

# A Technical Genealogy of Imagination: Some Reflections alongside Leroi-Gourhan

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**Abstract.** *Although critical studies have addressed Leroi-Gourhan’s theory of technical object formation through the notions of tendency and fact (Audouze & Schlanger 2004; Schlanger 2023), the role of imagination within this process remains underexplored. This essay, drawing on the central arguments of *Le geste et la parole*, contends that the genesis of technical objects has been inherently imaginative since the earliest Hominins. In Leroi-Gourhan’s framework, imagination fulfills a dual function: it operates as a cognitive instrument – most notably through the empirical method of the operational chain, which reconstructs the mental imagery of the prehistoric flintknappers – and as a co-originary element in the simultaneous emergence of technique and language. Conceived as a symbolic or figurative faculty, imagination co-evolves with these domains, shaping and being shaped by them. Crucially, Leroi-Gourhan underscores the non-voluntary nature of technical evolution, emphasizing the irreducibility of the technical object to mere functional imposition. From its inception, the technical process bears a symbolic dimension, wherein imagination is inscribed within the material artifact. The technical object thus materializes abstract thought within organized matter, through physical constraints. Over several hundred thousand years, a dynamic equilibrium between technique and language – mediated by the biological dimension – has fostered a recursive dynamic: imagination externalizes itself through technical supports, culminating in symbolic systems such as mythograms and writing. While *Sapiens* reached morphological stability approximately 300,000 years ago, their imaginative-technical superstructure continues to evolve. This process of externalization, anchored in the relational dynamic between subject and object, continuously reconfigures the imaginative horizon of the human species.*

**Keywords.** Leroi-Gourhan, Technology, Imagination, Evolution, Constraints.

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## 1. Introduction<sup>1</sup>

This article presents a philosophical inquiry of the role of technology in the emergence and development of imaginative faculties, drawing from the work of French paleoanthropologist André Leroi-Gourhan. In the evolving landscape of human cognition and technical interaction, the interplay between imagination and materiality plays a crucial role in our understanding of how we engage with the world around us.

<sup>1</sup> It is important to specify, preliminarily, that André Leroi-Gourhan uses a periodization and terminology that many recent discoveries have substantially reconfigured. In the emblematic case of Leakey’s “Zinjanthropus”, for example, one must refer to the contemporary *Paranthropus boisei*, while in the case of the “Australantropians”, one must refer to the modern notion of *Australopithecines* (cf. Sineo & Cecchi 2022).

By examining the proto-historical and evolutionary contexts of our relationship with tools and techniques, particularly among early hominins, we discover the ways in which imaginative capacity is not merely a cognitive function but a deeply embodied practice.<sup>2</sup>

As we dig into the concepts of affordances, disautomatization, and re-internalization, we also aim to illuminate how these processes shape our technical competencies and creative expressions.

Building upon the framework articulated by Leroi-Gourhan in the latter half of the 20<sup>th</sup> century, it is possible to contextualize the emergence and development of material structures – both human and technical – as a history of mutual co-productions of constraints and possibilities. In this perspective, organized inorganic matter is not merely a simple imitation of life but rather its continuation.

Within this context, the autonomy and evolution of physical organizations are not viewed as an emancipation from constraints – which qualify as both their premise and consequence – but as a constant tension between morphogenetic tendencies and the elimination of possible paths. Ultimately, this exploration seeks to highlight the circularity of interaction, where both imagination and techniques influence and transform one another, opening new avenues for understanding the fabric of human experience.

## 2. The immortal finite or the life of things

In a 1998 article, Bernard Stiegler states that the great question of Leroi-Gourhan is memory (Stiegler 1998b): we – tracing the complex phylogenetic journey illustrated in *Le geste et la parole* – argue that, parallel to the problem of memory, the issue of imagination also arises. This question, still not addressed by critical work, fits into the much broader discussion of technique, which, in the case of the French paleoanthropologist, is conceived as one of the possible extensions of the evolutionary movements of zoological history. In this sense, Leroi-Gourhan's thinking is primarily a thought of movement and form, hence of morphogenesis.

By examining the structural regularities of technical dimensions in human societies without any reciprocal contact, Leroi-Gourhan suggests the existence of universal tendencies that are autonomous from specific cultural dimensions, and concurrently, the methodology for studying the modelling processes of artificial supports:<sup>3</sup>

<sup>2</sup> In this article, in order to not alter the English translations of the works of Leroi-Gourhan and Simondon, the terms technique and technical object have been preferred over technology and technological object. This terminological choice underscores the idea – already extensively articulated by the French paleoanthropologist – that technical evolution does not necessarily concern the finished product, but rather the mechanical and anatomical articulation through which life itself becomes organized.

<sup>3</sup> The concept of tendency – borrowed, according to Stiegler, from a reading of Bergson's work – enables Leroi-Gourhan to legitimize his project of a «classificatory technomorphology based on raw materials» (Leroi-Gourhan 1993a, 14) by incorporating terms derived from the field of biology. The appropriation and organization of inert matter by organic beings is described as a genuine «Bergsonian rush» (Leroi-Gourhan 2002, 338), which, in the case of the French paleoanthropologist's framework, is referred to as tendency. As Stiegler notes in an important passage of *La Technique et le Temps*: «The Bergsonian analysis of the relation organic/inorganic confirms later in *Man and Matter* that the concept of technical tendency as the coupling of man to matter is already found in the Bergsonian concept: "Life is, before all else, a tendency to act upon raw matter. The meaning of this action is no doubt undetermined: hence the unpredictable variety of forms that life, in evolving, sows along its path. But this action always presents, to a greater or lesser degree, a contingent

This dual aspect leads to viewing human activity as comprising two orders of phenomena of distinct nature: phenomena of tendencies that depend on the very nature of evolution, and facts that are inextricably linked to the environment in which they occur. The tendency possess an inevitable, predictable, and linear character; it drives a flint held in hand to acquire a handle, and the load pulled by two poles to be equipped with wheels. Since ornamentation is a tendency, humans adorn themselves with colored earth, following the natural lines of their bodies in doing so. Therefore, it is no surprise to find similar designs at the ends of the globe along legs or around breasts; they inevitably attach ornaments wherever they can be suspended, inserting spines or bone sticks into the lobes of their ears, lips, and nostrils, as this is clearly visible and can be done without too much pain, bloodshed, or anatomical discomfort. (Leroi-Gourhan 1993a, 27, my translation).<sup>4</sup>

However, it is only with the emergence of paleoanthropology and the multidisciplinary approach that characterizes his mature work that Leroi-Gourhan's reflections gains their true depth. In the second volume of *Le geste et la parole*, Leroi-Gourhan posits that the technical object serves as a pivotal mediator between subjective experiences and the phylogenetic memory, enabling a dynamic interaction between the concrete and the abstract. From a strictly paleontological perspective, the emergence of technique coincides with both the dawn of humanity and its cognitive abilities, as well as with the appearance of a third memory – beyond somatic and species memory – that is transmissible through extra-genetic means and is spontaneously preserved by technical supports.

This artificial memory, fixed in inorganic matter, is manifested in the essentially hyper-textual nature of objects and their capacity to reproduce linked mechanical actions (Leroi-Gourhan 1993b, 222). Furthermore, the perceptual-motor process that leads to the technically effective production of a tool represents what Leroi-Gourhan defines as the process of exteriorization, or the anthropogenesis provoked by artificial prosthetics.<sup>5</sup>

character, implying at least a rudiment of choice. Now this choice presupposes the anticipated representation of several possible actions. Thus, possibilities of action must be delineated for the human being before the action itself" (ibid, 97). The whole of Leroi-Gourhan's genetics, embedding the first elements of properly technical evolution in the most remote zoological past, comes under the point of view according to which "life appears as a stream moving from germ to germ by means of a developed organism. Everything happens as if the organism itself were but an excrescence, a bud brought to life by the old germ working to survive in the new one. What is essential is the continuity of progress going on indefinitely, an invisible progress that each visible organism rides during the short interval of time that he has to live" (ibid). Leroi-Gourhan's originality lies in his inquiry of the pursuit of this vital tendency outside of the organisms themselves, in inorganic matter organizing itself – this is the fact of anthropological "intentionality"» (Stiegler 1998a, 281-282).

<sup>4</sup> Original text: «Ce double aspect porterait à voir dans l'activité humaine deux ordres de phénomènes de natures distinctes: des phénomènes de tendances qui tiennent à la nature même de l'évolution et des faits qui sont indissolublement liés au milieu dans lequel ils se produisent. La tendance a un caractère inévitable, prévisible, rectiligne; elle pousse le silex tenu à la main à acquérir un manche, le ballot traîné sur deux perches à se munir de roues. Parce que la parure est une tendance, l'homme se badigeonne de terre colorée et il suit pour cela les lignes naturelles de son corps: aucune surprise à trouver aux extrémités du globe les mêmes dessins le long des jambes ou autour des seins; il fixe inévitablement des ornements partout où l'on peut en suspendre et il enfile des épines ou des baguettes d'os dans le lobe des oreilles, les lèvres, les narines parce que c'est bien visible et réalisable sans trop de douleur, d'effusion de sang ou de gêne anatomique».

<sup>5</sup> On the one hand, it is important to highlight that the perspective framing the technical object as the successful outcome of a process of externalization of the human bodily functions into the environment originates with Ernst Kapp and his *Elements of a Philosophy of Technology* (Kapp 2018). On the other hand – as Georges Canguilhem already noted in the past (Canguilhem 1952, 153) – it is

Within this zootechnological movement, it is important to highlight, as Stiegler has already pointed out (Stiegler 1998a, 134), that humanity does not exist prior to this exteriorization. Structured in a transductive relationship, where one element cannot be conceived or identified without the other, the emergence of the tool signifies the emergence of humanity itself. This means that it is the evolution of the technical instrument, understood as «technology exuded by the skeleton» (Stiegler 1998a, 145), that constitutes the evolutionary reality of humankind.

From the prehistory of the Zinjianthropians, the ability to transmit individual experience to future generations through technical supports establishes «a relation of the human living being to the matter it organizes and by which it organizes itself, where none of the terms of the relation hold the secret of the other» (Stiegler 1998a, 49). In a profound sense, exteriorization is the continuation of life through means other than life, and humanity is the living being characterized by the traces left by its existence in the non-living.

The individual or epigenetic experience of early flint knappers fades with the end of nervous memory, but as the tool survives, the trace of their experience is preserved in a technical organized material. Those who inherit the tool, recovering its original function and using it in innovative ways that foster processes of exaptation, also inherit a part of the previous experience.<sup>6</sup> In interpreting technique as a third form of memory and as a testament to lost experiences, Leroi-Gourhan illuminates a particular intertwining, both synchronic and diachronic, between the cognitive-imaginative universe and the evolution of material prosthetics, which mutually influence each other from their very origin. As Leroi-Gourhan states:

The Australanthropians' world was already an imaginary one to the extent that it was founded upon the first materialization of what were in effect symbols taking the form of tools; so is the world of an average person of today all of whose knowledge is derived from books, newspapers, and television and who, using the same eyes and ears as our remote ancestor, receives the

equally essential to emphasize that Kapp's theory was firstly adopted in France by the philosopher Alfred Espinas and was subsequently misattributed to him, thereby obscuring its original source. Even today, Ernst Kapp's work struggles to gain broader recognition across Europe. Indeed, an official Italian translation of the German philosopher's principal work is still unavailable, despite a growing interest in recent years (cf. Cera 2019; Clarizio 2023; Grigenti 2016, 2018, 2021; Restuccia 2020). Crossing through the philosophical systems of Canguilhem and Bergson – who, however, was unfamiliar with Kapp's work – the notion of *Organprojektion* reached Leroi-Gourhan only indirectly. Furthermore, the French paleoanthropologist reinterpreted its inherently idealistic characteristics within an evolutionary framework. In his model, exteriorization becomes the fundamental anti-metaphysical concept for understanding the entire evolutionary process, thereby approaching the realization of a “biological philosophy of technology”, as envisioned by Canguilhem in 1952 (Canguilhem 1952; Leroi-Gourhan 1993b, 146). While adopting its foundational theoretical premises, it is still possible to assert that Leroi-Gourhan's philosophical proposal remains irreducible to that of Kapp's (Guchet 2021).

<sup>6</sup> Exaptation is a concept – central to contemporary evolutionary biology – coined in 1982 by Stephen Jay Gould and Elisabeth Vrba (Gould & Vrba 1982) that refers to the process where an acquired trait or feature that evolved for one specific function is later co-opted or used for a different, often entirely unrelated, function. Unlike adaptation, which describes the development of a trait that directly increases an organism's fitness in its environment, exaptation involves a shift in the use or purpose of a trait over time. Exaptation highlights the complexity and flexibility of evolutionary processes, showing that features of organisms may not always have been shaped solely by their actual utility, but can also have historical uses that are repurposed in entirely different contexts. The notion of exaptation is also useful in explaining how, in the case of technology, a form can assume ever-different functions, not being linked to a single purpose. In this way, the object materially escapes from a function that one might try to impose on it and from the danger of an evolutionary stagnation, opening possibilities for its own independent phylogenesis.

reflection of a world that has expanded to the proportions of the universe but has become a world of images, a world the individual is plunged into but cannot participate in except through the imagination. (Leroi-Gourhan 1993b, 401).

This inextricable relationship is also traceable in the possibility of reconstructing the history and protohistory of humanity, prior to the emergence of memory supports in the strict sense, based on the technical traces that provide access to the mnemonic capital and imaginative universe of civilizations otherwise destined for oblivion. These technical traces – mostly common objects – are true transmitters of memory, even if they were not originally conceived for that purpose, as they result from a successful process of exteriorization from the organic to the inorganic.

It is precisely in the ability to trace an «archaeology of the ancient mind» (Schlanger 1994) through a biographical approach to artifacts that Leroi-Gourhan attempts to formalize methodologically the series of operations underlying the production of the earliest human tools. This rigorous reconstruction of the material conditions of production – known as *chaîne opératoire* – makes it possible to address some of the complex social, ecological, cognitive, and imaginative dimensions surrounding ancient technical activities (Desrosiers 1991). By approaching technical processes as they unfolded in practice, we can reveal how they are at each moment materially determined while also being culturally mediated and effective.

We might say that the methodology inaugurated is based on the fundamental premise of narrowing down arbitrariness (Giorello 2017), focusing on an investigation that explores how constraints are managed to eliminate less probable alternatives and derive diverse morphologies, thereby opening new horizons of knowledge. As Leroi-Gourhan himself stated in 1969 during a renowned inaugural lecture for the Chair of Prehistory at the Collège de France:

Experimentation is certainly the best means of narrowing the range of hypotheses about manufacturing methods and the probable use of stone and bone tools. In many countries, and particularly in France, the experimental study of flint object production and the observation of wear marks on tools have yielded highly significant results. (Leroi-Gourhan 1970, 11, my translation).<sup>7</sup>

This is possible because «techniques involve both gestures and tools, sequentially organized by means of a “syntax” that imparts both fixity and flexibility to the series of operations involved. This operating syntax is suggested by the memory and comes into being as a product of the brain and the physical environment» (Leroi-Gourhan 1993b, 114). Furthermore, in a profound sense: «these gestures are the person’s memories and thoughts rendered visible. Gestures are like thoughts themselves. They belong, not to the outside world, but to the inside one of memory, thought, and mental images» (McNeill 1994, 12).

The interest in a grammatology of gesture also arises from the pervasive presence of the immaterial aspect in manufacturing processes and the desire to rescue tools from the dead end to which they had been relegated, restoring them to the currents of life. As Nathan Schlanger already pointed out:

<sup>7</sup> Original text: «L’expérimentation constitue sans aucun doute le meilleur moyen de réduire le champ des hypothèses concernant les méthodes de fabrication et l’usage probable des équipements en pierre et en os. Dans de nombreux pays, notamment en France, l’étude expérimentale de la fabrication des objets en silex, ainsi que l’observation des traces d’usure sur les outils, ont conduit à des résultats très significatifs».

By situating technical activities in their temporal and spatial settings (extraction, production, transport, use), *chaîne opératoire* studies can contribute to the reconstruction of the dynamics of past landscapes, both natural and social. At another level, the possibility of finely grasping series of material operations carried out in the remote past opens the way for an investigation of the knowledge, know-how and skills deployed by the prehistoric artisans. Rather than viewing flintknapping as governed by an immutable plan or a predetermined “mental template” (a standardised image of the desired end product), or as some adventitious blow-by-blow rock bashing, this goal-oriented activity can be considered as a structured and generative interplay between mental and material possibilities, involving planning and decision making as well as more tacit or routine reactions. This in turn relates to issues of representations, transmissions and skills as addressed by cultural anthropologists concerned with cognition in practice, and also to questions of neuro-biological and socio-cultural adaptation in the course of human evolution, as addressed by cognitive archeology and evolutionary psychology. (Schlanger 2005).

Not reducing itself to a simple reconstructive analysis of past techniques, the *chaîne opératoire* allows the manifestation of life and the dynamic processes of deep time through dead memories that are only apparently inert. At a deeper level, these memories reveal that technical systems, far from being mere raw materials organized into predetermined forms, are composed of practical knowledge, systems of symbols, and textual representations that converge in the collective imagination. It is only through the conception of the technical object as a sequence of explorable operations that the integration of memory into technicality has become possible (Cerqui 1997).

Indeed, what emerges from both paleontological evidence and the diagnostic method introduced by the French paleoanthropologist is that, concretely, humans have always constituted themselves in a dynamic of mutual shaping between their operational capacities – both the effect and cause of the development of their cognitive abilities – and the feedback from the external environment. The close relationship that exists between artifice and the zoological dimension constitutes us in a more decisive way than we might have been willing to believe (Pigeot 2011).

Given what we know of the apparatus of the higher mammals and humans, these dominant reference senses (sight and hearing), together with motor function, indicate that figurative behavior forms part of the system of responsiveness. In other words, its instruments are the same as those of technics and language: the body and the hand, the eye and the ear. The activities we distinguish as dance, mime, drama music, and graphic or plastic art all spring from the same source as the activities connected with technics and language. [...] But whereas the purpose of verbal figures – words and syntax – is, like the purpose of tools and manual gestures, their equivalents, to provide an effective hold on the world of relationships and of matter, figurative representation belongs to a different biological field, that of the perception of rhythms and values, which all living beings have in common. Thus we see that tools, language, and rhythmic creation are three contiguous aspects of one and the same process. (Leroi-Gourhan 1993b, 365-366).

The evolutionary framework presented so far – the emergence of humanity through a technical-imaginative interactivity with the environment – has recently been formalized by Lambros Malafouris in the model of Material Engagement Theory (MET), which places the normative aspect of matter and its reciprocal influences with human imagination and the symbolic universe at the center of philosophical inquiry (Malafouris 2016). The result is an innovative theory of the human mind, now conceived as extended and in a constant process of reshaping in relation to its techniques.

Examining the process of producing a chipped flint from the perspective of MET means, first and foremost, highlighting the relevance of affordances – expressed by the material being worked and often overlooked due to a voluntarist view of technique – in determining

the emergence of the technical object. Moreover, and most importantly, it requires us to reconsider the entire *chaîne opératoire* as a genuine process of imaginative modification, in which the cognitive world of the producer is profoundly altered and endowed with new technical and symbolic competencies that did not exist prior to the process itself.

In this sense, «we make things which in turn make us» (Ihde & Malafouris 2019, 195). This alteration – both morphological and cognitive – aligns with Leroi-Gourhan’s meticulous description of paleontological samples and the mechanical transitions – fundamental to human phylogenesis – provoked by interaction with the material environment.

The series of transformative correlations allows us, from the very origin of the first living organizations, to interpret the evolutionary process as «a series of successive liberations: that of the whole body from the liquid element, that of the head from the ground, that of the hand from the requirements of locomotion, and finally that of the brain from the facial mask» (Leroi-Gourhan 1993b, 25).

The zoo-technological movement of liberation, within the context of the MET, demonstrates that technical-manipulative ability always implies a certain degree of cognitive and morphological development – a primordial form of knowledge. In this sense, the origin of technique represents the imprint of a precise dual synchronic impetus: the emergence of the minimal physical conditions necessary for the production of artifacts and, simultaneously, the symbolic and hypertextual implications of their creation (DeSilva 2021). The liberation of the hand – whose functional versatility characterizes us as a species at a biomorphological level – marks the dawn of new ways of engaging with reality, not only spatially but, above all, temporally, as in the case of memory. This liberating function assumed by the forelimb is so central that «the body, we might say, is the handmaiden of the hand – its infrastructure» (McGinn 2017, 25).<sup>8</sup> Subjected to specific selective pressures, the hand functions as an ancestral technical prosthesis<sup>9</sup> and as an interface endowed with a plastic nature, enabling the earliest forms of Hominins to interact with the world-environment in increasingly complex ways.

Indeed, various microevolutionary movements, when viewed retrospectively, lead to a continuous complexity of the entire physical apparatus. This complexity results, at the

<sup>8</sup> Similarly, Leroi-Gourhan argues that the brain, functionally, acts as “the tenant” of the entire bodily structure. This subordinated role has led to the understanding that human evolution does not strictly depend on the evolution of the brain but rather on the evolution of the corporeal apparatus it governs, thereby dismantling the image of the primitive human that was prevalent in the nineteenth century (Leroi-Gourhan 1993b, 37).

<sup>9</sup> In this passage – fundamental to Leroi-Gourhan’s framework – the influence of Marcel Mauss’s anthropological theses is evident (Karsenti 1998). Beginning in 1935, Mauss introduced the notion of “techniques of the body” (Mauss 1973). With this concept, the French anthropologist sought to unify under a single term the diverse ways in which humans learn to use their bodies and interact with the surrounding environment. The body – where nature and artifice converge – is presented as the foundation of all socially acquired abilities, which are later transferred to tools: «The body is man’s first and most natural instrument. Or more accurately, not to speak of instruments, man’s first and most natural technical object, and at the same time technical means, is his body» (Mauss 1973, 75). It is worth emphasizing, for the purposes of this study, that as early as 1933, André Leroi-Gourhan worked in various ethnology departments in prominent French and English museums, including the British Museum and the *Musée de l’Homme*, where he became acting deputy director in 1945 (cf. Leroi-Gourhan & Rocquet 1982). During these years, his acquaintance with Mauss – at the time professor at the *École Pratique* and the *Institut d’Ethnologie* at the University of Paris, which Mauss himself had founded in 1922 – introduced Leroi-Gourhan to the field of ethnology for the first time (Piperno 1993, xiv).

beginning of our phylogenetic branch, in a “disposition” of our body to accommodate the progressive expansion of brain mass and the so-called process of encephalization:

Following Leroi-Gourhan, it is fascinating to observe the processes that, through the main stages of vertebrate evolution, lead to structural modifications in the facial sector, ultimately making it “disposed” to accommodate and support the expansion of the brain in hominids. What is surprising about this expansion is that it is simultaneously the result of mechanical interactions and the functional feedback loops between its development and the new functions that become possible. These new functions, in turn, feed back into brain capacity as new stimuli to process, further nurturing this growth. It is as if the brain and its abilities grow together, each feeding off the other and vice versa. (Le Moli 2022, 199, my translation).<sup>10</sup>

It is precisely in this cycle of feedback that the expansion of the brain is supported by the increasing variety of technical operations, which, in turn, are sustained by a constant complexity of the cerebral apparatus. The process of corticalization occurs as a mirror reflection of the epigenetic preservation of flint, representing an encounter with the material in which the cortex reflects itself. The relationship is thus remarkably close «that in the case of the Australanthropians and Archanthropians, the development of techniques more or less kept pace with that of the skull» (Leroi-Gourhan 1993b, 131).

It is clear, therefore, that the paradigm of MET, similar to Leroi-Gourhan’s perspective, cannot consider the technical-operational aspect as separable from the cognitive and imaginative dimensions, just as it cannot separate the concrete from the abstract. In the complex interaction with materials, humans form and organize themselves by following the suggested paths and inevitable choices, within a determinism constrained by physical supports and precise normativities. In this sense, the imaginative dimension, far from being an emancipation from inorganic constraints, can only emerge and move through material supports that ensure its development.

However, it is worth noting that the interactive event between the parts is not always perfectly balanced; rather, it can contain significant internal differentiations. For instance, there is a considerable difference between a tool as a spontaneous accumulator of experiences and the techniques that, beginning in the Neolithic period, specifically aim to encode experience, such as mitograms or alphabetic writing (Anati 2013).

It is reasonable to suppose, in fact, that in interaction with new supports, new projective intentions may emerge alongside a progressive re-interiorization of the fundamental technical protocols through a new imaginative framework – an *empowerment* specialized and derived from the inorganic (Montani 2022, 24). Thus, a further dis-adhesion from the artificial prosthesis that facilitated the initial distancing from the external environment becomes possible, as Malafouris writes in the case of lithic artifacts:

The stone projects toward the knapper as much as the knapper projects toward the stone, and together they delineate the cognitive map of what we may call an extended intentional state. The knapper first thinks through and with the stone before being able to think about the stone and hence about himself as a conscious and reflective agent. In tool making, all formative thinking activity happens where the hand meets the stone. (Malafouris 2016, 176).

<sup>10</sup> Original text: «Seguendo Leroi-Gourhan, risulta affascinante assistere ai processi che, attraverso le principali tappe dell’evoluzione dei vertebrati, conducono alle modifiche strutturali del campo settoriale facciale fino a renderlo “disposto” ad accogliere e accompagnare l’espansione del cervello negli ominidi. La cosa sorprendente di questa espansione è il fatto che essa è contemporaneamente figlia di interazioni meccaniche e dei cortocircuiti funzionali tra il proprio sviluppo e le nuove funzioni che sono rese possibili. E che, retroagendo sulla capacità cerebrale come nuovi stimoli da elaborare, la alimentano ulteriormente. Come se, cioè, il cervello e le sue abilità crescessero assieme alimentandosi l’uno con le altre e viceversa».

This technical re-interiorization must be understood in the context of the initial movement just illustrated, which establishes a specific relationship between the “who” and the “what”. It presupposes an outward expression of internal faculties from the body «as if their brains and their bodies had gradually exuded them» (Leroi-Gourhan 1993b, 106). However, the question of the first origin – or the emergence of the technical artifact – seems to confront an unavoidable incongruity that requires further exploration.

### **3. Technical re-internalization and interactive imagination**

The internal movement within the process of exteriorization is paradoxical in that Leroi-Gourhan asserts that it is the tool – produced by impersonal factors – that serves as the operating agent inventing humanity, rather than the other way around. Or, in a more precise sense:

the human invents himself in the technical by inventing the tool – by becoming exteriorized techno-logically. But here the human is the interior: there is no exteriorization that does not point to a movement from interior to exterior. Nevertheless, the interior is inverted in this movement; it can therefore not precede it. Interior and exterior are consequently constituted in a movement that invents both one and the other: a moment in which they invent each other respectively, as if there were a technological maieutic of what is called humanity. The interior and the exterior are the same thing, the inside is the outside, since man (the interior) is essentially defined by the tool (the exterior). (Stiegler 1998a, 141-142).

This presupposes that, despite discussing exteriorization, there is no internal state preceding the process itself, just as there are no faculties to be delocalized before the emergence of the tool. The opposition between the internal and the external is as illusory as the idea that seeks to separate the symbolic-imaginative aspect from the technical one. In the realm of memory, as previously discussed, there is exteriorization whenever the storage of information is delegated to a technical device, which survives beyond life itself.

The emergence of mnemonics, however, marks a decisive turning point, as they ensure the transmission of specifically symbolic content and collective or individual worldviews, no longer limited to experiences related to sensory-motor behaviors. Both ideographic and alphabetic writings, still in use today, allow access to the arguments and imaginative turns of classical antiquity in a relationship of almost symmetry.

Furthermore, technical empowerment has enabled the ancients to transcend the temporal constraints of memory itself and, above all, to delineate complex reasoning by fixing the symbols of their imagination (Stiegler 1998b). In this sense, technical support is not merely a means of transmitting information and abstract thought; it is the very condition for their elaboration. It is in this material formulation of knowledge and imagination, and in the quantum nature of the emergence of the technical brain (Leroi-Gourhan 1993b, 104), that the idea of unidirectional exteriorization collapses.

The asymmetry of this relationship appears to conform to a circularity that establishes its fundamental poles, which, in turn, can only be defined in relation to each other. The distinction between storage memories and spontaneous memories determines – more or less directly – the gradient of interactivity that the subject maintains with the support, and consequently, the acquisition of an ordered sequence of movements necessary for the success of an operation.

This functional interactivity presupposes the involvement of a large number of fundamental media elements – technical, cognitive, sensory-motor, material, and cultural – each of which has contributed to the acquisition of specialized knowledge. The knowledge in

question is, as noted, neither predetermined nor purely abstract, but a form of embodied internalization (Montani 2022, 26) guaranteed by the coordination of all elements and the feedback loop produced by the continuous movements of exteriorization and interiorization.

In Leroi-Gourhan's framework, the acquisition of technical competence appears to be linked to a natural extension of the body and sensitivity into artifacts, which enhance our faculties and mediate our interaction with the environment: «With the emergence of new intellectual possibilities, techniques began a dizzying ascent, but the curves of their evolution followed the lines of phyletic evolution so closely that we must ask ourselves whether they are not simply an extension of the general development of species» (Leroi-Gourhan 1993b, 106). As Montani suggests, it is only when humans become "technically dependent" that progressive movements of disautomatization and liberation from predetermined programs become possible (Montani 2022, 29).

In a passage that may seem contradictory, technique serves as both a prerequisite and a consequence of a plasticity that is directly proportional to the re-internalization of specific competencies, which can be spontaneously oriented and creatively reorganized towards responsive and non-compliant behaviors. In other words, the increasingly efficient appropriation of a technical-operational protocol ensures its modified restitution through the integration of new rules and the performances of interactive imagination.

Freedom, that fragile element of the human edifice, rests upon the imagination, both in the sense of illusion and in that of emancipation through the use of symbols. [...] Whereas the base on which we stand is and must remain the osteomuscular system of the last stage of the animal world, the superstructure is wholly artificial and imaginary, born of the interaction taking place externally between the two poles of creative activity – the face and the hand – in technics and language. (Leroi-Gourhan 1993b, 401-402).

Lastly, the interactivity of imagination is exercised effectively through a careful listening to the affordances presented by the environment and a surrender to the demands of matter, starting from the earliest specimens of the genus *Homo*. The imagination of the first *Australopithecines* interacts with the flint's propensity to split, following its ability to suggest specific objectual emergences.

However, this initial receptive aspect of contact with matter does not exclude further susceptible modes of interaction. It is indeed possible to elicit new affordances from matter, equally objective, but primarily dependent on the cognitive aspects of imaginative mediation, which now takes on a legislative role in determining the shaping processes. From the very beginning, imaginative capacity is nourished by the environment, which, in turn, is modified by the provocative capacity of technique in a circularity comparable to the evolutionary models of Niche Construction Theory (cf. Odling-Smee & Laland 2003).

In the spatiotemporal interstices opened by a limited range of possibilities, interactive imagination maintains a playful relationship with the suggestions of the environmental world (cf. Ingold 2013). It is only through this play that imagination, like technique, articulates and reorganizes itself differently by a constant process of re-internalization. The deeply receptive and embodied practice of technical formation, as highlighted by the MET, also carries the prerequisites for its upheaval. We could say, in fact, that the genesis of technical creativity through the original encounter between humans and matter rests on a primordial capacity of relief from operational sequences (Gehlen 1988, 54). This capacity represents the continuation of the evolutionary movement of liberation, which, in the case of *Homo sapiens*, manifests itself in the receptive nature of the relationship with the inorganic. In the interactive engagement with matter – and its affordances – the possibility for a new morphological articulation arise from old technical practices. This means that the

sudden “vertical ascent” (Leroi-Gourhan 1993b, 141) of artifacts owes its existence to a mode of interaction that is simultaneously receptive and creative, or more precisely, to a capacity of detachment that carries within itself the minimal conditions for a technical evolution. Leroi-Gourhan highlighted the dual nature of this evolution – the interaction between a biological normativity and an imaginative one – beginning from a crucial moment in the history of material culture:

In the Acheulian<sup>11</sup> the thinner edges of the bifaces produced by tangential impact meant that flakes detached from the matrix were larger, wider, and finer and could be employed for cutting. It was this development in the form of the biface that gave rise to the technique described by prehistorians as “Levalloisian”. The lump of stone initially intended to become an almond-shaped tool became instead a source of flakes of predetermined shape, and it was these flakes that were eventually used as tools. [...] Another fact we should note is that the tool function had shifted from the mass initially intended to constitute the tool to the flake derived from that mass. The Australopithecine stereotype had been gradually left behind; we shall see later that this process is generally characteristic of the more developed industries. In other words, from being the tool itself the lump of stone has become a source of tools (as we shall see, an additional stage was to be introduced from the Upper Paleolithic onward). The blade or flake would then no longer constitute the tool but would be divided into sections providing the starting point for the making of the tool proper (Leroi-Gourhan 1993b, 99).

The evolutionary shift of *Levallois* explicitly highlights – as a fundamental turning point – the profoundly plastic nature of material engagement, which leads to the emergence of a new organizing normativity that challenges the idea of a clear boundary between the organic and the inorganic. For this new scenario we must consider the assembly of new combinatory possibilities as the successful outcome of a technical-imaginative process that is intrinsically embodied, yet owes its origin to circumstances and experiences external to the body itself and which did not exist prior to the material connection.

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<sup>11</sup> The Acheulean is a prehistoric lithic culture periodization primarily associated with *Homo erectus* and later *Homo heidelbergensis*. It emerged during the Lower Paleolithic, around 1.76 million years ago, and persisted until approximately 200,000 years ago. The name derives from the site of *Saint-Acheul* in France, where the first “hand axes” of this tradition were discovered and then described by Gabriel de Mortillet in 1872 (Butler 2005; Darvill 2003).

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