Are there still traces?

Memory and the obsolescence of the paradigm of inscription

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The most recent discoveries in contemporary neurobiology have revealed that no single memory center existed in the brain where complete memories would be stored. In their book *Memory: From Mind to Molecules*, Erik Kandel,l and Larry Squire write: "*Memory* does *not* exist in a *single* site or region of the central nervous system."[1] Memory occurs through a distributed economy of storage instead of being stocked in a single, localizable preservation site. There exist several memory systems, involving different parts of the brain, mainly the amygdala, the hippocampus, the cerebellum, and the prefrontal cortex. From this follows that memory itself is fragmented: scientists distinguish between declarative memory, episodic memory, semantic memory, procedural memory, to name only the most well-known ones. The amygdala is involved in fear and traumatic memories. The hippocampus is associated with declarative and episodic memory as well as recognition memory. The cerebellum plays a role in processing procedural memories, such as the knowledge of piano playing. The prefrontal cortex is involved in remembering semantic tasks. All these memory systems work together and collaborate within what is now called the "neuronal global workspace," [2] but they remain different in their specificity. Therefore, they can also be dissociated and function independently from each other. Brain diseases show the extreme consequences of such disscociations. Injuries to the hippocampus area, for example, leave the patient unable to process new declarative memories, even if they can still remember information and events that had occurred prior to the wound or surgery.

Another striking fact is that memories are not encoded as images. They do not have any material presence in the brain, nor leave any mark on neural connexions. They rather produce modifications of the forms of these connexions. Repeated neuronal activity leads to a modification in size, volume, and volume of the connections. For a long time, memories were said to imprint the connections, like a writing stylus on a wax tablet. Such a model has now become obsolete. The substitution of plasticity—change of form—for inscription and trace constitutes one of the fundamental shifts in contemporary neurobiology of memory. Conceptualizing the obsolescence of the writing metaphor has become one of the most urgent philosophical tasks.

Is such a shift sufficient to challenge the concept of trace though? After all, why should we identify trace with the written sign only? Can't inscription itself be understood beyond writing? Can't there be plastic inscriptions? That is also a plasticity of trace and inscription themselves?

How are memories preserved? Eric Kandel has spent decades working on the synapse, the basic structure of the brain, and its role in controlling the flow of information through neural circuits needed to encode and store memories. Such a control first operates as a selection between memories that will be consolidated and classified long term, and those that will be discriminated as short term. Long term memories, as we said, are

[1] Eric Kandel & Larry Squire, *Memory: from Mind to Molecules* (Greenwood Village: Roberts & Co, 1999, new ed. 2002), 10.

[2] See George A Mashour, Pieter Roelfsema, Jean-Pierre Changeux, and Stanislas Dehaene. "Conscious Processing and the Global Neuronal Workspace Hypothesis," *Neuron* (2020), 105(5):776--798,

not stored in just one part of the brain but are widely distributed and are preserved throughout the brain as groups of neurons that are primed to fire together in the same pattern that created the original experience. Connections are said to be potentialized when frequently sollicitated, and depressed when seldomly. These modifications are made possible by neurotransmitters that allow communication among neurons and whose action is critical for developing new memories. Frequent activity by neurons leads to increased neurotransmitters in the synapses and more efficient synaptic connections. This is how memory consolidation occurs.

Again, why should such a consolidation process challenge or impact the concept of trace? There is absolutely no reason why we should reduce the trace to an inscription, and the inscription itself to a graphic mark. At this point, we should remember Jacques Derrida's "grammatological" lesson. A trace is not necessarily "graphic" in the usual sense of the term: "The (pure) trace is differ*a*nce. It does not depend on any sensible plentitude, audible or visible, phonic or graphic."[3] A trace can be a stain, a breath, or a form precisely. If "differ*a*nce is the being-imprinted of the imprint," it can also be "the formation of form."[4] A trace can then be considered plastic. Writing itself , Derrida pursues, should not be reduced to the act of writing, that is using letters in order to compose a sentence or a text. Writing can also mean "to scratch, to engrave, to scribble, to scrape, to incise."[5]

Nevertheless, and whatever Derrida's careful enlargement of the concept of writing, scratching, scribbling, scraping, still presuppose an inscription, something that remains and breaks a path—a line on a sheet of paper, or on wax tablet, a scratch on a rock, a road in a wild forest, some condensation on a surface.

> One should meditate upon all of the following together: writing as the possibility of the road and of difference, the history of writing and the history of the road, of the rupture, of the via rupta, of the path that is broken, beaten, fracta, of the space of reversibility and of repetition traced by the opening, the divergence from, and the violent spacing, of nature, of the natural, savage, salvage, forest. The silva is savage, the via rupta is written, discerned, and inscribed violently as difference, as form imposed on the hyle, in the forest, in wood as matter; it is difficult to imagine that access to the possibility of a roadmap is not at the same time access to writing.[6]

One of the major issues of deconstruction is that, while announcing the irreducibility of the trace to any determined material modality, it has never been able to extend the trace beyond the paradigm of inscription. Plasticity, in Derrida, remains dominated by such a paradigm. The formation of form is not the simple flip side of the being imprinted of the imprint; it designates a dramatically different economy that that of the imprint. Something grammatology never accounted for.

Coming back to the brain: One might object that scientists still use the term "engram" to designate the outcome of the process of consolidation of a memory. It is clear that the notion of "engram" still belongs to the inscription lexicon. Nevertheless, a very puzzling paradox lies in its neurobiological definition: "An

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[3] . Derrida, Jacques, *Of Grammatology*, trans. Gayatri Chakravorty Spivak (Baltimore: Johns Hopkins University Press, 1976), 62.
[4]. Ibid, 63.
[5]. Ibid, 123.
[6]. Ibid, 107-108.

engram," we can read in an article, "is a hypothetical biophysical or biochemical change in the neurons of the brain, hypothetical in the respect that no-one has ever actually seen, or even proved the existence of, such a construct." [7] Nobody has ever "seen" an engram, which means that, despite its name, an engram is not engrammed, so to speak.

It is difficult, if not impossible, to isolate a particular memory in the innumerable neural networks at work in the global neural workspace. Besides, the three processes of memory encoding, memory storage and memory retrieval, for example, are not operated by the same networks. Therefore, in the end, a stored memory and a retrieved amemory are always unfaithful to the original. All memories change the form of what is remembered. Again, this is not only a matter of writing and erasing, but also a matter of transvestment, and neurobiological alternative facts.

I do believe that our era of "post-truth'" is linked with the disappearance of inscription. In an article called "Blame Derrida for Donald Trump," S.D. Kealy, wrote: "The world is no longer logocentric, words no longer mean anything, and this is not Trump's fault. Trump is not to be held solely responsible for the fact that, when he is front of a crowd, or in a debate, or in an interview, telling it like it is, there is no longer an is. Our politicians make a practice of speaking words into the void and seeing what happens next. If the madness that follows the political rhetoric at a rally demonstrates the dismantling of society itself, don't blame the practitioners. Blame the theoreticians for a change. Blame Derrida."[8] Such a conclusion is erroneous, I think. Donald Trump is not a deconstructionist, and post-truth is not a product of deconstruction. Contrarily to what the author of the artice tends to think, deconstruction has faith in the trace, deconstruction has faith in the inscription. It is when there are no traces anymore that post-truth can start. Post-truth does not belong to the graphic era. It is a post-deconstructive phenomenon.

The paradigm of inscription is highly dependent upon the Freudian category of *Bahnung*, "facilitation," as exposed in the *Project for a Scientific Psychology* (1895).[9] *"*Facilitation" designates the opening of a path in the neural flesh, a breach that renders a passage easier. The opening of the path and its reiterative use facilitate the retrieval of memories. As Derrida explains, "there are two kinds of neurons according to Freud: the permeable neurons (*phi*), which offer a resistance and thus retain no trace of impression (…) ; and other neurons (psy), which would oppose contact-barriers to the quantity of excitation, and would thus retain the printed trace."[10] These printed traces themselves can be rearranged, reinscribed elsewhere. This is the palimpsest principle, so important in the definition of the unconscious. In a letter to Fliess, Freud declared: "As you know, I am working on the assumption that our psychic mechanism has come into being (…) The material present in the form of memory-traces is subjected from time to time to a rearrangement in accordance with fresh circumstances to a retranscription."[11] Such a transvestment, a displacement, does not impact the fact that memories, differently inscribed in different layers of the system, constitute an archive. Reinscription in Freud is the very condition of possibility of the archive. We know now not only that there are

[7] Se "Memory encoding," in *The Human Memory*, online edition, September 2020.
[8] Sue D. Kealy, "Blame Derrida for Donald Trump," *Mere Orthodoxy* (March 31, 2016), online edition.
[9] Sigmund Freud, *Project for a Scientific Psychology* (1895), *The Standard Edition of the Complete Psychological Works of Sigmund Freud*, Volume I (1886-1899): Pre-Psycho-Analytic Publications and Unpublished Drafts (London: Hogarth, 1953) 281-391.
[10] Jacques Derrida, "Freud and the Scene of Writing," in *Writing and Difference*, trans. Alan Bass, (Chicago: The University of Chicago Press, 1978), 201.
[11]. Quoted by Derrida in "Freud and the Scene of Writing," 206.

no neurons "*psy*," but also that neuronal networks do not form a palimspsest or a "Wunderblock," a mystic writing pad.

Neural materiality does not obey the archeological principle. The different cortical layers of the brain do not constitute a multi-dimensional text in which a message would be encrypted. Memories are not deposited in the depth of a palimpsest. Memories are abstrations, the result of chemical processes that sculpt the forms of the neurons but do not endow them with any iconic content.

This fact has dramatic consequences. Because they are processed by different memory systems, because they are not inscribed or archived anywhere, memories are fragile, alterable, changeable, they can also be false. False memories are recollections that feel real but are not based on actual experience. The great specialist of false memories, Dr. Elizabeth Loftus, says we need independent evidence to corroborate your memories: "The one take home message that I have tried to convey in my writings, and classes (…) is this: Just because someone tells you something with a lot of confidence and detail and emotion, it doesn't mean it actually happened. You need independent corroboration to know whether you're dealing with an authentic memory, or something that is a product of some other process." [12]

Just because we are absolutely confident, we remember something accurately does not mean it is true. We not only distort memories for events that we have witnessed, but we may also have completely false memories of events that never occurred at all. Such false memories are particularly likely to arise in certain contexts, such as (unintentionally) through the use of certain dubious psychotherapeutic techniques or (intentionally) in psychology experiments. There is currently no way to distinguish, in the absence of independent evidence, whether a particular memory is true or false. Even memories which are detailed and vivid and held with an adamant conviction can be completely false. And there is no convincing evidence to support the existence of the psychoanalytic concept of repression either, that would help explain the emergence of false, disguised, or distorted memories. Memory, to summarize, is highly malleable, to such a degree that truth based on recollection is highly challengeable. No inscription can guarantee the authenticity of a memory.

I was mentionning the phenomenon of false memories, I could also mention that of the trauma erasing molecules. Neuroscientific research on the removal of unpleasant and traumatic memories is at a very early stage, although in recent years there has been significant progress in the understanding of the mechanisms of memory and its possible alterations. The main purpose of such practices is to give relief to those who have experienced or witnessed negative events (accidents, assaults, natural disasters, terrorist attacks) which caused serious psychological consequences and, in severe cases, even led to post-traumatic stress disorder.

Here also, erasure isn't simply the erasure of a trace, it is not like wiping a board. The different processes involved in the erasing operation all pertain to plasticity to the extent that they act on neural connections and neurotransmitters. When a protein synthesis inhibitor is given after retrieval, molecular and cellular mechanisms of reconsolidation are disrupted, and long-term memories are significantly impaired on subsequent tests. Although that technique has only been used in animal models, it may be feasible for use in humans. Theoretically, patients could be brought into a clinical setting, presented with a stimulus that

[12]. Quoted by Julia Shaw in "What Experts Wish You Knew about False Memories," *The Scientific American* (August 8, 2016), 175 (online edition).

retrieves the fearful stimulus and given a drug, and the fear memory would be weakened. A reorganization of neural networks would follow from this, allowing the neural architecture to reshape istelf.

The paradigm of inscription has never been challenged in the whole history of philosophy, and this even in deconstruction. Be it in Heideggerian or Derridian deconstructions, what was challenged and critically explored was essentially an order, an order of succession. The paradigm of the inscription of the idea in the soul has determined an order of priority, according to which the idea is prior to its inscription. The trace therefore is only a result, the consequence of this precedence. The act of imprinting comes first, and the trace appears as its outcome. For Derrida, more strongly perhaps than in Heidegger, the trace is older than that which it is the trace of. First comes the trace, then the presence, or the passage. Understood in that sense, the trace would always be originary. The past to which the trace refers is a past that never happened, a past that was never present. Yet, the past remains as a trace, even if it is written under erasure. The inscription model remains pregnant, allowing the eternal recurrence of interpretation, reading, infinite conversation. Even when Deleuze challenges psychoanalysis in *A Thousand Plateaus*, he still does it in the name of the trace, contrasting Feud's psychic imprint with the multitude of animal traces scattered in the snow.[13] The trace never ceases to inscribe itself, even in the form of its erasure. It lasts, persists, as a ghost, indestructible. "Long-term memory (family, race, society, or civilization) traces and translates, but what it translates continues to act in it, from a distance, off beat, in an 'untimely' way, not instantaneously." [14]

Neural memory processings, on the contrary, resists hermeneutics. Plasticity renders the trace illegible because there is no trace. This explains why, for example, psychoanalysts so often resist the possibility that there exists a cerebral unconscious. Such an unconscious dismisses all attempts at interpreting it. Experience plastically sculpts or fashions the brain and yet, it does not inscribe it. This does not imply that psychoanalysis of the cerebral unconscious is impossible, but it definitely has to reelaborate its main concepts and methods.[15] Plasticity raises two issues at the same time: the first one is a paradigm shift, the second is an ontological problem.

Plasticity does not only designate a new modality of memorization or healing, it also characterizes the way in which the subject is excluded from these modalities themselves. Because of the way in which the brain and regeneration function, the possibility for a subject, be it individual or collective, to appropriate or reappropriate their own wounds or traumas, to constitute and read their own archive, finds itself profoundly and definitely challenged.

The recent success of "speculative realism" in philosophy can be partly explained by the current demise of inscription. Contemporary realists, like Quentin Meillassoux in *After Finitude*,[16] also and rightly affirm the ontological impossibility of inscribing the world. What Meillassoux calls the "real" is precisely what resists the human attempts at leaving traces in or on it. The ecological crisis renders such an incompatibility manifest, as it shows the deep incompatiblity between the earth and "our" traces on the earth, the catasrophe

[13] Gilles Deleuze and Felix Guattari, *A Thousand Plateaus: Capitalism and Schizophrenia*, trad. Brian Massumi (Minneapolis: University of Minnesota Press, 1987).
[14] Ibid, 16.
[15] A perspective hopefully opened by "neuro-psaychoanalysis."
[16] Quentin Meillassoux, *After Finitude: An Essay on the Necessity of Contingency*, trans. Ray Brassier, (London: Continuum, 2008).

of our "imprints." The earth, the world in general, the realists declare, is perfectly indifferent to the possibility of being thought, remembered, deciphered, read, or interpreted.

Meillassoux redefines the very definition of what a "fossil" is. The "arche-fossil" refers to event anterior to "life as consciousness," this anteriority being characterized as "fossil time": "date of the origin of the universe (13.5 billion years ago), the date of the accretion of the earth (4.45 billion years ago), the date of the origin of life on earth (3.5 billion years ago), the date of the origin of humankind (*Homo habilis*, 2 million years ago)."[17]

The becoming obsolete of the trace opens a desertic ontology, a void, that can be characterized as a space of non-response. The world does not respond us as we thought it did through traces, that is artefacts, the subject does not respond to itself as we thought it did through traces, that is through memories and history. Traumas, wounds, scars would just be formed and reformed in a continuous fluidity without leaving any trace anywhere. We would have to think of "a world where humanity is absent; a world crammed with things and events that are not the correlate to any manifestation."[18] The demise of the trace then opens a space of absolute opaqueness, that is also, paradoxically, of absolute transparence.

One will object that the brain—or the nervous system in general—does not exactly belong to such a space to the very extent that their appearance in evolution marks the emergence of life. Nevertheless, Daniel Smail, in his book *On Deep History and the Brain,* expresses a different point of view. In the brain, he says, some modules are precisely "like fossils," and remain unchangeable. "Like fossils, modules were laid down in the strata of the brain a long time ago and preserved against the ravages of time."[19] Further: "Some modules, like basic fears, urges, and other predispositions, are identical to those found in primate or mammalian brains and indeed derived from them. Other modules, like deep grammar, emerged more recently and are unique to humans. According to evolutionary psychologists, all have remained largely unchanged since the origin of the species some 140 000 years ago." [20] What is "deep history"? Let's recall the definition proposed by Edward Wilson, in his book *In Search of Nature:* "Human behavior is seen as the product not just of recorded history, ten thousand years recent, but of deep history, the combined genetic and cultural changes that created humanity over hundreds of [thousands of] years."[21]

For Smail, deep history is inseparable from an archeology of the brain, that is a study of the brain that compares it to a geological formation. For Smail, deep history substitutes itself for prehistory. According to the usual view, history starts with the ris of civilization, and begins from a "buffer zone" between biological evolution and history proper—such a buffer zone is what precisely is called prehistory. If history must be understood , as Wilson suggests, as the originary intimate interaction between the genetic and the cultural, it would start at the beginning of hominization, with no "pre" zone.

Smail declares: "To abandon prehistory would be to postulate continuity between the biological descent of hominids and the 'ascent of civilization' of the abstract 'mankind' of humanistic historical writing. Prehistory is a buffer zone. A deep history of humankind is any history that straddles this buffer zone, bundling the Paleolithic and the Neolithic together with the Postlithic—that is, with everything that has happened since the

[17] *After Finitude*, 9. Translation modified.
[18] Ibid, 26.
[19.] Daniel Lord Smail, *On Deep History and the Brain* (Berkeley: University of California Press, 2008), 139.
[20] Ibid.
[21] Edward Wilson, *In Search of Nature* (Washington D.C.: Island Press, 1996), ix-x.

emergence of metal technology, writing and cities some 5,500 years ago. The result is a seamless narrative that aknowledges the full chronology of the human past. Although the themes of a deep history can coalesce around any number of narrative threads, the one I propose in this book centers on biology, brain, and behavior."[22]

The relationship between the three terms brain, biology, and behaviour set up here — we notice that the brain is situated here as a crossing point between the two others—is clearly an *epigenetic* approach. Epigenetics is a branch of molecular biology that studies the mechanisms that modify the function of genes by activating or deactivating them without altering the DNA sequence in the formation of the phenotype. Epigenetic modifications depend on two types of causes: *internal* and *structural* on the one hand; *environmental* on the other. Firstly, it is a matter of the physical and chemical mechanisms described (RNA, nucleosome, methylation). Secondly, epigenetics also supplies genetic material with a means of reacting to the evolution of environmental conditions. The definition of phenotypical malleability proposed by the American biologist Mary-Jane West-Eberhard is eloquent in this respect: it is a matter of the "ability of an organism to react to an environmental input with a change in form, state, movement, or rate of activity."[23] Contemporary epigenetics reintroduces the development of the individual into the heart of evolution, opening a new theoretical space called "evo-devo"—"evolutionary developmental biology."[24]

The paradoxical situation of this "archeological," "epigenetic," "deep-historical" brain is that it is the incarnation—in the proper sense—of a very ancient memory, the bearer of old traces, that is of arche-inscriptions. At the same time, and this is what interests me, to the extent that those inscriptions *cannot be made conscious*, because they are biological, cancel themselves as such. Memory is too deep to be written. It appears, I said to start with, in the way in wich neural connections change form, develop or decrease.

In conclusion, I think we are confronted to the following alternative. Either we state, as contemporary realists do, that the disappearance of the trace means that everything is radically contingent, that nothing is stable, not even laws, not even rules, and that consequently, truth itself is definitely aleatory, to such a degree that no memory can ever be trusted. The world can be considered a decorrelated desert, from which something like subjectivity has disappeared and has only a delusionary presence. Or we affirm, and such is my contention, that the non-inscribable essence of memory determines a new structure of responsibility. A responsibility for the non- response. If subjectivity is just a window through which we see, if there is no possibility for us to turn on ourselves and decipher with certainty the past of our neural system, if there is no ground, no encrypted secret, no palimpsest, then we have to remain at the surface. The prefix "epi," in "epigenesis" and "epigenetics," precisely means "at the surface" (epigenetics is said to operate at the surface of the DNA). We have to remain at the epicentre, in the middle, at the crossing point between the ground and the sky, with the task of producing an understanding of the impossibility to refer to any origin or even trace of the origin. Such an understanding would constitute this plastic responsibility, this capacity to respond to the absence of any preliminary question, to witness in the absence of witnesses. To go on reading and writing when there are no texts anymore, no books even, nothing to read, but still a lot to say.

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[22] *On Deep History and the Brain*, 2-3.
[23] Mary-Jane West-Eberhard, *Developmental Plasticity and Evolution*, (New York: Oxford University Press, 2003), 34.
[24] Ibid.

This contribution is a prolongation of the discussion developed in chapter II ("Grammatology and Plasticity") of my book *Changing Difference: The Feminine in Philosophy*, trans. Carolyn Shread (Cambridge: Polity, 2011).