011: 295).

From this, another lesson may be drawn: if the essence of a thing is no collection of properties, but rather a special "habit of action", or a "bundle of habits" for a "law-cluster", we may well need more than mere *efficient* causation to explain the way it exerts its causal power as a whole, to view the thing in terms of a final cause specifying the general patterns of behavior it will tend to manifest and become (so that the causal function of the essences of things may be defined in terms of both formal and final causation). And we may also have to view the *binding* ("cement" or "glue") of all the objects itself in terms of some *final* (or *intentional*?) causation (Ellis 2001; Tiercelin 2011). At all events, this requires a careful elaboration and determination of the exact role played both by dispositions and by laws of nature in the intelligibility of nature. As I have argued elsewhere, both seem to be needed: dispositions find their intelligibility in the conditional necessity of laws; but laws can only be a true description of the world, provided they are

grounded in what things can do (in a dispositional and not merely possibilistic sense) (Tiercelin 2011: 344).

5. Concluding Remarks

From this brief presentation of Peirce's logical and metaphysical account of relations, I think we can already note an interesting point, namely that, for the logician of Milford, much more than: should we view relations basically as internal or as external? Or: is it so easy to draw the line between what we intend as a "relation of reason" and a "real relation"? The crucial issues to be dealt with seem to be: what is the best logic for a correct account of the reality of relations? Which does not merely mean: do we need other signs than symbols, namely indices, icons? But rather: should we favor graphical logic, or even build an indexical or iconic logic? And from the metaphysical perspective: how can we make sense of *foundationism*? More precisely: what is, indeed, the real *fundamentum relationis*? And, not so much: "should we opt for relationism or substantialism?" but: "how can we frame a satisfactory dispositional realism?" Whether or not Peirce's options are right depends of course on the stance one takes on the trend to pursue in logic and, in metaphysics, whether or not one is convinced (as indeed I am) by the virtues of dispositional realism. So, in a few concluding remarks, let me suggest a few merits of the latter position—which also seems implied by Peirce's views on relations—over, in particular, various kinds of structuralism.

Indeed, a detailed account of Peirce's dispositional realism would show how much it has in common with contemporary structuralism, whatever its variants might be (Tiercelin 2011: 368-374). However, it is likely that Peirce would also oppose *ontic structural realism*, which, strengthened by an underdetermination of individuality, seems to become today 'The Metaphysics' of fundamental physics (non relativistic quantum mechanics, quantum field theory, and general theory of relativity mainly). As critics have observed, when pushed too far, structuralism tends to be counter-productive: if there is nothing in the world but structure, to what will it be opposed? In general, when one resorted to the term of structure in science, and profitably so, it was because one meant it as an entity with blank places which objects could occupy. But if the latter must be "reconceptualized" or are meant to have a mere "heuristic" function (French 1999: 204) or even to disappear (French and Ladyman 2003: 37), what role can the structure itself still play (Psillos 2006, 2011; Chakravartty 2003; Tiercelin 2011: 371)? Even more problematic is the fact that if dispositional realists may be willing to assert the non supervenience of relations on the objects, namely that objects do not have any existence or identity independently of the relations they have with one another, they are not ready to accept the pure disappearance of the objects, which is advocated by some eliminativist ontic structural realists. If relations are merely primary in relation to objects which are literally constituted by them, or simple "nods" within structures in a relation of asymmetric dependence, then there are no objects any more, only relations or structures, namely relations without *relata*. If relational structures are ontologically more fundamental than individual objects, then all there *is*, is structure. Now, several *reasons* (and not only common sense) seem to militate in favor of maintaining the category of "object" in our ontology. A metaphysical one, first: without *relata*, relations have no reason of being; even if such *relata* have not necessarily any intrinsic identity. Secondly, an empirical reason: the physical characteristics on which one relies do not in the

least suggest to abandon such a commitment for objects in the fundamental physical world. Finally, a logical reason, which has to do, as Esfeld and Lam (2010) have mentioned, with quantifying over objects in standard first order logic and the apparently unavoidable use of set theoretic concepts in physical theories. If one tries to pull too far the very meaning of our primitive concepts of “real” and “object”, we run the risk of rendering the world simply unintelligible (Heil 2003: 58-60).

As is usually claimed, *causal* structural realism is, in many respects, more convincing, in particular in its “moderate form”: while giving ontological priority to relations, it does not deny that properties and objects are part of a fundamental ontology; however such properties need not be intrinsic, they may be relational or extrinsic. If there are physical relations between objects or *relata*, such objects have themselves relational properties. While the universal context of entanglement and non separability in quantum mechanics is fully admitted, a principle of *weak discernability* is also granted and viewed as a symmetric and irreflexive relation between two objects (hence there are two objects and not only one), which has some merits over mere ontic structuralism: like in dispositional realism, properties are well identified through their causal roles and the structures are defined as a network of causal relations among properties, hence by the causal powers which they confer to their possessors. Yet, it remains to be shown how it handles a problem which any kind of dispositional monism has to face, when forced to follow a *holistic* model. *Causal* structuralism is indeed a structuralism that rejects any form of quidditism, or the view according to which there would be “something” beyond the causal profile which, independently of it, insofar as it might exist, would make of that property what it is. But if no property can be identified unless all the others are, it looks as if none of them can be identified *simpliciter*. We hoped to understand the identity of properties while avoiding unknowable quiddities, we have merely moved the problem to another place. Since what we come to is a holistic network of relations among properties which seems even more mysterious and which is not more able to identify the properties. Quiddities have not disappeared: they have become a global “totusity” (Psillos 2011). As Chakravartty observes, “any case of warranted attribution of a causal property is facilitated by some properties which are being known independently of a knowledge of their other effects” (2007: 136). This seems plainly to grant that, in all cases, the conditions of individuation of the causal powers which are assured by the place they occupy in the global network can only be so provided that the identity of some properties or relations is fixed independently of the place they occupy in that network. And it also means that causation itself must be a relation identified independently of the role it plays in the causal network, even if it runs then the risk, from the point of view of structuralism, to turn this time into some kind of “hypostructuralism” (see Psillos 2011, Tiercelin 2011: 374).

Again, there is something preposterous to consider that “one can in principle discover what properties are through the effects they produce” (Esfeld 2009: 184), and that this applies to “all” the properties. First, because, to suppose that the real is knowable, at least in principle, does not imply that “everything” in the real is. As Peirce noted, there are “ultimate” facts which any one, be he a man of science or any man in the street should take account of (1.405), and in particular, such isolated facts as do not imply any explanation whatsoever (7.200; 7.194). Secondly, one should never underestimate the length, the complexity and even the

tricks of the various chains through which we come to discover the causal properties, some being too far from one another, some being hidden by the screen some may constitute. Besides, even granted that the total network of the causal profiles might be knowable, how could we ever know that it is indeed such and such properties that play such and such a role in the totality? Finally, what the limitations of causal structural realism show, is also, to what extent it is illusory and mistaken to think that one can do, in the end, as Peirce also clearly saw, without *aliquidditism* (Tiercelin 2011: 347 ff.), at least if one's aim is to provide genuine identity conditions, allowing, in particular to distinguish between the essential and the accidental parts of causal powers and to say what the *fundamentum* of things consist in. One cannot be satisfied with mere modal or conceptual distinctions, even in a Spinozist guise. For more than conceptualism is needed to be able to say what a thing consists in, what its real being is. Such a real being, its identity, is what makes the thing, the thing it is. Indeed, any radical anti-essentialism would take us to such a global anti-realism that it would surely be incoherent, as E.J. Lowe rightly pointed out (2007: 92). Without a minimal essentialism, or a "serious essentialism" (2007: 86), neither in the sense of an ersatz essentialism of possible worlds or of an essentialism of act and potency, but capable of specifying, for each object, the very being of the reality it signifies, which was Locke's (*Essay*, III, 3, § 15) as well as Aristotle's definition, it becomes very problematic, not even to know but merely to *understand* what is at the root of the intelligibility of things.

If many of these suggestions are already implied, as I think they are, in Peirce's account of relations, and more generally in the scholastic realism he defends, then they are still worth being carefully studied and discussed by any serious metaphysician today.

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