Volume 4

The Trace Odyssey 1

A Journey Beyond Appearances

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The Trace Odyssey 1
Traces Set
coordinated by
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Introduction

Establishment of the Roadmap

I.1. Preamble

The use of the term “trace” is associated with many old and ancient practices - (traces of passage, heritage traces, etc.), but also with more specifically current contexts, such as that of the digital society. The question of the origin of a trace has always been of a particular interest to certain professionals: the investigator in pursuit of a criminal, the doctor researching symptoms, the archaeologist wishing to reconstruct the lifestyles of ancient civilizations, historians seeking to retrace the path of humans over the centuries, astrophysicists watching for gravitational waves, the tax inspector, etc.

NOTE.– The concept of trace questions every period in the history of humanity and the cosmos, both past and future. The force of the questions on the nature of the concept of trace and its consequences is accentuated when scientific developments open up new horizons and when humans become aware that their present choices produce conséquences-traces\(^1\) in their lives and in those of future generations.

Today, more and more social actors in society (individuals, organizations, public institutions) are taking the concept of conséquences-traces into account in their activities, particularly as the digital society opens up other forms of presence in the world.

\(^1\) In this book, the term conséquences-traces is used in its original French to indicate that what is written is integrally bound to the concept of a “trace”, seen through the angle of its consequences. Similarly, each time a phrase includes the term “trace”, it will be written in French, indicating a terminology specific to the paradigm of Homme-trace (Ichnos-Anthropos in Greek, Human-Trace in English). This approach implies an understanding in terms of the interactions of complex systems based on the concept of conséquences-traces. Concepts like Homme-trace, and conséquences-traces are extensively developed throughout the book.
I.2. The call of digital society for new forms of traceability

The pressing obligation to exist on the Web leads to the temptation to circulate pieces of information that are constantly renewed and multiplied, although quickly or poorly verified, in response to flattering misrepresentations (Goffman 1973) that invite the adoption of digital devices providing false appearances (Debord 1967). The machine records important digital inscriptions and circulates them according to a given algorithm logic.

Initially, an algorithm is a logical sequence of actions. For example, a kitchen recipe is an algorithm that provides instructions to someone wishing to cook, by specifying the execution of tasks, and their contents, in a precise order. Based on such “recipes”, the first programmers designed computer algorithms whereby a digital algorithm provided pieces of information in the form of machine language. The algorithm ensures that these pieces of information followed a precise path resulting from binary answers (“yes” or “no”) to human-designed questions. The process enables the algorithm to produce a rationally constructed result.

**DEFINITION.** – A digital algorithm is a numerical written form, of human reasoning (and thus a cognitive trace) that is then integrated into a machine.

We shall see further on that these algorithms, by working from numerical inscriptions – combining 0s and 1s – can cut the numerical sequences for other assemblies and other computations than those initially planned. The more numerous these manipulations, the more difficult it is to go back to the original inscriptions. This raises serious questions about the nature and validity of the results obtained from this process.

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2 As is to be seen later in the book, (a) the mathematical dimension of a digital algorithm should not conceal the fact that algorithms are fabricated by human beings with their inherent shortcomings. Hence, by their very nature, algorithms convey the conséquences-traces of their judgments. In short, algorithms are everything but neutral (“unbiased”). As Cathy O’Neil (2016, p. 21) reminds us: “Our own values and desires influence our choices, from the data we choose to collect to the questions we ask. Models are opinions embedded in mathematics”. She also goes on to state that “mathematical models are based on the past, and on the assumption that patterns will repeat” (p. 38); (b) the interaction of the complex systems of digital conséquences-traces can produce unexpected results for human beings. These observations lead Cathy O’Neil to state that algorithms create their own reality. See in French: https://www.liberation.fr/debats/2018/11/16/cathy-o-neil-les-algorithmes-creent-leur-propre-realite_1692515.

3 See Chapter 2 of this volume.

4 The idea of “computation” is specific to computing in that it is based solely on 0-1.
This is why the possibility of performing the path backwards, the so-called “tracing of computer processes” is of considerable importance in order to grasp the “relevance” (Sperber et al. 1986) of the data resulting from these successive transformations. Computer traceability is the possibility of identifying all the selection actions that lead to the retention of certain data and the exclusion of others. In some cases, this system can lead to the programmer, who designed the algorithm, being called into question.

Digital data processing produces what contemporaries call digital traces. They constitute a major challenge for all users of digital technology given that soon, the entire population of societies will have access to it. For them, the reign of the “Internet of Everything” is now well established. Individuals and machines are permanently connected to each other, creating a continuous flow of meshed connections of interactions between networks that produce “trace-domino effects.”

I.3. Enthusiasm for the place of the trace in crime series

It is by noting the current success of crime series and the place given to the examination of all objects, especially in relation to investigations that “make the traces speak” that has led us to choose this area to illustrate some of our explanations, even if this reference to investigations that seek to grasp the concept of trace is not original per se. In his analysis of the difference between indices (clue, index) and traces, Carlo Ginzburg (1989) gave the example of the sleuth Sherlock Holmes.

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5 Computational traceability must be possible and must allow the results to be traced back, concerning the algorithmic consequences in algorithmic outcomes/consequences, to ethical frameworks that were initially programmed by individual humans. Since some algorithms can be subject to learning loops, the algorithm is self-evolving, which makes traceability increasingly complex and problematic to reconstruct. This is the case for “learning robots”, which use such algorithms to develop an autonomy and consequently raise questions of liability in the case of human safety violations.

6 Forecasts for 2020: global web traffic of 2.2 ZB for a broadband connection speed of 47.7 Mbps, carried by mobile devices and Wi-Fi connections that would then represent 2/3 of the traffic, and by connected objects connected to IP networks that would be three times more than the world’s population.

7 “Domino effect” is a term we use to signify chain reactions.

8 When we focus the illustrations on the concept of “corps-traces” (Volume 2), we use the field of medical diagnosis to illustrate the point.

9 As indicated by Yves Jeanneret (in Jeanneret Y., The Trace Factory, ISTE, London and John Wiley & Sons, New York, 2020, p. 35–39), the term indice is often translated into English as “index”. However, these terms are not perfect synonyms. This is why we have kept the French term indice in this book. In the case of Ginzburg, this is all the more justified in Mythes, emblèmes et traces (1989), where he explains the link between “traces and indicator roots” (idem, p. 139–181).
Holmes, whose ability to spot the smallest traces left by a culprit has remained famous in the history of literature.

This reference to investigations is all the more relevant today, what with the generalized digitization of society, new forms of surveillance being introduced, possibilities of controlling what is said or done in communication situations, the breaking down of barriers between the public and private spheres, and direct or indirect dependency on decisions taken, on the basis of work carried out on computerized sorting systems by using algorithms that transform them into data. Hence, the importance of questioning the concept of conséquence-trace in this development.

10 As is to be seen later, Carlo Ginzburg also refers to Doctor Giovanni Morelli.
11 Later in the book, we stress the ethical dimension to be included in the workings within the ecosystem (Chapter 2). Our thoughts on this point (Galinon-Mélénee, 2017) concur with that of the recommendations of Guszcza (2018), Hempel (2018) and O’Neil (2018), namely that, Algorithm auditing must be interdisciplinary in order for it to succeed. It should integrate professional skepticism with social science methodology and concepts from such fields as psychology, behavioral economics, human-centered design, and ethics. A social scientist asks not only, “How do I optimally model and use the patterns in this data?” but further asks, “Is this sample of data suitably representative of the underlying reality?” An ethicist might go further to ask a question such as: “Is the distribution based on today’s reality the appropriate one to use?” (Guszcza et al. 2018).

As part of auditing algorithm, Cathy O’Neill (of O’Neil Risk Consulting and Algorithmic Auditing) created a tool she calls an ethical matrix, a worksheet that helps companies think through the consequences – intended and otherwise – of the algorithm’s results. Across the top of the matrix are a half-dozen traits – accuracy, consistency, bias, transparency, fairness and timeliness. The vertical axis lists that the stakeholders’ Rentlogic must consider in its model: building owners, renters, the company, and NYC officials. O’Neil says the matrix creates “a conversation around what you might need to worry about”. It’s intended to prompt programmers to consider important questions as they work: “Who cares if this algo works? Who cares if it fails?” she asks, “Who gets hurt if it’s wrong?” When these questions reveal ethically problematic consequences like, say, discriminating against a class of people, she flags the yellow or red box (see Hempel 2018).
12 We see later (Chapter 2 of Volume 1), how data is constructed and how it circulates in a viral way, by following the path that leads them to various computer hosts willing to receive them. This multiplier effect produces an exponential storage of data where privacy-invasive connections can be established. This risk leads users to demand the right to keep a private space that is not subject to digital capture, the possibility of access, rectification and opposition to data processing.
13 That conception is specific to Galinon-Mélénee’s paradigm of Ichnos-Anthropos and is not exactly equivalent to general uses of “trace”.

I.4. The investigation, an approach also used in the social sciences

Many investigations in social sciences (Weber et al. 1997) use digital text corpora, not only because social practices require it (discussion forums, social networks, discussion spaces on press sites, etc.), but also:

[...] because the range of methods for collecting and quantitatively processing these inscriptions has expanded considerably in recent years. In addition to the quantitative methods of textual analysis commonly used in the social sciences\(^{14}\), new methods have recently been added from the worlds of computer science and artificial intelligence (thematic modeling, sentiment analysis, semantic networks, etc.). (Lassègue 1996, p. 21–65, author’s translation)\(^{15}\)

Compared to face-to-face field investigations, this approach via traces accessible on the Web (Cointet et al. 2019) has the advantage of not directly soliciting the person being investigated, thus avoiding the investigator-respondent influence bias.

However, there is the risk of misunderstanding and misinterpreting due to its quantitative importance:

– What sorting is there to be done? Using which criteria? The lack of qualitative information on the sociological characteristics of the author of the digital trace makes it difficult to select respondents in a representative manner.

– How can we process the amount of data? Is it necessary to call upon computer engineers? Currently, computer scientists and the humanities define the concept of trace differently. As we shall see below, they make a distinction between “digital fingerprints” and “digital traces”, thus underlining nuances similar to those we put forward.

I.5. Investigations and indices, two related concepts

Starting from the notion of an investigation is a useful approach. However, it leads to a questioning of the concept of an indice in relation to that of a trace.

\(^{14}\) The respondent/investigator relationship is likely to influence the respondent’s responses.

\(^{15}\) “[...] this distinction disappears if we consider that at the origin of these two fields is that of theoretical computer science, an autonomous scientific field constituted by the articulation of discrete mathematics, and the logical theory of computability” (Lassègue 1995, p. 21–65, author’s translation).
For us, from the moment we assimilate the concept of trace to that of consequence, the trace precedes the indice.

All reality\textsuperscript{16} – whether physical or living\textsuperscript{17} – is the conséquence-trace of something else, and this holds true, even when humans were absent from the surface of the globe.

As we shall see later on, a conséquence-trace can be posited as existing outside the perception that humans can have of it. For example: the whole universe that we currently know nothing of, but whose existence we axiomatically assume exists.

I.6. Distinguishing between “trace anthropocentrée” and “trace ontologique”

Figure I.1 seeks to remove the ambiguity surrounding the concept of trace and to distinguish the trace identified by human beings, which we call “trace anthropocentrée”, from the “trace ontologique”, which refers to the concept of what human beings do while they don’t have access to an assumed all-existing Real. Even if a person is not omniscient, the individual can nevertheless hypothesize that they result from a chain of conséquences-traces.

We return – in Chapter 4 (Figure 4.4) and Chapter 5’s conclusion (Figure 5.5) – to what this distinction between “trace anthropocentrée” and “trace ontologique” imply; in particular, when (as we see in Figure I.1) it induces the position of the concept of the indice in the anthropocentric sense.

Obviously, this distinction is a debatable hypothesis, insofar as it is a human being who advances it; this hypothesis is thus necessarily anthropocentric. Nevertheless, we believe it is useful for considering the relationship between humans and the way in which they live.

\textsuperscript{16} By “reality” we mean that which is within the realm of formal human knowledge. In this sense, “reality” can be formally differentiated from the “Real”, with a capital “R”, whereby it is axiomatically assumed that phenomena exist, that are ultimately outside the reach of human knowledge.

\textsuperscript{17} The living cannot be reduced to human beings. Living beings existed before humans, such as triploblastic animals (e.g. worms) and chordates (vertebrates and invertebrates).
In Figure I.1, the horizontal line separates today’s unobservable Real from an observable reality, which although unobservable is assumed to exist. For “today’s unobservable Real”, we posit the existence of an evolution that produces conséquences-traces that drive researchers to identify other, hypothetical existences.

Then, using increasingly complex and efficient equipment, humans develop concepts that evolve in time and space to broaden a scientific understanding of the whole of known reality. In Figure I.1 the dotted line\(^{18}\) indicates that the frontier between a perceived reality and an assumed Real changes each day. In this sense, we see how the Real becomes reality (Galinon-Mélénéc 2020).

The part above the horizontal line corresponds to the part observed by humans. As Paul Watzlawick states in *How Real is Real*\(^{19}\) (Watzlawick 1978), the belief that our perception of reality is the reality, is a dangerous illusion. In fact, each individual understands perceived reality differently. The different resulting representations

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\(^{18}\) See Chapter 4, Figure 4.4.

\(^{19}\) From our point of view, it would be more accurate to say: *How Real is Reality.*
cannot cover the totality of the Real whose existence is assumed, though not perceived in its entirety by humans.

_The Trace Odyssey 1_ illustrates this point by explaining that reality is perceived differently by each person according to a “corps-trace” that integrates—among other elements that we develop later—the conséquences-traces of their respective life history. The “corps-trace” induces representations in individuals about the perceived reality that do not perfectly overlap with other individuals’. This partial overlap can be explained by taking into account the conditioning openness to the reception of what surrounds individuals, the direction of attention to achieving objectives, and the reference points from the senses, emotions and affects. Given all these different factors, misunderstandings can occur in all communication between speakers, even those of the same language.

**I.7. From “trace anthropocentrée” to the signe-trace**

When we use the term _signe-trace_ in Figure I.1, we place ourselves in an anthropocentric context.

**Definition.**— _In our paradigm, a sign is a part of a “réalité-trace” in the anthropocentric perception of an “homme-trace”. A sign is a “signe-trace”._

To designate a sign by the terminology “signe-trace” is to present the sign as a “conséquence-trace” of complex dynamic processes of “conséquences-traces” that we explain in the next part of the book.

Let us remember, for the moment, that:

– Placing the concept of trace in the context that we have just specified corresponds to our wish to offer the reader a critical approach to the “trivial” use of the term (Jeanneret 2014) and the taken-for-granted thoughtlessness that it implies. It is so “natural” to forget that the meaning of the term social is not necessarily shared (Hall 1984).

20 Sign: all that can fall within the compass of human understanding. The field of semiotics investigates the nature of signs and the laws that govern them. For example, Jacques Derrida affirms that the signifier and the signified are not fixed. He invented the expression _differance_ to signify the endless postponement of meaning according to their readings in context. For us, there is no sign emerging outside of the _conséquence-trace_ interaction processes between a human-trace in context and a reality-trace.


22 “At one level, words mean one thing, while at another level, something quite different is communicated” (Hall 1984).
– Relationships between humans are no longer confined to a co-presence. They increasingly take place at a distance and are often established between people who are very far apart geographically, socially and culturally. It is therefore necessary to express oneself with words, whose nuances can be understood and interpreted correctly by different speakers. This is all the more important as the shift in usage between oral and written expression is spreading with the explosion of digital writing, which is now instantaneous\(^23\).

For this reason, if we place ourselves as a researcher in the information and communication sciences, addressing readers from other cultures or other sciences, we think it is appropriate to show the different levels of the use of the term “trace”. The different levels can be deconstructed to show their relativity and, finally, to reconstruct them on the basis of a linguistic consensus integrating definitions that allow us to distinguish the singularities of meaning between trace, sign, indice and imprint.

The relationship between these terms has already produced a significant number of publications, the most essential of which can be found in the References section. Controversies, sometimes very lively ones, among certain authors have provoked schools of thought.

For our part, guided by the idea of exploring the complexity of the concept of trace from an approach that we see as interdisciplinary, we propose to study the trace as a result of the influence of an event on its environment/milieu\(^24\). This choice allows us to state that all the consequences of an event can be considered as a trace, hence the evocative term conséquences-traces. This enables us to situate the terms “imprint”, “mark” and indice in relation to the term conséquences-traces.

I.8. Need for agreement on terminology

In this book, we seek to test the acceptance of the terms “imprint”, “mark”, and “indice” as subsets of the “trace” class. This brings us closer to the statements of the Dictionnaire historique de la langue française (Rey and Hordè 2006)\(^25\). The

\(^{23}\) Digital and paper writing processes differ in many aspects. We note here that a spell-checking or synonym selection algorithm automatically intervenes in digital writing and in translations. It is therefore advisable to enrich this database with useful nuances to avoid confusions that are harmful to communication.

\(^{24}\) Milieu refers to the immediate physical and social setting in which anyone lives, or in which something happens or develops. In the rest of the book, we explain, in more detail, the difference between milieu and environment.

\(^{25}\) Definitions are provided in the footnotes in each case.