The Consequences of Things
The Semiotics and the Pragmatistic Route to Designing

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ABSTRACT

The starting point of this contribution is the concept of "sense", which derives from the Charles S. Peirce's semiotic view: "Our idea of anything is our idea of its sensible effects" (Peirce, CP 5.401). For Peirce, the meaning – or sense – of any sign (text, artifact, system) comes surrounded with all the conceivable effects and the "practical consequences" that the sign produces or could produce.

However, among the practical consequences, could be also included the formation of beliefs and the definition of individual or social behaviour through habits, and furthermore – in the long run – the very organization of political life. From this derives the responsibility of design, which stimulates an improvement of the consumer goods production (sort of an extension of the design, widening its application in more areas: communication, services, ecology etc.) in the cultural context where part of the social and the planet lives are decided.

In this perspective, the sense is no longer just a semantic value within a system, such as the structuralist tradition has taught us, but is open and attempts to a pragmatic dimension. That is, the sense is not found only in texts and artifacts, but above all in the living scene of use: in the context where the objects are found and used.

Keywords: Semiotics, Pragmatism, Design

1 THE ROUTE OF PRAGMATISM

How to conceive a semiotics capable of conceiving itself as part of the design process? What kind of routes should be followed? How is it possible to construct a semiotics that is not only *of design*, but also *inside* design, a semiotics of the design activity?

When we talk about the "design activity", however, we must not only think at what happens inside the designer's mind and in the mind of the person commissioning a project. We must also think at what happens in the social dimension of design, i.e. the use, redesigning and reinvention operated by the user (Cf. Deni & Proni, 2008; Bianchi, Montanari & Zingale 2010). As a matter of fact, the design action *pours* its meaning into the heart of life and social history. This means that an artifact must not only be considered for the values and meanings it expresses through its form and structure, but – above all – for everything it determines in the mind of the user-agent.

Hence the social and historical responsibility of design: from formerly being an input to a better production of goods, design is more and more turning into a cultural place where most of our life in the society and on the planet is played – especially since design has been extended to larger fields of application such as communication, services, ecology etc. In our opinion, such social responsibility can be better understood if a new *pragmatist route* is followed in design semiotics. For the artifacts, once inserted in the socio-cultural circuit, act like transmitters of values, and as such they shape, in the long run, our cultural systems. In other words, the artifacts are not neutral objects, but "semiotic organisms", capable of influencing some our mental representations like tastes, beliefs, prejudices, and stereotypes.

The pragmatist route we are talking about is that started in the second half of the 19th century by Charles Sanders Peirce, philosopher and pioneer of modern semiotics. Here, we will summarize this route by three fundamental points (See Peirce, CP; Fisch, 1986; Murphy, 1990; Proni, 1990).

The first point is the well-known pragmatic maxim contained in *How to Make our Ideas Clear* (1878):

"Consider what effects, that might conceivably have practical bearings, we conceive the object of our conception to have. Then, our conception of these effects is the whole of our conception of the object." (Peirce, CP 5.402)

What is of interest here is how the attention shifts to the concepts of *effect* and *consequence*. Indeed, in the pragmatistic view of semiotics and of the branch of semiotics looking at design, the meaning or sense of every artifact is to be searched into the *sensible effects* and into the *practical consequences* it determines both in the physical and cognitive environment to which the artifact is destined. In a semiotics of the design activity, these concepts largely replace that of *meaning*, or they are at least a necessary step further, since, according to Peirce, "our idea of anything is our idea of its sensible effects" (Peirce, CP 5.401). The idea for a design, the conception of an artifact, is the idea that we must/want to have of its future effects. We need to remember that also the creation of beliefs and the establishment of social and individual behaviors through habits must be taken into account among the practical consequences, as well as the same political organization: "what a thing means is simply what habits it involves" (Peirce, CP 5.400).
And here we come to the second theoretical point, which we actually find in many parts of the 1877 essay *The Fixation of Belief* but which we summarize here with the following passage:

"Thus, both doubt and belief have positive effects upon us, though very different ones. Belief does not make us act at once, but puts us into such a condition that we shall behave in some certain way, when the occasion arises. Doubt has not the least such active effect, but stimulates us to inquiry until it is destroyed". (Peirce, CP 5.373)

In other words: the search for knowledge consists in the effort of, or fight for, passing from a state of doubt deriving from uneasiness and dissatisfaction, to a state of belief. In the design activity, this effort can be identified in the passage from a "problematic state" to a "solution" of a problem through the individuation – often an *invention* – of an artifact: an *interpretant artifact*. What the designer interprets is always a *problematic reality*: something missing, or not working, or inadequate, or that requires a new design goal. The individuation of a *problem*, the act of making it object of attention and thought, is the primary condition for

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implementing a design process: it assumes not only the knowledge of the problem but also the prefiguration of a possible solution (Cf. Bonfantini, 1987, 2000; Zingale, 2012).

The third point is the one that will be developed through this paper because it contains, among other things, a neat methodological indication. The quotation is taken from *The Logic of Drawing History from Ancient Documents* (1901), and it seems to outline what can be addressed as the fundament of the pragmatistic design method:

"Now the only way to discover the principles upon which anything ought to be constructed is to consider what is to be done with the constructed thing after it is constructed. That which is to be done with the hypothesis is to trace out its consequences by deduction, to compare them with results of experiment by induction, and to discard the hypothesis, and try another, as soon as the first has been refuted; as it presumably will be. How long it will be before we light upon the hypothesis which shall resist all tests we cannot tell; but we hope we shall do so, at last". (Peirce, CP 7.220)

In this passage, the so-called *macroargument* is explained, which can be intended as the logic layout of every design process, marked by the abduction-deduction-induction movements. This is an open-ended process, a potentially unlimited semiosic cycle (Bonfantini, 1980). A recursive *inferential cycle* destined to start and restart all over again, until at least one design hypothesis "shall resist all tests", as Peirce writes, and shall open the doors to the operative and productive stage. But still keeping in mind that "the tests", in fact, never end: every time a product is used, it will be *under test* to some extent. Every
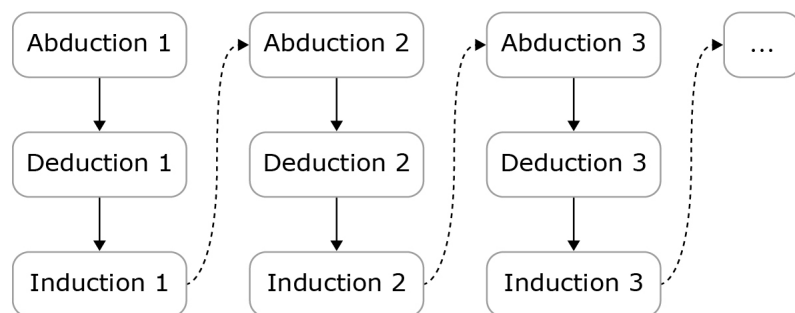
use constitutes a new interpretant. The inferential cycle is the "design life" of a product and it acts before, during and after the design. It always involves all its players: from the designer to the final user, from production to disposal, from the buyer to the technical assistant.

FIGURE 1 – Peirce's macroargument.

Thus, the meaning of an artifact can be neither found inside the artifact itself nor inside the system of objects to which it belongs, but rather in all the possible practical or mental actions that the artifact is able to involve. The meaning of a design continues and completes itself in its use (Rabardel, 1995; Bonfantini & Zingale, 1999). The user completes and continues the design because the use phase is conceived as a form of design activity as well.

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2 DESIGN LOGIC AND USER LOGIC

The pragmatist view forces us not only to consider the meaning of things starting from their consequences, but also to place better the arising of this meaning inside the frame of the dialogic relations involving all agents of design (Zingale, 2009). Once again, the meaning is placed beyond the artifact.

As a matter of fact, to consider the use of an artifact as a continuation of the design implies to expand the concept of "design logic" and its dialogic relation to the "user logic", or interpretation of use implemented by every user. Here, the dialogic process is a game that involves the designer in the first instance, performing the opening action from the initial idea to the production of the artifact; and secondly the user, who is the subject of an action then performed by means of the artifact. The two logics should infer the actions of the other.

It is precisely at the intersection, at the center of the mediation between design and user, that the artifact is found: an entity into which the designer *inscribes* value and from which the user *infers* value. The artifact plays a *mediation* role in the threefold process of design semiosis.
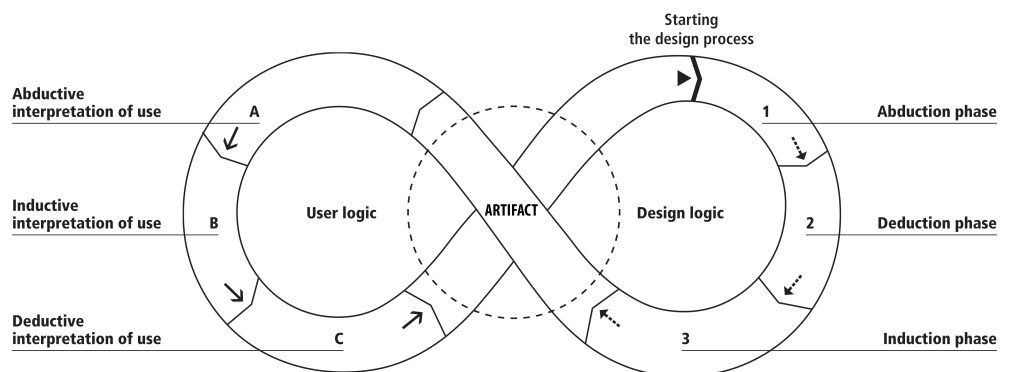

FIGURE 2 - User logic and design logic. Diagram by Luna Gasparini.

The diagram should be interpreted as representation of a dialogic process where the design action originates in the designer's mind and is addressed to the user's mind, having the artifact as *keystone*. The process is therefore triadic, with the artifact as mediator between design aims and effects on the user. The artifact – or more generally, every artificial reality in which we live – is thus to be conceived as a place where a "common mind" shapes: a place of shared behavioral and cognitive habits, beliefs and opinions, compared and contrasted viewpoints or values.

The following paragraphs will describe the various parts of the diagram as an application of Peirce's macroargument, intended as methodological reflection.

3 THE THREE PHASES OF DESIGN LOGIC

Let us focus on Peirce's "pragmatist method" contained in his macroargument, which could be represented by three moves as it applies to design. Keep in mind that **A** will stand for the *antecedent* of the abductive reasoning, the artifact come out of a design: a tool, a service, an organizing system. With the letter **C**, we will be addressing to the *consequent* of the abductive reasoning, i.e., the set of consequences derived from the use of an artifact: all the use practices that the

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product originates as outcome of the actions *on* and *with* the product after it has been introduced into the social game.

Phase 1: Prefiguring effects (abduction)

A given *effect* or *outcome* may be thought of – in a possible world – as a *consequent* (**C**) caused by an *antecedent* (**A**). The abductive move takes the following form:

(1.1) I have a certain effect or consequence (**C**) I would like my design to produce.

(1.2) I have to understand how the artifact (**A**) must be done in order to produce that consequence (**C**).

(1.3) It is possible that the artifact (**A**) I have conceived is able to produce the consequence (**C**).

This is the first instance in design logic, the hypothesis on the possibilities of the design made through an inventive abduction (Cf. Bonfantini & Proni, 1980; Zingale, 2012). The antecedent (**A**) is the product, the aim of the design process that must be conceived in relation to its consequent (**C**), which constitutes the set of *effects of meaning* or *effects of use* that the product involves. The design hypothesis then develops from imagining the possible consequences of the object of design.

Phase 2: Drawing conclusions (deduction)

We now try to imagine and calculate – in the real world – *what would happen if* the situation occurred whereby, given **A**, you obtain the consequence **C**. The deductive move takes the following form:

(2.1) If I design the artifact (**A**), some consequences can derive from it (**C**).

(2.2) I design the artifact (**A**).

(2.3) The artifact (**A**) will certainly have the following consequences (**C**).

The second instance is a deductive and mental calculation based on knowledge of the real world starting from the hypothesis. It leads to the evaluation whether the design we prefigured can be created, whether it may work or not or produce suitable outcomes. This is an interrogative phase, pondering on questions like: if the product we have in mind right now actually existed, what kind of features would it require? And what kind of interpretation of use would it bring with it?

Phase 3: Trial and verification (induction)

If that mental and deductive calculation leads to a positive response, then we attempt to discover, by testing, *if **A** truly has **C** as a consequence*. The inductive move takes the following form:

(3.1) I designed the artifact (**A**).

(3.2) I can see that the artifact (**A**) produces the consequences (**C**).

(3.3) It may be that the artifact (**A**) always produces these consequences (**C**).

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The third instance is that of experiment, of tests and results. This is when the inference-guide is induction, whether an observation of real data, such as a laboratory experiment to verify a hypothesis, or a verification of models and prototypes and other tools of observation. And it is here, based on the experience-experimentation dyad, that the design process enters into one of its most delicate and decisive phases. It is a phase that requires method and science: even the method of the science of signs.

4 THREE MODES OF INTERPRETATION OF USE

But how do users act *semiosically* when confronted with a product to use? We shall represent this interpretive activity imagining someone that tries to use a product but which the use is still unclear. In doing so we must remember that inferential interpretation is always based on partial knowledge: "The object of reasoning is to find out, from the consideration of what we already know, something else which we do not know" (Peirce, CP 5.365).

In the interpretation of use, what we know is the product as it is presented; what we do not know is *how* we can or must use it. It is like saying that interpretation of use consists in allowing appropriately and to one's benefit a *potential* or *possible fact* (the performance of a task) to take place starting from an existing fact (the tool). The conjunction-mediation between one and the other is the complex of actions – mental or practical – that lead to the interpretation of use by means of what we have already named *user logic*.

Unlike in the design phase, in the use phase the inferences are not necessarily presented in sequential order. The type of inference brought into play is always a resultant of the degree of knowledge that the user has of the product: both knowledge in his mind (in the encyclopedia) and that which the product *lets us know* about it.

Thus, given any product, we can say that the interpretation of its use can come about via deduction, induction or abduction. The resulting effect in any of these three modalities may be identical (the task is done), but the semiotic implications may vary (the sense of the interpretation). Let us see how and why.

Mode A: Deductive interpretation of use

The interpretation of use comes through a deductive process when the user's knowledge takes the form of a *rule to be followed*. This rule may take the form of (i) a *law*, (ii) an *imparted instruction*, or (iii) a *habit* or *custom* deriving from tradition.

(i) In the first case, the *law* in question takes the form of a planned prescription, leaves little room for initiative, and provides for an orderly sequence of actions. As in driving a car or using machinery on an assembly line: *you do it this way and only this way*. The interpretation of use here depends on a relatively strictly defined use plan, where use is likened to a one-way street, specially designed and produced, inscribed and prescribed, to gain a benefit.

(ii) In the second case, the rule to be followed is not a law but an *instruction*. The difference lies in the fact that a law, in the strict sense of the term, has a generalizing value and in many cases is also subject to juridical pronouncement. An instruction, on the other hand, is the transmission of information from one agent to another.

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In this case, the interpretation of use is again an application of rules, but more importantly it has to be seen as an informed reiteration of know-how. The problem arises when a designer presupposes the existence of this know-how within the user's competencies without verifying whether this is indeed the case. This happens when, with regard to a product, specific skills or competencies are implicitly demanded that not all users necessarily possess. And this is a typical case of a *dialogic caesura* between design and use: the former imparts instructions using a language that the latter does not understand.

(iii) Lastly, the deductive application of a rule can take place by means of *habit*, Peirce's *mental habit*, or, as we have already seen, "a tendency […] actually to behave in a similar way under similar circumstances in the future" (Peirce, CP 5.487). A habit of use is thus a stable, acquired disposition, understood by the user as an invisible guide to the use of artifacts.

Here we must note that the notion of habit is associated with that of *inhabit*, and *habit* in the sense of apparel, and derives from the Latin *habere*: to have. A habit is thus also a *desire to have*, a rule that one accepts into his "wardrobe" but is not necessarily obliged to follow. So the habit should be intended as the invention of a practice rather than allegiance to a code: a rule that a user designs, in a sense, and adopts autonomously. A habit, in short, is always the result of abduction.

Mode B: Inductive interpretation of use

The interpretation of use depends on inductive reasoning when, in the absence of a clear rule, the user's knowledge of a product derives (i) in the first instance via *observation*, (ii) then by trials and *experimentation*, and lastly (iii) by tests and *verification*. Here, the rule is *to be sought*.

The observation is mainly visible but also tactile and otherwise exploratory, and it leads to the identification of significant associations among the various components of an artifact. By "significant associations", we mean the associations between things that, once established, can lead to cognitive content and, as a consequence, to the identification of rules or constants. Hence, when we find ourselves in a particular public place for the first time – a library for example – the inductive observation is what suggests that the association between some architectural or furnishing element ("that corridor, that service counter") and some events ("many walk through that corridor, lots of people are headed for that counter") provides an orienting function. Another example is when we have an unfamiliar artifact in our hands and to get it to work we seek associations between one of its elements (an opening, a button, a lever) and one of our possible actions (lifting, pulling, moving, pressing). We do this until we learn that a given action on a given element *causes* a given outcome.

In this case as well, experimentation calls upon experience: past and current experience. In inductive use, the knowledge gained in previous deductive practices (our actions "in similar circumstances") is combined to the knowledge progressively obtained through the process of testing and verifying. Induction is thus (literally) an *introduction* to interpretation of use, a *leading towards* full mastery of the rules of use, but it is also a way to learn how to use a product during and via the experience of using it. And it goes without saying that during that experience the user logic is inevitably engaged in an abductive process, in the first acceptation we shall see below.

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Mode C.1: Abductive interpretation of use: chance

When the rule is lacking and the possibility of experimentation is denied or costly, the interpretation of use necessarily depends on abduction. In these cases, one takes a "stab", so to speak. Or, more prudently, one wagers on one's ability to understand instantly. Again in this case, what is at work in the background are Peirce's *habits*, i.e. the abduction by selection, the one by which we hypothesize a rule of implication by searching within our knowledge base (Bonfantini & Proni, 1980).

In the final analysis, in the interpretation of use, the "abductive attempt" is what nearly always precedes inductive experimentation, because in the attempt to use a product appropriately, the first "stab" is always a gamble.

This happens, for example, every time we enter a place that we know poorly or not at all and find ourselves under some sort of emotional pressure: when we enter a hospital anxiously, a train station hurriedly, a governmental office in irritation, a museum engrossed. And analogously, it happens when we find ourselves in possession of a *semiotically opaque* artifact, like some photocopiers or printers when they jam: you must know how to open them, something has to be moved, paper has to be removed. In these cases, the question is: what does this machine tell me to do? If we cannot resort to a habit acquired in an earlier experience, and if the interface provides no aid, all we can do is to venture a guess.

Mode C.2: Abductive-inventive interpretation of use: reinvention

From what we have said so far, it might seem that abductive interpretation – and any inductive experimentation following it – is necessary only in cases of negative usability or emergency situations. We can say that venturing a guess is often a *way out*, and that our probing the terrain inductively is an index of uncertainty or semantic opacity. At the same time, we must point out that abduction – not coincidentally also termed *retroduction* – is for the most part a return backwards in time: from effect to cause. For example, from the formal configuration of an artifact (effect) it is possible to abduct the rules of use planned into it (cause).

But abduction is always invention and thus *projective gaze* (Zingale, 2012). It is so where the law-mediation either is completely nonexistent or requires reformulation, and thus in cases where the design process (including that of the user) is oriented towards innovation: either for need for survival when a problem presents itself, or for a spirit of adventure. In general, the reinvention of use takes the form of overcoming the limits of the artifact: limits of suitability to purpose (the artifact does not do what it is supposed to do), limits of conception (a possible use has not been envisaged), limits of availability (the artifact does not exist or is impossible to find), and so on.

There are thus cases where the design process passes into the hands of the user-agent, and consists in reformulating, partially or wholly, an artifact's program of use. Just like in a metaphor, seen as a stratagem for getting beyond the limits of language so that we can say what the language as it is does not allow us to say. The metaphor is indeed a way of constructing sense that allows

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new concepts or content to be "named" via old expressions by means of analogic pairing, regenerating the language (Cf. Eco, 1984). If we really think about it, we users also regenerate our relationship with objects in a similar way when we modify at least one of the components of the design of an artifact. For example, we can override or take the place of the designer, or change the purpose of the artifact. In so doing, the use of objects can be often *shifted* or *moved* in a way that brings advantageous exceptions to the plan. This is what happens when we employ a knife in place of a screwdriver.

Ugo La Pietra is an example of someone who interpreted the principle of reinvention both with an artistic and critical approach. In the last years of the 70's, he proposed two works that highlighted – though in a provocative and paradoxical way – the inventive and designing role played by the user.[1]

5 CONCLUSION

"The tourist consumes his life, the traveler writes his", writes Marc Augé (2003). We can paraphrase this by saying that there is an idea of the user who limits himself to *consuming* a product and an idea of the user who *writes* and *designs* his actions through the use of a product. Full usability is achieved when an object can be used efficiently and to the user's benefit, but above all when it suggests and involves an act of reinvention. When a product induces the user to reinvent and thus to undertake a new design action, then the virtuous circle of participatory design is initiated. As in the unlimited semiosis of Peirce, the use becomes the *interpretant* of the design idea, which is, in turn, able to act as *interpretant* of the observed use actions.

In conclusion, the pragmatist view of design semiotics informs us that design originates *before* the artifact and keeps living *beyond* it.

Before, because design can only start from a problematic reality: something missing, a sense of uneasiness, inadequacy, dissatisfaction. A problem is the "feeling of an absence", the consciousness of an unavoidable imperfection in the artificial world as it has been historically and socially produced.

Beyond, because every artifact is not only a "text" to be interpreted: it is also – and unavoidably – a motivator to actions and behaviors, something that suggests tastes and mental habits, a place where the design activity gathers and starts again.

In the end, design does not fulfill itself in the single design of an object. It continuously triggers recursive and potentially unlimited processes of interpretation. Design is always a silent but hard-working part of our history. Design is one of the most powerful routes through which our beliefs and views of the world flow. For all the reasons above and for many more, a pragmatist semiotics may and should help design to act according to the global idea of *meaning* and *consequences of things* with which we decorate the setting of our social life.

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[1] The two works in question are: *I gradi di libertà* (1975) and *Attrezzature urbane per la collettività* (1979. See. Rui (2014).

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6 REFERENCES

AUGÉ, M. (2003) *Le temps en ruines*. Paris: Galilée.

BIANCHI, C., MONTANARI, F. & ZINGALE, S. (2010) *La semiotica e il progetto 2 – Spazi, oggetti, interfacce*. Milano: FrancoAngeli.

BONFANTINI, M. A. (1980) Introduzione – La semiotica cognitiva di Peirce. In: PEIRCE, C. S. *Semiotica*. Torino: Einaudi.

BONFANTINI, M. A. (1987) *La semiosi e l'abduzione*. Milano: Bompiani.

BONFANTINI, M. A. (2000) *Breve corso di semiotica*. Napoli: Esi.

BONFANTINI, M. A. & PRONI, G. (1980) To guess or not to guess? *Scienze umane*. 6. p. 249-265.

BONFANTINI, M. A. & ZINGALE, S. (eds.) (1999) *Segni sui corpi e sugli oggetti*. Bergamo: Moretti&Vitali.

DELEDALLE, G. (2000) *Charles Sanders Peirce's philosophy of signs*. Bloomington: Indiana University Press.

DENI, M. & PRONI, G. (2008) *La semiotica e il progetto – Design, comunicazione, marketing*. Milano: FrancoAngeli.

ECO, U. (1984) *Semiotica e filosofia del linguaggio*. Torino: Einaudi.

FISCH, M. (1986) *Semeiotic, and pragmatism*. Bloomington: Indiana University Press.

MURPHY, J. P. (1990) *Pragmatism.* Boudler: Westview Press.

PEIRCE, C. S. (1931-1958) *Peirce, CP of Charles Sanders Peirce.* Cambridge: Harvard University.

PEIRCE, C. S. (1998) *The essential Peirce, the Peirce edition project*. Bloomington: Indiana University Press.

PRONI, G. (1990) *Introduzione a Peirce*. Milano: Bompiani.

RABARDEL, P. (1995) *Des hommes et des technologies – Approche cognitive des instruments contemporains*. Paris: Armand Colin.

RUI, A. (2014) *Ugo La Pietra. Progetto disequilibrante*. Milano: Corraini.

SHORT, T. L. (2007) *Peirce's theory of signs*. New York: Cambridge University Press.

ZINGALE, S. (2009) *Gioco, dialogo, design – Una ricerca semiotica*. Milano: ATì Editore.

ZINGALE, S. (2012) *Interpretazione e progetto – Semiotica dell'inventiva*. Milano: FrancoAngeli.