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The future of the "Homme-Trace" : a substantial societal challenge

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Béatrice Galinon-Méléneq,
THE FUTURE OF THE “HOMME-TRACE”
A SUBSTANTIAL SOCIETAL CHALLENGE,
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Abstract:

Having observed that the notion of trace is used in disciplines whose subjects and methods often stand far apart, the author has put forward some definitions from French anthroposemiotic research (signe-trace, signe-signal, “echoing of traces” etc.). The propositions result from her own findings in professional situations of communication. In this article, B. Galinon-Méléneq explains that confusing the sign and the trace is an anthropocentric view and that “if any sign is, in fact, a “signe-trace”, a trace is not necessarily a sign”.

The latest scientific discoveries have led the author to propose a new anthropological definition spanning time: the *Homme-Trace*. Revealed by both anthropology and astrophysics, traces of the distant past make it possible to question the trace in terms of processes, interactions (human or nonhuman), systems and complexity.

This paper serves as a basis for debate within the international and interdisciplinary e.laboratory “Human-Trace-Complex-Systems”, with the aim of developing a collective intelligence of the notion of *Trace*. All disciplines are invited to respond to this substantial societal challenge.

Keywords:

Homme-Trace, Traces Processuelles, Signe-Trace, Signe-Signal, Construit de traces, Milieu, Habitus, Embodied Traces, Relationship, Interpretation, Interactions, Process, Relation, Milieu, Environment, System, Complexity, Anthroposemiotics.

¹ Translated by Isobel M. Blackett-Hié.

INTRODUCTION: THE ROLE OF THE *TRACE* IN OUR RELATIONSHIP WITH THE WORLD

One of our major areas of research concerns the study of interpersonal relationships in real-life situations. We concluded that the relationships were the result of interactions of “*signes-traces*”. The epistemological questions associated with them and the results² obtained led us to believe that other disciplines should be associated with an interdisciplinary dynamic concerned with the question of traces. However, right from the initial attempts, it emerged that differences in the meaning of terms presented an obstacle to cooperation. Consequently we shall provide some guidelines concerning the notion of *Trace*³.

Traces and sustainable development of the human species

When conceiving the future of the human species, it appears essential today to understand how it fits into the ecosystem with which it interacts. For this purpose, examining traces of the past plays a central role because it is an opportunity to take a look back in time. The older the traces are, the more their presence today can serve as a problematic of sustainability. There is a close correlation between the two notions of “Traces” and Duration.

New discoveries relative to traces left by humanity’s history and life on earth come to light each year. There appears to be an increasing number of connections which are so close that they might possibly represent only part of the relationships between this evolution and the birth of the universe. They prompt us to conclude that life developed out of inanimate matter and that the first living beings were single cell organisms. Today one can trace the evolution of living things as they take us from one stage to the next (cells, plants and animals) to present-day humans⁴. Bringing “visibility” to the stages of the relationship between the evolution of the human body - in particular its

² GALINON-MÉLÉNEC Béatrice, “From *sign-traces*” to “*Human-trace*”. The production and Interpretation of Traces from an Anthropological Perspective”, UMR CNRS IDEES, Normandie University. Brown Laura (trad.), Hong Kong 2013. For the original version published in French, *Intellectica* 2013/1, n°59 pp 89-113. Open source: HAL: halshs-00935346.

NDT: In the English version of 2013, the translator did not make the same choice as the one here, i.e. an attempt was made in the former translation to find equivalents in English for terms proper to the subject and the author, who is a French researcher, terms such as “*Homme-trace*”, “*signe-trace*”, “*signe-signal*” etc.

³ The details of the explanations cannot be dealt with in the space provided in this paper. Readers interested should refer to the bibliography.

⁴ WULF Ch., *Anthropologie de l’Homme mondialisé*, CNRS éditions, 2013.

brain - and what surrounds it has produced some classifications among which figure *homo erectus* and *homo sapiens*.

In the 20th century, palaeoanthropological discoveries opened up new perspectives. Traces of human evolution could be tracked over about 4 million years to the present day⁵. This led us to propose (2011) a new transversal definition of eras: a human is fundamentally an *Ichnos-Anthropos*, an “*Homme-Trace*”⁶. They can be defined in the following way: Humans, who have been part of History for several millennia and in a multi-scale, multi-dimensional space, can be defined as “L’Homme-trace” since they are the product of their history – their own and that of the generations before them – they are both “un construit de traces” (“*a construct of traces*”) and “a producer of traces”. The two dimensions operate in a complex system of interactions (Galinon-Méléneć, 2011, 2013)⁷.

At the time of writing this chapter (March 2014), the astrophysicists who have been searching for traces of a fundamental wave responsible for the origin of the universe think they have perceived a fossil vibration of the universe. It appears to be the oldest trace of the world’s early development to have been discovered. It is important to take account of the fact that this was only made possible because scientists *started looking for its existence*, that is, from the moment it was assumed that the Universe began with the Big Bang, followed immediately by primordial waves. We will return later to the abduction process underlying this discovery.

Thus, palaeontology and astrophysics are making considerable advances in what we know about humanity and the history of the universe. Their progress, in conjunction with observation of traces, shows how fundamental the question of trace is for the representation humans have of themselves and their place in the universe. This journey into history is equally relevant as it makes it possible to attempt to conceive human sustainable development.

Furthermore, building on the ever increasing capacities of technology, research is making great strides in a number of major fields of knowledge including that of the human body (molecular genetics, genetic transmission, the brain, etc.).

⁵ Cf. *infra*, GALINON-MÉLÉNEĆ B., *Intellectica*, 2013.

⁶The term “Homme-trace” can be translated as “Human-trace” on the condition that the two locutions cover the same definition. Where errors of interpretation could arise, the term *ichnos-anthropos* is more appropriate.

⁷ GALINON-MÉLÉNEĆ B., *ibid*.

All these discoveries, just like those that came before, have contributed to developing humans' responses to the great metaphysical questions about the origin of humanity. Despite its importance, this dimension will not be discussed in our article

Using as a basis the recognised traces, we shall simply attempt to show that a human is fundamentally an *Homme-trace* and that the interactional process of traces between human beings and milieu can be observed in any culture, at any time and in any place. This places the issue of trace in a general perspective; but insofar as our questions concern in particular the interpretation of trace by humans, the research falls within the province of anthroposemiotics⁸.

Introductory definitions

- The “traces processuelles”

Regarding the relationship between human beings and the real, we posit that a human is confronted with a reality existing externally to him/herself: reality existed prior to humans. Today's reality has come about through evolution. All evolution is a process. The process leaves a trace that we call a “*trace processuelle*” (a *processual trace*⁹). The most spectacular example of this principle is the research that astrophysicists have been carrying out since the 1980s in order to detect a vibration in the universe, the trace of the primordial cosmic wave.

With respect to the view that is ours today, we will focus on the processes that produce the trace, i.e. that all the examples will be given with the purpose of illustrating one aspect or other of the process. The subsequent presentation should not obscure the fact that it is not an exhaustive list nor that they form together a complex dynamic.

- The “traces of the cultural evolution”

Astrophysicists ceaselessly watching the sky bear within them traces of knowledge that differ from that of the Sumerians who observed the heavens in order to understand the universe of the gods (SOUCHIER, 2013)¹⁰.

In order to hunt traces in the sky, astrophysicists have all the

⁸ Anthroposemiotics: The study of human communication.

⁹ Translator's note: The term used in the previous translations (*procedural traces*) seems less appropriate in the sense desired by the author.

¹⁰ SOUCHIER E. “Voir le web et deviner le monde. La “cartographie” au risque de l’histoire de l’écriture”, dans *Traces numériques. De la production à l’interprétation*, Paris, Editions du CNRS, série L’Homme-trace, 2013, pp. 213-234.

observational tools needed that also bear the traces of evolution. In this example, the skills of both (human and technological) combine to keep on tracking the primordial trace.

- The “*trace incorporées*” (“*embodied traces*”)¹¹

An individual’s body (in particular his/her brain) carries the traces of his/her history and consequently what came before: its genetic, cultural, individual and social history. What can be seen here is that the trace issuing from history is embodied. We call this the “*embodied trace*” (“*trace incorporée*”).

Bodies are able to perceive their surroundings. Their “embodied traces” sort out their perception. Humans are not aware of all the traces inscribed in their bodies and of this selection resulting from processual interaction. They need to be informed.

- The “*perceptual traces*”

The way in which observers break down reality depends on their history and the *traces processuelles* inscribed in their bodily matter: discerning an object or person, selecting one sign or another, corresponds to reciprocal activation processes of traces.

“We can represent nothing as combined in the object without having previously combined it ourselves” (E. KANT)¹².

Our theory is that the manner in which individuals fragment what is real by selecting only fragments of this continuum of traces differs from one individual to another. The result of this relationship is that the sign is a trace of interactions of previously produced traces¹³.

The consequence is that the meaning an individual gives to information he/she perceives from outside is what we call a “*signe-trace*” of embodied traces. The best known example relative to the effect of these “embodied traces” is the role of language, of learning and of knowledge in perception. (KORZYBSKI, 1951; BATES, 2005)¹⁴.

¹¹ *Embodied cognitive science* appeals to the idea that cognition deeply depends on aspects of the agent's body other than the brain. See *Embodied Cognition* (Stanford Encyclopedia of Philosophy).

¹² In other words, even if reality in itself were law-governed, its laws could not simply migrate over to our mind or imprint themselves on us while our mind is entirely passive. *IMMANUEL KANT*, Stanford Encyclopedia of Philosophy, May 20, 2010.

¹³ KORZYBSKI Alfred, *The Role of Language in the Perceptual Processes*, Reprinted from *Perception: An Approach To Personality*, edited by Robert R. Blake and Glenn V. Ramsey. Copyright 1951, The Ronald Press Company, New York.

¹⁴ “*Patterns of organization are not limited to perceptions, however. In our brains we create*

- The *signe-trace*

In our paradigm, when the trace is identified as a trace, it becomes a *signe-trace* and, “If any sign is, in fact, a “*signe-trace*”, a trace is not necessarily a sign”¹⁵.

Indeed, if reality (the entire universe) is defined as a complex referential inaccessible to humans as a whole, and if the universe is evolving (thus leaving in the matter and in the universe the *traces processuelles* of this evolution), it must follow that humans have access to only fragments of the real. The fragment selected by an individual represents what a human calls a “sign”. However, the selection and interpretation of the sign is filtered and processed by the brain according to the “embodied traces” which are also the *traces processuelles* of its history.

The same sign selected by two individuals thus cannot lead to the same signal for each one. The way in which a sign is transformed into a signal by an individual is also a *signe-trace* (the *signe-trace* from the embodied history of the one who does the interpreting). The trace inscribed (in the brain) will not be the same either.

- *Invisible traces*

There are traces of the evolution of the world which have not yet been discovered by humans. Only what we call “*signes-traces*” are recognised as traces.

and store our own patterns of thought, feeling and memory in the neurons, which we then subsequently draw on for further thought and action. Further, we mould the world around us by imposing patterns of organization on the world, whether by intentionally producing houses, tools, books and the like, or unintentionally by beating a path through the woods by repeated use. In our own species, we generate enormously complex social systems and cultural expressions, which are, in turn, stored as information in our minds and in the patterns of organization of the objects and infrastructure around us”. BATES Marcia J. “Knowledge is defined as information given meaning and integrated with other contents of understanding” in *Information and knowledge: an evolutionary framework for information science*, Department of Information Studies University of California, Los Angeles, CA 90095-1520, USA. Cf. <http://www.informationr.net/ir/10-4/paper239.html>

¹⁵ “The restricted semiotic field is where the focus of legitimacy lies, both that of the *actors* and that of the *concepts*. It is *semiotics for semioticians*. [...] It is in the semiotic field of dissemination and wider production that the discipline plays an auxiliary role [with other disciplines]. And its practitioners, mostly casual, moreover, have little legitimacy under standards governing the limited market of this restricted field. The observation has also been made that the semiotic tools selected by them are frequently detached from their theoretical framework, and besides, are not specifically considered as central or currently relevant to actors in the restricted field.” (Klinkenberg, 2012: 17).

In this chapter, we make transpositions and overruns and propose a new method coming from interdisciplinary relationships.

Many traces exist that are invisible to humans. Their existence is based on general hypotheses such as the one described above on the genesis of the universe, the *traces processuelles* and *residual traces* that should logically ensue. We shall return later to the reasoning by *abduction* which is the foundation of this reasoning.

It should first be noted that the absence of material traces can be interpreted as “*traces processuelles*”, for example, in the case where logically the material trace should be found (e.g. fingerprints on a door handle) but where there is none. This absence is the trace of a process of effacement¹⁶. However, to give it a signification (is it the act of a criminal or the cleaning lady?), other traces must be found that would connote the signification to be given to the former.

To conclude this introduction, we claim that the notion of trace is to be found in a number of disciplines but its signification is rarely made clear. Yet there is a heuristic interest in opening up an epistemological discussion on trace to all disciplines but more particularly to those whose objective it is to conceive complex relationships between humans and trace, in other words, between humans and the real¹⁷, as will be explained below.

This is the objective of the unitwin HUMAN-TRACE COMPLEX SYSTEMS¹⁸ which we founded. One of the major difficulties of this interdisciplinary research dynamic on traces is agreement on the meaning of the term *trace*. The aim of this article is to serve as a basis for exchanges for this very purpose.

I. “TRACE” A GENERAL TERM WITH A VARIETY OF FORMS¹⁹

¹⁶ GALINON-MÉLÉNEC, 2011: 23.

¹⁷ The reader will find examples illustrating our propositions in previous publications: cf. bibliography and, regarding some examples, more particularly: GALINON-MÉLÉNEC, B., (dir.), *L'Homme trace. Perspectives anthropologiques des traces contemporaines* (« *The Homme trace* ». *Anthropological perspectives of contemporary traces*), Paris, CNRS éditions, 2011.

¹⁸ The HTCS HTCS (Human-Trace Complex Systems) is an e.laboratory of l'unitwin Complex systems UNESCO. The dynamic of the HTCS is part of the perspective of the UNESCO/CISS/ OCDE (2013) report which calls for more cooperation from the humanities and social sciences with the other sciences with a view to responding to the problematic of complexity. The report can be obtained in a printed version from Éditions UNESCO (UNESCO ISBN 978-92-3-104254-6.). For the HTCS cf.: <http://rightunivlehavre.wordpress.com/ichnosanthropos/> re the French version. [Complex_Systems_Digital_Campus/E-Laboratory_on_human_trace](http://rightunivlehavre.wordpress.com/ichnosanthropos/) for the English version.

¹⁹ The trace includes the imprint which is a connoted trace of a more accentuated marking.

Our approach is based on the interweaving of the different complex systems under study not only in the sciences of matter and life sciences but also in social science and the humanities, studies which have already enabled us to pinpoint several characteristics which could lead to an understanding of *The universality of the trace* (B. Galinon-Méléneec, 2011: 31-40)²⁰.

Perception of the real world and discontinuity²¹

“Objects do not exist independently of conceptual schemes. We cut up the world into objects when we introduce one or another scheme of description” (H. PUTNAM, 1981: 52).

In our “L’Homme-Trace” paradigm, we posit that the complexity of the real is inaccessible to the human mind. When a human distinguishes signs in a continuum of the real, it is the result of a sorting process; yet this process is linked to his/her history.

An individual’s history is an uninterrupted continuity of interactions with a human and non-human environment. These interactions produce a magma of traces inside the individual and they are themselves in continuous and constantly renewed interactions. As a result, when humans perceive the world, they have the impression that it is a juxtaposition of images emerging from a discontinuity whereas it is not a question of the world but their relationship with the world which is in fact a *continuum*. This question (of continuum) is not new. From the “*natura non facit saltus*” of Leibniz to the philosophical thought of Immanuel Kant, Poincaré and Peirce - to name but a few - the question of continuity played a central role in scientific and philosophical thought²².

²⁰ GALINON-MELENEC Béatrice, “L’universalité de la trace. Le XXI^e siècle, siècle de la trace?” Embodied Cognition in *L’Homme-trace*, CNRS éditions, série L’homme-trace, volume 1, 2011, pp 30-55.

²¹ On this subject, one can also read the distinction made by FLORIDI (2005) *diaphora de re*, absence of uniformity in the “real world out there”, exterior to the interpretant. “*The real world out there*”, *diaphora de signo*, absence of uniformity between two states of the physical signal, and *diaphora de dicto*, absence of uniformity between two symbols, cited in Sylvie LELEU-MERVIEL “Le processus d’information, de la trace d’interaction à la communication numérique” (“The process of information, from the trace of interaction to digital communication”) in Colloque CECI, Université du Havre, 11 June 2014.

²² From LEIBNIZ's apothegm “*natura non facit saltus*” to “The opposition between continuity and discreteness in the philosophical thought of Immanuel Kant (1724–1804)”: see *Continuity and Infinitesimals*, Stanford Encyclopedia of Philosophy, Sep 6, 2013.

With respect to Immanuel KANT: “His mature philosophy, transcendental idealism, rests on the division of reality into two realms. The first, the phenomenal realm, consists of appearances or objects of possible experience, configured by the forms of sensibility and the epistemic categories. The second, the noumenal realm, consists of “entities of the understanding to which no objects of experience can ever correspond”, that is, things-in-themselves” (*ibid*).

From our point of view, individuals do not perceive the real in strictly identical fashion which is why it is more a question of an indetermination of what they perceive. In the sense that it is still currently impossible to penetrate inside an individual and attain knowledge of all the details of his/her perception and interpretation of the outside information thus perceived.

It is all the more difficult in that what every individual perceives corresponds to what we call a “process of reciprocal activation of traces” that varies eminently from one individual to another inasmuch as what is perceived corresponds to the *processes of reciprocal activations of traces*²³ *between the individual and that which is outside him/her (the Other, the human but also the non-human).*

*This definition marginalises the notion of a voluntary cut*²⁴ *in the continuum. In our view, the relational system of interaction of traces that leads to the emergence of the *signe* is complex and not necessarily a conscious one. Conversely, one of its results – the *signe* which is the subject of a process of “*semantisation*”- is brought to an individual’s awareness*²⁵.

Differences in terminology

- Distinguishing between trace and imprint

A distinction must be drawn between the terms “trace” and “imprint”. The origin of the term “imprint” (originally as “emprint” – late Middle English) is from Old French *empreinter*, based on Latin *imprimere*, from *in-* “into” + *premere* “to press”, whose original meaning (1250) was “to stamp (a mark or outline) on a surface”. The term “trace” covers a greater degree of general connotations and nuances. Our notion of trace includes the imprint that is a connoted trace of a more accentuated marking. *On this basis, any imprint is a trace but a trace is not necessarily an imprint.*

With respect to Henri POINCARÉ: “The idea of continuity played a central role in the thought of the great French mathematician Henri POINCARÉ (1854-1912)”.

With respect to PEIRCE: “Peirce's conception of the number continuum is also notable for the presence in it of an abundance of infinitesimals. Peirce championed the retention of the infinitesimal concept in the foundations of the calculus, both because of what he saw as the efficiency of infinitesimal methods, and because he regarded infinitesimals as constituting the “glue” causing points on a continuous line to lose their individual identity” (*ibid*).

²³ Which we call also “the echoing of *signes-traces*”

²⁴ Pour Mioara MUGUR-SCHÄCHTER cited by Sylvie Leleu-Meviel (2014): *the first phase is the generation, through a function-conscience of the “entity-object”, i.e. the capture of purely factual fragments of substance, still a-conceptual, obtained by a voluntary cut in the density of the real which is then treated as a raw material for further “desemantisations”*.

²⁵ Illustration of the application: trends in French psychoanalysis.

The term “trace” is used in a variety of ways which means it can include the infinitesimal or even the invisible. Let us take the example of homeopathy, an alternative medicine based on successive dilutions that render the initial molecules undetectable by modern science without in any way arresting the effects which persist by means of complex processes: even if they remain invisible, unreadable and not open to interpretation, there are traces that are not nonexistent nonetheless, as the effects on animals appear to testify. They are simply proof of the limits of human ability to see them (to transform them into signs), to read or interpret them.

- *Trace, signe, signal*

According to the *Dictionnaire historique de la langue française (The Historical Dictionary of the French Language)*, the term “*signe*” in French comes from the Latin *signum*, one root of which is *secare* meaning “to cut”, *signum* originally being the mark made by an incision²⁶. As an identification of the material discontinuity in the continuum of the real world, it is fully justified, therefore, to call a “*signe*” any sample taken from a part of this continuum.

In other words, we posit that there is a preexisting continuum to our perception and what we call “Reality” emerges from a relational process between an individual and this continuum. In our view, any object is a relation. A relational process of reciprocal activation of traces occurs. It produces different accesses to the continuum. These “gateways” blend intuition with reason, more or less.

It is our belief that the *noumenon* (the Entirety) is not accessible to human rationality²⁷.

The relational process operates cuts in the continuum of that which exists. This “portion of the world that comes to the attention of a cognitive system” (BATESON) is made by an “Homme-trace” which, as we have seen, carries in his body (including his brain) the traces (*embodied traces*) of his individual and social history (genetic, sensorial, experiential and cultural, etc.).

These cuts are the subject of a language qualification – in the wider sense²⁸ - by humans (object, information provided, *signe*, etc.).

²⁶ “*Signe*” in REY Alain, *Dictionnaire historique de la langue française (Historical Dictionary of the French Language)*, Le Robert, 2006, p 3505.

²⁷ On this subject, refer to the writings of Kant, Hegel, Husserl and Spinoza.

²⁸ Mathematics, graphs, are here understood as forms of language.

When human beings look at the world, they see only a part of it, thus dividing the world implicitly into sections since they cannot see it in its entirety. What has been unconsciously selected is therefore only a sign of the trace or traces that have remained inaccessible.

What has been perceived as a sign by the human unconscious is then “digested” by the unconscious and processed by the conscious so that the sign resulting from the divisions and selections within the trace is no longer but a more or less faithful image of the sign, the distortion of which has transformed it into a “*signal*”.

The trace is of the order of the real, the sign that of perception and the signal that of interpretation. To put it another way, referring a trace to a meaning is only possible because there is an implicit temporal-causal relationship between the currently discernable phenomenon (the *signe-trace*) and a past phenomenon that is not necessarily discernable (the trace); the subjectivity of the signal interpretation of the sign (*signe-signal*) renders the meaning given to the trace uncertain.

This dynamic process involves numerous direct systems (person, situation, etc.) and indirect ones (economic, cultural and scientific contexts, etc.).

Human traces, corporeality, milieu

Traces are inextricably linked to everything in motion, in particular to the life of any body²⁹. Indeed, life³⁰ presupposes exchanges that shape the milieu³¹, i.e. the close relations nearby that are themselves modified, albeit temporarily, by the living.

It should be clarified here that the word “milieu”³², when it is distinguished from the word “environment”, corresponds to the surrounding world, limited to what is likely to be in immediate interaction³³ with the living.

“Those milieu-relations are not all the same for all species –meaning may differ quite radically between species, even those involved in the

²⁹ Human or animal.

³⁰ All forms of life are therefore concerned.

³¹ On this subject, cf. WATSUJI T. *Fûdo, le milieu humain*, translated into French by Augustin Berque, CNRS Editions, Paris, 2011.

³² This definition coincides with Watsuji TESTURÔ’s which distinguishes between the environment defined as objective (*Umgebung*) and the milieu defined as ambient world (*Umwelt*), peculiar to a certain being (individual, society, species). Watsuji Testurô read in the translation of the French geographer Augustin BERQUE. Cf. BERQUE A., (Translation and annotation of) Watsuji Tetsurô, *Fûdo. Le milieu humain*, Paris, Éditions du CNRS, 2011.

³³ The notion of environment refers to the idea of “outside oneself”.

same ecosystem or interdependent in various ways (WATSUJI TETSURO)³⁴.

Conversely, use of the term “environment” signifies a lesser proximity of interactions. *The term milieu (mi-lieu) refers to what is merely halfway external to the human. It is not Man but it is not outside Man. They share an intimate relationship* (SIMONDON, 1989)³⁵.

Conception of the relationship between a thing and human life falls within the province of what Augustin Berque calls *médiance*. What humans call objectivity in fact stems from a relational process.

We posit that:

- Humans and Milieu never cease to mutually influence one another through a system of interactions of traces;
- By observing a milieu, *signes-traces* (signs of traces) of human existence can be identified.

For us, these two dimensions are indissociable. Concerning technology, if it is recognised today that humans’ use of it leaves traces in their bodily matter – in their brain – the notion of *milieu* will be used when reference is made to its *symmetrical and immediate influence* on the technology itself, on its matter; both influences playing continuously and retroactively. Should this not be the case, the term “environment” is to be preferred.

Upon an individual’s entering a space, it takes on a particular dimension when the space is qualified as territory³⁶ by one or more individuals taking possession of it. When a body enters this space, it produces traces of its passage. If the traces have been perceived, they become not only *signes-traces* but also *signes-signaux* in that they are likely to be interpreted as a signal of intrusion triggering a reaction against the person regarded as an intruder.

Where animals are concerned, any *signe-trace* of entry into “its” territory is more often than not felt as a signal of intrusion and causes reactions, some of which result in new traces that could be more or less

³⁴ “Watsuji’s mesology implies that it is our very humanity that is at stake”. Cf. JANZ Bruce B., *Watsuji Tetsuro, Fudo, and climate change, Journal of Global Ethic*, Vol. 7, No. 2, August 2011, 173–184

³⁵ SIMONDON G., *L’individuation psychique et collective*, Aubier, Paris, 1989.

³⁶ Territory (Dictionnaire Larousse): English translation: “Expanse of land under some authority or jurisdiction. (The territory of a State is the land, sea and air space upon which government bodies can exert their power.)

Expanse over which an individual or family of animals reserves the rights of use.

Relatively well defined space that a person has assigned him/herself and over which he/she wishes to retain his/her authority: *His/Her bedroom is his/her territory.*”

persistent (excreta, smells, sounds, etc.). Confrontational behaviour is caused if the marked-out space is entered nonetheless. The perceived characteristics of these physical animal behaviours make up the *signes-traces* of belonging to the territory.

With respect to humans, the basic process is the same. We say that its interpretation is indexed according to their history (both individual and social) which inscribes traces within the bodily matter and in particular the brain. These physical traces (including the sensory) form the basis of initiation into the reception and the interpretation.

“The experience of the affective trace of ‘my’ relations with particular others is preserved, again not as psychological memory, but as a reminiscence of the flesh” (E. LEVINAS, 1961)³⁷.

We would say, therefore, that:

- the bodily matter of an individual has embodied the traces of his/her history;
- although all the traces are present in the body, their existence can remain unknown to humans, particularly to the person concerned;
- when one of the traces is identified by an individual, it takes on the form of a sign; this trace becomes a “*signe-trace*”;
- the *signe-trace* can be interpreted in a certain way by one individual and in a different way by another. The sign thus interpreted becomes a “*signe-signal*”. At each stage of transformation by selection of a trace into a *signe-trace* and by interpretation of a sign into a *signe-signal* in order to ultimately bring about a behaviour-signal (*comportement-signal*), we are dealing with an interactive coupling of the traces peculiar to the individual concerned and those of his/her milieu.

The echoing of sign-traces

It has been seen that a trace can become a *signe-trace* for one individual and yet remain unknown to another. In other words, the existence thereof is likely to be contested by the second³⁸.

The role of *psychic traces* inscribed in the bodily matter (*habitus*)³⁹ should be stressed: embodied (in-body) interactions of humans with their

³⁷ The exploration of sensibility as the locus at which ‘inside’ and ‘outside’ merge. If sensibility already played an important role in *Totality and Infinity* (LEVINAS), sensibility will now be traced back to the density of the flesh itself. And the flesh serves Levinas as his pre-consciousness, whose ontological meaning counts above all else.

³⁸ Opening up to the reception becomes for the authors of the decision “availability heuristics”: KAHNEMAN D. et TVERSKY A. “Judgement under uncertainty: heuristic and biases”, *Science*, vol 185, n°4157, 1974, p. 1124-1131.

milieu produce psychic traces. These are externalised in the milieu in the form of behaviours and practices, “*signes-traces*” of embodied psychic traces. The transformation into a *signe-trace* occurs as soon as another body perceives it.

Current research into neural imaging shows that the brain is activated even when there is no conscious attention (while asleep or in certain coma cases)⁴⁰. There are therefore different levels of perception of the trace through reciprocal processes of activation. Some are invisible to the human but this does not mean they are not working. Consequently, we believe that each individual should be made aware of the overlapping of what is inscribed in his/her psychic memory and that which he/she perceives. Knowing that the process is common to all individuals⁴¹, it is to be hoped that this state of awareness improves the tolerance towards differences and with it the ability to live together based more on cooperation and less on conflict⁴².

Similarly, it has been noted that the selection among traces of the same sign by two individuals can lead to a difference in signals according to how they are interpreted, i.e. to two distinct *signes-signaux*. In other words, the same *signe-trace* could be seen by two individuals as two completely different *signes-signaux*.

The *ex-post* analysis of a communicative relationship can help to demonstrate that *signes-traces* have echoed one another. This echoing comes from interactions between *signes-traces* that are entwined in complexity. The nature of the relationship established cannot be reduced to the rational knowledge of the identity of the individuals and the communication frameworks. What underpins the relationship profoundly is taken to be a

³⁹ *Habitus* is a system of embodied dispositions, incorporated from Man-milieu interactions, a system that generates behaviours and "practices" (as P. Bourdieu states). Cf. BOURDIEU P., *Distinction: A Social Critique of The Judgement of Taste*, trans. Richard Nice, Harvard University Press, 1984. The dispositions constituted by *habitus* of any human produce a dynamic situation of communication between persons in a relationship.

⁴⁰ Work on neural imaging shows that the brain is activated even when there is no conscious attention (while asleep or in certain coma cases).

⁴¹ Cf. RICOEUR P., *Oneself as Another*, trans. Kathleen Blamey, Chicago: University of Chicago Press, 1992 (in French: Paris, Seuil, 1990).

⁴² Recent knowledge concerning the most primitive peoples shows that conflict and violence have not always been the order of the day in human relationships. In her book *Préhistoire de la violence et de la guerre (Prehistory of violence and war)*, published by Odile Jacob, Marylène PATOU-MATHIS goes back to the origins of humans to discover traces of alleged original violence and observes: “*During the Palaeolithic Era, among several hundreds of human remains examined, only two testify to voluntary acts of violence: they were perpetrated by modern Man (Homo sapiens)*”. If the hunter-gatherer of Palaeolithic times had been a warrior, there would be traces of his aggressivity: marks, *signes-traces* of violence should be visible on the human fossils. On the contrary, recent archaeological discoveries have been interpreted as indications of altruism and compassion instead.

process whereby *signes-traces* are echoes of one another, the complexity of which is beyond explanation:

“If you press me to say why I loved him, I feel that I can say no more than it was because it was he, because it was I. There is, beyond all my discourse, and all that I am able to say in particular, I know not what inexplicable and fated power that brought on this union.” (MONTAIGNE M., “Of Friendship” in *Essays*, 1580)⁴³.

The hypothesis of *signes-traces* echoing gives us the opportunity to clarify the processes that come into play between the two co-present people at the very instant the traces inscribed in both bodies are activated reciprocally, by following, in most cases, an unconscious selective process.

For Levinas⁴⁴, ethics must find its ground in an experience that cannot be integrated into logics of control, prediction, or manipulation⁴⁵.

II. HUMANS’ RELATIONSHIP WITH THE REAL

As a consequence of the foregoing, if the scientific disciplines separately analyse milieu (natural, technical, political, sociological and cultural, etc.), they are merely bringing nearer, from a great distance, the reality of an “Everything”, resulting from interactions between multi-scale systems. Multidisciplinary elements thus appear as the essential requirement of any scientist who places the real as being a result of interactions of complex systems. However, there are epistemological differences between disciplines which have turned out to be very difficult to overcome. In order to try to resolve the difficulty in an attempt to get closer to the complexity of multidisciplinary elements presupposes a reconsideration of several previously discussed points.

Discovering the real, ontology⁴⁶ and reasoning by “abduction”

By using increasingly efficient technological tools⁴⁷, scientists are seeking to make gradual progress in finding out part of what already exists which human senses and technical extensions have no access to⁴⁸. However,

⁴³ “*Because it was he, because it was I*” (Of his friend La Boétie). Translation adapted from: <http://www.gutenberg.org/files/3600/3600-h/3600-h.htm#link2HCH0028> (03.06.2014)

⁴⁴ LEVINAS E., *Totality and Infinity*, 1961.

⁴⁵ *The Stanford Encyclopedia of Philosophy*

⁴⁶ *Ontology* signifies here the relationship between thought and the real.

⁴⁷ To visualise some tools and explore the subject, several sites can be consulted including the NASA website: http://www.nasa.gov/images/content/739997main_SEP_15_full_full.jpg

⁴⁸ Cf. WATZLAWICK P., *How Real is Real? Communication, disinformation, confusion*, New York, Ed. Random House 1976. French translation, éditions du Seuil, 1978.

if the captors in the wider sense of the term make it impossible for them to bring this existence to light, how do scientists presuppose to make assumptions about this existence? They use a variety of reasoning methods, including abductive⁴⁹ reasoning.

What is known as “abductive reasoning” is based on the formulation of hypotheses which, on the one hand, enhance the analysis of what they perceive and, on the other hand, provide evidence of what should exist if their hypotheses that were induced and their reasoning that was deduced were accurate. Abductive reasoning is one of the keys of scientific discoveries⁵⁰.

Of abductive argument:

“According to Hanson, the abductive argument has the following schematic form:

Some surprising, astonishing phenomena p1, p2, p3 ... are encountered. But p1, p2, p3 ... would not be surprising were an hypothesis of H's type to obtain. They would follow as a matter of course from something like H and would be explained by it.” HANSON 1960: 104)⁵¹.

Of the background:

“Anomaly appears only against the background provided by the paradigm” (KUHN, 1970).

Of an “ontology of relations”:

In *The New Scientific Mind*, Gaston Bachelard says that, in modern sciences, “ontology of relations” had replaced the classical ontology of the substance (BACHELARD, 1934).

Let us return to the example given in the introduction with a citation from the press in March 2014. On 18th March, the “leading magazine for scientific news” *Pour la science* writes “The team working on the American BICEP2 experiment announced on 14th March 2014 that they had detected for the first time the trace of primordial gravitational waves, produced during the Big Bang, terminating a 30-year-old quest”⁵².

On that account, scientists were searching for a primordial cosmic wave,

⁴⁹ Cf. KAPITAN T., “Peirce and the structure of abductive reasoning” in *Studies in the logic of Charles Sanders Peirce*, Nathan Houser, Don D. Roberts & James Evra (eds.), 477-496. Bloomington: I. U. Press, 1997.

⁵⁰ Abductive reasoning is universal, common to the human race, be it scientific or otherwise.

⁵¹ SCHICKORE, Jutta, “Scientific Discovery”, *The Stanford Encyclopedia of Philosophy* (Spring 2014 Edition),

⁵²http://www.pourlascience.fr/ewb_pages/a/actu-ondes-gravitationnelles-primordiales-la-preuve-decisive-de-l-inflation-cosmique-se-rapproche-32729.php

a fossil tremor, the existence of which was still to be discovered following a scenario imagined by Andrei Linde in the 1980s to explain the origin of the universe. This trace was thought to be of an extremely rapid cosmic inflation over a very short period and existed before scientists made the hypothesis about its existence. This is what led them to concentrate their observation of the sky on finding the trace. As has been explained elsewhere, this approach underlines some of the facets involved in searching for a trace, namely: the *interpretative presupposition, discontinuity and the temporal causal implicit* (2011: 35-40).

By informing the media that they believed they had found the primordial wave, the team stated that this discovery had changed the representation humans had of the world: “The universe one can see is in fact just a tiny part of the real universe. (...). This phenomenal inflation opens the imagination to interactions between every point in the Universe situated a thousandth of a billionth of a billionth of seconds later, millions of light years away from one another. This inflation could not have occurred without leaving traces of phenomenal fluctuations which necessarily generated this mind-boggling cosmic inflation. These are the oldest traces in the history of our world that seem to have been discovered.”⁵³

Thanks to widespread media coverage⁵⁴, attention paid to the existence of this trace has largely overtaken the astrophysical world. On this ground, as has been said, if it is confirmed, it will modify humans’ representation of their place in the universe. This is an important issue, so important that there might be a temptation to exploit the trace for illustrative purposes, to advantage the positioning of laboratories in a highly competitive scientific environment, turning it into a media show to feed the news, and so on. It triggers, therefore, irremediable controversies concerning the existence as well as the interpretation of this trace. A whole system is being established for the purpose of authenticating the reality of this trace, the causal relationship and the indexing of its signification. Hence the questions that arise concerning human capacities for receiving and interpreting a trace

From the trace to the “*signe-trace*”. From the “*signe-trace*” to the “*signe-signal*”⁵⁵

⁵³ Etienne KLEIN, French physicist, author of *Discours sur l’origine de l’univers*, Flammarion. Award for the best scientific book of the year 1993 in Germany for *Conversations avec le Sphinx, les paradoxes en physique*.

⁵⁴ Etienne Klein’s declaration was reprinted in *Le Figaro Magazine* of 4 April 2014 (p 48).

⁵⁵ GALINON-MÉLÉNEC B. (dir.), *L’Homme trace, Perspectives anthropologiques des traces humaines contemporaines*, Paris, CNRS éditions, série L’Homme-trace tome 1, 2011, p. 353.

Everything that a human being perceives is a trace which makes a sign. We call this specific trace a “*signe-trace*” in order to distinguish it from an existing trace which has not yet been discovered by humans. This “*signe-trace*” is a “product” of interactions, a resulting “construction” between the real and its interpreter, and the indexical face of the sign that we call “*signe-signal*” is the result of a process of interactions of *signes-traces*: it is, in fact, the interactions (the relationship) that activate or deactivate the *signe-signal* face of the *signe-trace*.

The complexity of the notion of trace comes from the fact that everything happens simultaneously in interactions, in multi-scale systems and the relationship. To obtain a clearer idea of the complexity, the processes that build the relationship between humans and reality and produce meaning must be made visible, must be taken apart, must be “*deconstructed*”⁵⁶

The construction of social representations

“The fact of the matter is that the ‘real world’ is to a large extent unconsciously built up on the language habits of the group. No two languages are ever sufficiently similar to be considered as representing the same social reality” (SAPIR E., 1929, p. 209).

If the perception of the real is qualified as interactions of *signes-traces*, we can imagine that, when a *signe-signal* involves a large number of individuals, it is a question of progressive conformation linked to the internalising of social processes.

In this paragraph, a different perspective is used in order to stress the complexity of the trace (JEANNERET, 2011)⁵⁷, using analyses which have become familiar to researchers in the field of information and communication sciences. Furthermore, to show how humans can construct a social interpretation of the trace, another topical example is used below.

Currently, in the spring of 2014, France is getting ready for the events commemorating the Great War of 1914-1918 and the Allied Landings in 1944. The objective of these commemorations consists in making the traces of the past visible by granting them special status: the consolidation of a collective memory. For demonstrative purposes, symbolic *signes-traces* will be performed. The relationship between the performance shown and the signification will be provided by a commentary, the intention of which will be grasped through analysis. New monuments will be erected and these

⁵⁶ Cf. DERRIDA, 1991.

⁵⁷ Cf. JEANNERET Y., “Complexité de la notion de trace. De la trace au tracé” dans B. Galinon-Méléneq, « *L’Homme trace* », CNRS éditions 2011, pp 59-86.

monuments will become the “*traces de traces*” (*the traces of traces*) (BARTHES, 1980)⁵⁸. Constructed intentionally in this way, the traces will take on the form of a material memorial inscription. They will be part of the formulation of a collective memory (HALBWACHS, 1950)⁵⁹, a common heritage⁶⁰ for the countries concerned.

This display of commemorative events will be widely broadcast by the media. However, in the process of the social representation induced there still will remain an element of a particular individual process: each individual’s memory will sort the traces shown by the media. This sorting takes place more or less consciously. It constitutes a *signe-trace* of the individual’s past.

The sorting process of mnesic traces is not specific to this situation. Indeed, what sort of memory would it be that expected to retain everything and never organise anything with the pretext of being constant to a past experience? If people had to memorise every experience encountered in life, they would be faced with an inextricable situation. Yet, humans need to fall back on a certain coherence to make decisions. This coherence is obtained at the cost of reductive methods of complexity: by reducing the volume and number of elements to manage, by classifying and arranging into different types of “boxes”. People do this by carrying out processes of discretisation and breaking up the links of traces that they remove from their production contexts.

CONCLUSION: TOWARDS A COLLECTIVE INTELLIGENCE OF THE TRACE

Having stressed the issues of the trace in terms of human sustainable development and in order to achieve cooperation between disciplines so as to focus on this existential problematic, we have made clear where we stand in our epistemological research into the notion of trace.

To this end, we began by distinguishing between the different uses of the terms *trace*, *imprint*, *signe* and *signal*, stating directly that, for us, if any *signe* is a trace, a trace is not necessarily a *signe*⁶¹. We underlined the importance of “*traces processuelles*” and their paradoxical effect: the absence of

⁵⁸ BARTHES on photography. Cf. BARTHES R., *La chambre claire*, Paris, Gallimard, 1980.

⁵⁹ HALBWACHS M., *La mémoire collective*, Paris, PUF, 1950.

⁶⁰ *Memoriae* : in ecclesiastical Latin, signifies “commemorative monuments”. *Patrimonium*: family assets. Cf. Rey A., *op. cit.*

⁶¹ Cf. Bibliography and more particularly *RFSIC*, 2013 and *Intellectica* 2013.

*materially supported traces*⁶² can be interpreted as the trace of a process of effacement.

In order to convey the meaning of these nuances, we introduced new notions (*signes-traces*, *signes-signal*, etc.) which were then related to the anthropological definition of the *Homme-trace* and with his corporeality. We emphasised the role that echoing of *signes-traces* plays in the initiation of reception and interpretation: while recognising that between two co-present human beings, the bodily *signes-traces* echoing is a simple experience lived out in the present moment, we wanted to show that behind this apparent simplicity was hidden an inextricable interweaving of traces.

We underlined the role played by all the sciences, including the humanities, in exploring this complexity. Research scientists are, of course, human beings like any others and their rationality is limited in relation to the complexity of the real⁶³. Nevertheless, specific work based on a rigorous epistemological approach can legitimately hope to bring to the surface the role that traces play in fundamental questions humans ask themselves. From our point of view, given the universal role of traces, it is indeed essential today for as many scientists as possible to get together for this purpose. On that ground we felt it was necessary for us to clarify the presuppositions that have produced the *homme-trace* and *signe-trace* paradigms that we have put forward.

Hence we explained abductive reasoning, because, even if it is well known to scientists, it is less easily identified by all those individuals who use it without realising it: the imagination and projections play an important role in the attention paid to traces.

Having thus made clear the difference between the existence of traces in their objective reality and their perception by humans, we undertook a presentation of the process by which they are interpreted.

As the disconnection between individuals and society is considered as an artefact, we then demonstrated the reciprocal influence of embodied traces (the individual body and social body) in face to face human relationships. We also undertook to set out to outline the role of the media in the construction of the representation of reality.

Following this, the significance of an analysis into the ways in which the

⁶² Including the *inscribed traces* which are easily identified in the literature. Cf. the synthesis of Sylvie LELEU-MERVIEL “Traces, information et construit de sens” (“Traces, information and construct of meaning”) in MILLE A., *Intellectica*, n°59, 2013, pp 65-88.

⁶³ JANKELEVITCH V., BERLOWITZ B., *Quelque part dans l'inachevé*, Paris, Gallimard, 1978, p. 18.

media exploit traces was demonstrated. This point is especially relevant since many individuals rely on what they find in the media (television, Internet, etc.) to prove that their interpretations of traces is beyond question.

Finally, we emphasised how the process of trace visibility worked: we concluded that, in our view, it corresponds to *processes of reciprocal excitation of traces*, leading to what we call “*the echoing of signes-traces*” which itself defines the *relationship*.

Demonstrating the relationship infers that the possibility of separation is but apparent: the “divisions” of the real made by humans to conceive the world, to talk about it and organise it into categories are essential to their development; yet they must keep in mind that the divisions that taxonomies constitute produce a certain fixedness in the representation of reality. There is a contradictory tension between the need for stability in representations and the progression in the access to understanding the complexity of the real.

This notwithstanding, from our point of view, humans should always bear in mind that the notions of existence, of duration and of trace are closely linked and that inside as well as outside the individual, time does its work as a producer of traces.

We have seen in this chapter how essential a role the interaction of traces plays. As a consequence, we invite the reader to:

- question what is the relevance of a one-to-one correspondence⁶⁴ between *traces* and *signe*,
- develop a wider understanding of interactions and relationships between *trace* and *signe*, the role of relationality and interdependence in any situation.
- establish how these interpretations of the trace correspond with complex interactions,

Trace after trace, the sciences have reconstructed the history of the universe and of humanity. And, the way in which human sustainable development is conceived depends on how the oldest traces are interpreted.

Connecting the trace, its reception by humans and their interactions with the milieus that they are part of, at a given time and place in evolutionary history, means formulating the epistemological principles which underpin their analyses. In this context, there is no division of labour between science and epistemology.

⁶⁴ One-to-one linear relationship.

The e.laboratory on trace that we set up within the framework of Complex Systems UNESCO wants to pave the way for a “collective intelligence of the trace” where research findings complement one another, are modulated, deconstructed and reconstructed in the hope of generating a new method of apprehending the real.

BIBLIOGRAPHY

- BACHELARD G., *The New Scientific Mind*, (French ed., 1934) and in *English* Beacon, Press, Boston, 1985.
- BACHELARD G., *Intuition of the Instant*. Northwestern University Press, 2013.
- BATES Marcia J. “Knowledge is defined as information given meaning and integrated with other contents of understanding” in *Information and knowledge: an evolutionary framework for information science*, Department of Information Studies University of California, Los Angeles Los Angeles, CA 90095-1520, USA. Cf. <http://www.informationr.net/ir/10-4/paper239.html>
- BARTHES R., *Empire of Signs*, Hull and Wang, 1983.
- BATESON G., *Mind and Nature, a Necessary Unit (Advances in Systems Theory Complexity and the Human Science)*, 1979. French translation: *La nature et la pensée*, Seuil, Paris, 1984.
- BATESON G., *Steps to an Ecology of Mind: Collected Essays in Anthropology, Psychiatry, Evolution and Epistemology*, University of Chicago Press, 1972. French translation: *Vers une écologie de l'esprit*, Seuil, 1995.
- BERGSON H., *Creative Evolution*, Kessinger Publications, 2003.
- BERKELEY G., *Principles of Human Knowledge*, New York: Doubleday, 1960.
- BOURDIEU P., *Distinction: A Social Critique of The Judgement of Taste*, trans. Richard Nice, Harvard University Press, 1984.
- BOYDTSON J.A. ed., *The Collected Works of John Dewey*, 37 volumes, Carbondale: Southern Illinois University Press, 1967-1991.
- CHABOT P., *The philosophy of Simondon. Between technology and individuation*, Bloomsbury, (English) 2013.
- CHANDLER, D., *Semiotics: The Basics*, London, Routledge, 2007.
- DAMASIO A., *Descartes'Error: Emotion, Reason, and the Human Brain*, Putman, 1994, revised Penguin edition 2005. *L'erreur de Descartes*, Odile Jacob, 2005.
- DAWKINS R., *The Selfish Gene*, New York: Oxford University Press, 1976.
- DERRIDA J., co-author & trans. BENNINGTON G., *Jacques Derrida*, Chicago & London: Chicago University Press, 1993.
- DESCOLA Ph., *Beyond Nature and Culture*, Janet Lloyd (trans.), Chicago: University of Chicago Press. 2013.
- DOUGLAS L. et alii, “Respect for Similarity”, *Psychological Review*, vol 100, n°2, 1993, p.p. 254-278.

- ECO U., Introduction. In: Lotman, Yuri M., *Universe of the Mind: A Semiotic Theory of Culture*. London: I. B. Tauris, vii–xiii., 1990.
- FOULCAULT M., *L'archéologie du savoir*, Paris, Gallimard, 1969.
- GALINON-MÉLÉNEC B., “From “*sign-traces*” to “*Human-trace*”. The Production and Interpretation of Traces from an Anthropological Perspective”, UMR CNRS IDEES, Normandie University. Brown Laura (trad.), Hong Kong 2013, For original version published in French, *Intellectica* 2013/1, n°59 pp 89-113. Open source: HAL: halshs-00935346.
- GALINON-MELENEC B., “L’universalité de la trace. Le XXI^e siècle, siècle de la trace?” in *L’Homme-trace*, CNRS éditions, série L’homme-trace, tome 1, CNRS éditions, 2011, pp 30-55.
- GALINON-MÉLÉNEC B., (dir.), *L’Homme trace. Perspectives anthropologiques des traces contemporaines*, Paris, CNRS éditions, 2011.
- GINSBURG C., *Traces. Racines d’un paradigme indiciaire, in Mythes, emblèmes, traces. Morphologie et histoire*, Paris, Flammarion, 1989.
- GOFFMAN E., *Stigmate. Les usages sociaux des handicaps*, 1963, Editions de Minuit, Collection Le sens commun, 1975.
- GOODY J., *La raison graphique. La domestication de la pensée sauvage*, Paris, Editions de Minuit, 1979.
- HACKER P.M. S., *Wittgenstein*, London, Phoenix, 1997, French translation, Seuil, 2000.
- HALBWACHS M., *La mémoire collective*, Paris, PUF, 1950.
- HALL E., *La dimension cachée*, Paris, Seuil, 1978.
- HAWKING S., MLODINOW L., *A briefer history of time*, Bantam; Reprint edition, 2008.
- JAMES W., *The Principles of Psychology*, 2 vol., 1890, Cosimo Classics, 2013.
- JANKELEVITCH V., BERLOWITZ B., *Quelque part dans l’inachevé*, Paris, Gallimard, 1978.
- JANZ Bruce B., “Watsuji Tetsuro, Fudo, and climate change” in *Journal of Global Ethic*, Vol. 7, No. 2, August 2011, 173–184.
- JAPPY T., *Introduction to Peircean Visual Semiotics: A Visual Rhetoric*, New York, Bloomsbury, 2013.
- JEANNERET Y., “Complexité de la notion de trace. De la trace au tracé” dans B. Galinon-Méléneec, “*L’Homme trace*”, CNRS éditions 2011, pp 59-86.
- JEANNERET Y., *Penser la trivialité, Volume 1. La vie des êtres culturels*, Lavoisier, Hermès sciences, Paris, 2008.
- KAHEMAN D., *Thinking fast and slow, Allen Lanen*, coll. « AI RPB », 3. 11.2011
- KAHNEMAN D. and TVERSKY A. “Judgement under uncertainty: heuristic and biases”, *Science*, vol 185, n°4157, 1974, p. 1124-1131.
- KANT I., *Critique of Pure Reason*, London: Macmillan, 1964.
- KEVE T., *TRIAD: the physicists, the analysts, the kabbalists*, Kindle eBook, 2012.
- KLEIN E., *Discours sur l’origine de l’univers*, Paris, Flammarion, 2010.

- KORZYBSKI Alfred, *The Role of Language in the Perceptual Processes*, Reprinted from *Perception: An Approach To Personality*, edited by Robert R. Blake and Glenn V. Ramsey. Copyright 1951, The Ronald Press Company, New York.
- KUHN T.S., *The Structure of Scientific Revolutions*, 2nd ed., Chicago: The University of Chicago Press. 1970 [1962]. First edition published in 1962.
- LATOUR B., *We Have Never Been Modern* (tr. by Catherine Porter, Harvard University Press, Cambridge Mass.,USA, 1993.
- LEIBNIZ G., *The Labyrinth of the Continuum: Writings on the Continuum Problem, 1672–1686*, trans. Arthur, New Haven: Yale University Press, 2001.
- LELEU-MERVIEL S., *Le processus d'information, de la trace d'interaction à la communication numérique*, in Colloque CECI, Université du Havre, le 11 juin 2014.
- LELEU-MERVIEL S. "Traces, information et construits de sens. Déploiement de la trace visuelle de la rétention indicielle à l'écriture" dans Mille A. (dir.), *De la trace à la connaissance à l'ère du web*, *Intellectica*, 2013/1, n°59, pp. 65-88.
- LEROI-GOURHAN A., *Le geste et la parole*, vol. 1, Paris, Armand Colin, 1964.
- LEVI-STRAUSS C., "Hommage à Margaret Mead", *Courrier de l'UNESCO*, volume 32, Paris, 1979.
- LEVINAS E., *Existence and Existents*. Trans. Alphonso Lingis, The Hague and Boston: Martinus Nijhoff, 1978.
- LEVINAS E., *Humanism of the Other*. Trans. Nidra Poller, Introduction by Richard A. Cohen. Urbana and Chicago, IL: Illinois University Press, 2003.
- LEVINAS E., *The Theory of Intuition in Husserl's Phenomenology*. Trans. Andrée Orianne, Evanston, IL: Northwestern University Press, 1973.
- LEVINAS E., *Totality and Infinity: An Essay on Exteriority*. Trans. Alphonso Lingis, Pittsburgh, PA: Duquesne University Press, 1969.
- MALPAS J. *Heidegger's topology: Being, place, world*, Cambridge, MA: MIT Press, 2006.
- MILLE A. (dir.), "De la trace à la connaissance à l'ère du Web", *Intellectica*, n° 59, 2013.
- MORIN E., *La complexité humaine*, Flammarion, 2008.
- PEIRCE, C. S (1829-1909) [1867-1892], *Writings of Charles S. Peirce: A Chronological Edition*, 8 vol., Bloomington, Indiana University Press.
- POPPER K., "Evolutionary Epistemology," in *Evolutionary Theory: Paths into the Future*, J. W. Pollard (ed.), London: John Wiley & Sons Ltd, 1984.
- PRIGOGINE I., *From being to becoming*, W.H. Freeman and Compagny, San Francisco, 1980.
- PUTNAM, H., "Philosophy and our Mental Life", in W. Capitan and D. Merrill (eds.), *Art, Mind, and Religion*, pp. 37-48, 1967.
- REY A., *Dictionnaire historique de la langue française*, Le Robert, 2006.
- RICOEUR P., *Oneself as Another*, trans. Kathleen Blamey, Chicago: University of Chicago Press, 1992 (1990).

- SAPIR E., *The Status of Linguistics as a Science*, American Association for the Advancement of Science, New York City, December 28, 1928.
- SIMON H. A., LE MOIGNE J.L., SFEZ L., "Débat", dans Sfez L. *Critique de la communication*, Paris, Seuil, 1988, pp. 364-372.
- SIMONDON G., *L'individuation psychique et collective*, Aubier, Paris, 1989.
- SIMONDON, G., "The Genesis of the Individual" in Jonatha Crary & Sanford Kwinter (eds.), *Incorporations*, Newyork Zone Books, 1992, pp 297-319.
- SOUCHIER E. "Voir le web et deviner le monde. La "cartographie" au risque de l'histoire de l'écriture", dans *Traces numériques. De la production à l'interprétation*, Paris, Editions du CNRS, série L'Homme-trace, 2013, pp. 213-234.
- THOM R., *Esquisse d'une sémiophysique*, Paris, Inter Éditions, 1988.
- TIERCELIN C., *C.S. Peirce et le pragmatisme*, Paris, PUF, 1993.
- KAPITAN T., "Peirce and the structure of abductive reasoning" in *Studies in the logic of Charles Sanders Peirce*, Nathan Houser, Don D. Roberts & James Evra (eds.), 477-496. Bloomington: I. U. Press, 1997.
- VARELA F. J., THOMPSON E., ROSCH E., *The Embodied Mind: Cognitive Science and Human Experience*. Cambridge: MIT Press, 1991.
- WAGNER G., "Review of Embryology, Epigenesis, and Evolution: Taking Development Seriously, by Jason Scott Robert", *Science*, 305: 1405, 2004.
- WATSUJI T. *Fûdo, le milieu humain*, traduit en français par Augustin Berque, CNRS Editions, Paris, 2011.
- WATZLAWICK P., *How real is real Communication, disinformation, confusion*, New York, Ed. Random House 1976. French translation: éditions du Seuil, 1978.
- WILLIAMS James. *Gilles Deleuze's 'Difference and Repetition': A Critical Introduction and Guide*. Edinburgh: Edinburgh University Press, 2003.
- WINKIN Y., LEEDS-HURWITZ W., *Erving Goffman: A critical introduction to media and communication theory*, New York: Peter Lang, 2013.
- WULF Ch., *Anthropologie de l'Homme mondialisé*, CNRS éditions, 2013.