35. Ibid., p. 106.
36. Ibid., p. 107.
37. Dumézil, *Mitra-Varuna*, pp. 108–9.
38. Deleuze and Guattari recognise that Dumézil 'has established the mythological importance' of the *celeritas/gravitas* opposition 'precisely in relation to the State apparatus and its natural "gravity"' (TP 371), but they argue that *celeritas* belongs properly to the war machine.
39. Dumézil, *L'Idéologie tripartie des Indo-Européens*, p. 32.
40. Ibid., p. 33.
41. Ibid., p. 57.
42. Georges Dumézil, *Archaic Roman Religion*, trans. Philip Krapp (Chicago: University of Chicago Press, 1970), pp. 255–6.
43. Georges Dumézil, *Mythe et épopée I: L'idéologie des trois fonctions dans les épopées des peuples indo-européens* (Paris: Gallimard, 1968), p. 15.

13

André Leroi-Gourhan

Daniel W. Smith

André Leroi-Gourhan (1911–86) was a French palaeontologist, archaeologist and ethnologist who held the chair of Prehistory at the Collège de France from 1968 until his retirement in 1982. During the 1960s and 1970s Leroi-Gourhan's impact on palaeontology was on a par with that of Claude Lévi-Strauss, his colleague at the Collège de France, in anthropology.[1] He was an extraordinary polymath, having received degrees in Russian (1931) and Chinese (1933). In 1936, while working at the Musée de l'Homme in Paris, he went on an ethnographic expedition to the Far East,[2] where he collected materials for his 1944 dissertation at the Sorbonne, which was entitled 'The Archaeology of the North Pacific' and directed by Marcel Mauss. His wide-ranging work focused primarily on prehistoric art, the history of technology, and human evolution. Among his many enduring legacies are the 'Techniques et Cultures' school of cultural anthropology,[3] the *chaîne opératoire* approach to technology, and the *decapage* method of excavation. He is well known to archaeologists for his pioneering studies of area excavations at Arcy-sur-Cure[4] and, especially, Pincevent.[5] Outside France, Leroi-Gourhan initially became known for his studies of Palaeolithic art,[6] for which he was often credited, somewhat simplistically, with having provided a 'structuralist' interpretation.[7] In the 1940s he achieved international recognition with the publication of *Evolution and Techniques* (in two volumes, *Man and Matter* [1943] and *Milieus and Techniques* [1945]), a massive ethological study of the evolution of technology that remains a touchstone in the field.[8]

But Leroi-Gourhan's *magnum opus* was his two-volume masterpiece *Gesture and Speech* (*Technique and Language* [1964] and *Memory and Rhythms* [1965]), a work of extraordinary scope that presents a synthetic account of the course of human evolution from a philosophically informed viewpoint.[9] The work had an immediate impact in France and was taken up by several philosophers: Jacques Derrida discusses the book in his 1967 *Of Grammatology* (primarily

with regard to Leroi-Gourhan's analyses of the linearity of phonetic writing),[10] and Deleuze and Guattari appeal to it throughout their works. It would take more than thirty years for the book to be translated into English, in 1993, and its impact in the English-speaking world, especially in philosophy, has remained limited. It is true that in hindsight, more than fifty years after its publication, it is easy to identify aspects of the book that are outdated. Even in 1964, for example, Leroi-Gourhan was using an idiosyncratic terminology that was already becoming obsolete: he calls the biface makers 'Archanthropians', and their predecessors, 'Australanthropians'. Moreover, *Gesture and Speech* was written long before the discoveries of *Homo habilis* in Africa and the famous *Australopithecus afarensis* named 'Lucy', and its analyses necessarily must be reconsidered in light of subsequent fossil evidence. At times, the text even betrays a certain anthropocentrism that would be shared by few contemporary palaeontologists.[11]

Despite such caveats, the vision of human development presented in *Gesture and Speech* retains all its topicality and contemporaneity, for several reasons. The first is Leroi-Gourhan's morphological approach to human evolution. As Tim Ingold has noted, Leroi-Gourhan's work is derived as much from the tradition of Geoffroy Saint-Hilaire and Cuvier as it is from Buffon and Darwin.[12] For Leroi-Gourhan, *On the Origin of Species* did not so much inaugurate a new era in science as it brought an end the tradition of natural history started by Buffon, which firmly anchored humans in the natural world.[13] Cuvier's work, by contrast, had focused on the relations between the morphological components of the body, and Leroi-Gourhan's presupposition is that adaptations (variation and selection) can take place only within a fairly demarcated space of possible bodily transformations. Morphology is the *condition* for corporeal adaptations, and on this score animal species have two fundamental morphological patterns: *radial* symmetry (hydras, sea anemones, polyps) and *bilateral* symmetry (worms, molluscs, crustaceans). Humans belong to the second group, in which 'the entire organism is placed *behind* the aperture for ingesting food', or what Leroi-Gourhan calls the *anterior field* (27–8). Leroi-Gourhan's analysis of human evolution begins with the general morphology of bilateral symmetry, which polarises the front and rear, and locates the organs of prehension, ingestion and responsiveness in the anterior field in the front of the body.

Second, given this starting point, Leroi-Gourhan analyses the evolutionary transformations that took place within this bilateral

morphology, which included changes in the mechanical organisation of the spinal column and limbs, the position of the skull, the size and layout of the teeth, the organisation of the forelimb (the hand) and the size of the brain. Leroi-Gourhan is highly critical of 'celebralist' theories (Rousseau, Teilhard de Chardin) which presume that human evolution was guided by intelligence (10, 19), arguing instead that it was the *foot*, and not the brain, that played the determinative role in human evolution, since the size of the human brain was dependent on the development of an erect posture (bipedality). In other words, *mobility*, and not intelligence, was 'the significant feature of evolution toward the human state' (26). The reason for this is strictly mechanical: a brain of human size and weight simply could not exist in quadrupeds with a horizontal backbone. For the human brain to develop, the vertebral column had to become vertical, and the skull had to be foreshortened in the front (including the face and dentition) and considerably extended over the convex 'roof' of the cranium – what Leroi-Gourhan calls the opening of the 'cortical fan'.[14] Leroi-Gourhan is in no way denying the important role that the brain played in the development of human societies – a factor Darwin famously emphasised.[15] His point is that, from an evolutionary perspective, cerebral development is a derivative phenomenon, an *effect* of bipedalism. Put differently, Leroi-Gourhan sketches the portrait, not of an embodied mind, but of an enminded body. The ongoing privilege accorded to intelligence and cognition has its roots in the longstanding bias that favours the mental rather than the corporeal, the mind rather than the body. In this sense, *Gesture and Speech*, although it never mentions his name, follows Nietzsche's advice to philosophers: 'Essential: to start from the body and employ it as a guide. It is a much richer phenomenon [than the mind], and admits of clearer observation.'[16]

Third, Leroi-Gourhan provides a detailed account of the evolutionary emergence of the bipedal body with erect posture, starting from a stable way of life in an aquatic medium, and proceeding through a series of what Leroi-Gourhan calls 'liberations': the initial liberation from the aquatic medium (amphibiomorphism), the freeing of the head (which distinguishes reptiles from fish), the acquisition of erect quadrupedal locomotion ('walkers'), the acquisition of seated posture ('graspers'), and, finally, the acquisition of erect posture (anthropomorphism), which entails the liberation of the hands and the mouth (36–60). Deleuze and Guattari will call these transitions 'deterritorialisations' rather than 'liberations' – in the

upright position, the hand and mouth are literally de-territorialised and removed from the ground (*terre*) (DR 86–7). Our front paws gradually lost their faculty of locomotion, but in the process they became hands, which can do many more things than simply walking, such as the fabrication of tools. At the same time, the mouth lost its capacity for prehension, which was taken over by the hand, but in the process it gained the capacity for speech. In being deterritorialised, the forelimb and the mouth were *reterritorialised* on new actions, gestures and tool-making (for the hand) and speech (for the mouth). The is the source of the title of Leroi-Gourhan's book *Gesture and Speech*, and the most original aspect of the book is its analysis of these two morphological poles: the hand (gestures and tools) and the face/mouth (speech), and their complex interactions.

Indeed, the fundamental claim of *Gesture and Speech* is that 'tools, language, and rhythmic creation are three contiguous aspects of one and the same process' (336) – all of which are linked to the enlargement of the human brain, though not derived from it. The appearance of an erect bipedal body in humans *at one and the same time* freed the forelimb from the function of locomotion and created the hand; freed the mouth from the function of prehension and created language; and allowed the brain to expand by placing the cranium at the top of the now-erect spinal column, which led to the externalisation of visceral bodily rhythms in space and time. Though separable, these three changes in the human body were the result of the same morphological process, and can thus be considered as a single event. Since they are the result of one evolutionary process, Leroi-Gourhan will argue that there are inevitable parallels in the evolution of 'technics, language, and aesthetics' (275)

In what follows, we can do little more than provide a summary overview of each of these three poles, and the elements that Deleuze appropriated from Leroi-Gourhan, although it is no doubt the first pole (technics) that had the greatest impact on Deleuze.

First Pole: The Hand (Gestures and Tools)

Leroi-Gourhan belongs to a long tradition that interprets technical artefacts as *biological* phenomena. 'Leroi-Gourhan', Deleuze and Guattari write, 'has gone the farthest toward a technological vitalism taking biological evolution in general as the model for technical evolution', positing the existence of a 'university tendency' (which Deleuze and Guattari will term the 'machinic phylum') that traverses

both the technical and internal milieus of organisms (TP 47). Perhaps the key term in Leroi-Gourhan's account of technology is the notion of *externalisation*. The evolution of the hand produced an entire series of manual gestures that went far beyond the locomotive of the paw: prehension, percussion, rotation, grasping, kneading, transmission and so on. The hand became a tool that could undertake numerous complex operations such as crushing, moulding, scraping, cutting, digging and so on. But these motor skills, in turn, were then externalised in technical artefacts, in relation to which the hand ceased to be a tool itself and became the motor force of these externalised tools. I can attempt to pound a stake into the ground with my fist, but I do a much better job at the task with a hammer, which externalises my forearm and fist in wood and metal. Similarly, a baby's bottle externalises the mother's breast; an oven externalises the stomach; writing externalises memory; and so on. Technical artefacts are biological phenomena because they are extensions or 'externalisations' of the motor skills and organs of the body. Ernst Kapp, a contemporary of Marx, seems to have been the first to make this argument in his *Prinicples of a Philosophy of Technology* (1877), which was taken up in France by Alfred Espinas in his 1897 book *The Origins of Technology*.[17] In the English-speaking world, the same tradition was revived in Marshall McLuhan's 1964 *Understanding Media*, which was published in the same year as Leroi-Gourhan's *Gesture and Speech*, and bore as its subtitle, precisely, *The Extensions of Man*.[18] Yet the characterisation of tools as 'externalisations', while a useful and perhaps necessary starting part, must be qualified in at least two ways.

On the one hand, long before any process of externalisation, one can find a 'proto-technicity' throughout the plant and animal kingdoms. Evolution, in other words, *produces its own technology*. Oviparous animals (birds), for instance, followed an evolutionary path that externalised the ovum through the action of laying eggs, objects that are half-living (the embryo) and half-technological objects (the calcium shell). In this sense, one could say that oviparous animals had already produced the 'objective', and that the egg could perhaps be considered one of the material origins of technology.[19] But birds were simply continuing an immense movement that had commenced with invertebrates such as arthropods (insects and molluscs), who secreted armours of chitin, or even scallops and shellfish, who produced an exoskeleton to protect themselves – just as masons build our houses, through another type of externalisation. From

this viewpoint, one could push the advent of technology back half a billion years to the Cambrian explosion, the Palaeozoic era in which exoskeletons appeared – the exterior of an interior, a protective framework for soft and fragile parts. Later, in the vertebrates, feathers, hair, hooves, nails and teeth, the shells of the turtles and the scales of anteaters will continue this vital flux of proto-technicity. From the most ancient exoskeletons to the appearance of the most recent 'appendages' (*phanères*), we can follow a gigantic chain of 'natural' technologies. Even if they have not yet been detached from the body, they are nonetheless the precursors of subsequent externalisations. Indeed, are the ancient ruins of long-vanished civilisations or even modern junkyards filled with the carcasses of rusting automobiles all that different from the fossilised remains of the Cambrian period that are found in the Burgess Shale in the Canadian Rockies, about which Stephen Jay Gould wrote his superb book *Wonderful Life*?[20] They are *all* cemeteries of externalised techniques.

One could push this analysis even further. Bergson observed that a unicellular animal such as an amoeba can digest food, react to its surroundings, and even 'think', although it does not have a digestive tract, sensory organs or a brain.[21] To use Deleuze's terminology, taken from Artaud, an amoeba is a *body without organs*. Lacking organs, the amoeba is nonetheless capable of unified behaviour such as self-direction, conditioned reflexes, learning, adaptation, instinctive habits and so on. In so-called higher animals, these 'functions' become localised in specific organs such as the stomach and the brain, but clearly the functions do not require the specialised organs.[22] Raymond Ruyer drew the obvious conclusion: *bodily organs are themselves technical artefacts*, that is, they are specialised 'tools' that have been fabricated by the organism. [23] I do not necessarily need a hammer to drive a stake into the ground, but I can do it more quickly and efficiently if I have one. Similarly, organisms do not need a stomach to digest, or a nervous system to interact with the environment, but they perhaps digest and interact better if they have specialised organs devoted to these tasks. In other words, technologies may be externalisations of our organs, but our organs are themselves technologies that have been invented by the organism over the course of evolution. In his book *Climbing Mount Probable*, for instance, Richard Dawkins has a marvellous chapter, aptly titled 'The Forty-Fold Path to Enlightenment', that analyses the fact that eyes – which Dawkins calls 'a remote sensing technology' – have evolved no fewer than forty times in the animal kingdom in accordance with nine

distinct principles.[24] Indeed, the greatness of Darwin, as Marx said in a famous text, was that he 'directed attention to the history of *natural technology*, that is, the formation of the organs of plants and animals'.[25] Variation and selection are the two mechanisms of this natural technology.

However one sketches this history of proto-technicity, it is clear that 'technology' is a product of evolution. Although we consider technological objects to be artificial, these artificial objects have a 'natural' origin. It was Plato and Aristotle who separated *tekhne* from *episteme*, and devalued the former in favour of the latter.[26] But this has had a pernicious effect in philosophy: far from being a mere application of science or 'theory', technology long preceded science and in certain respects conditions it.

On the other hand, even if one limits the idea of technical artefacts to objects outside the body, it is obvious that many species besides hominids fabricate external artefacts: beavers construct dams, birds create nests, spiders weave webs.[27] In these cases, however, technical activity is 'a faithful reflection of biological status' (137), that is, the technical artefacts fabricated by animals seems to be largely tied to their genetic makeup, as if they had been 'secreted' (91) or 'exuded' (239) by the organic body. Here, too, the artefact/organ distinction becomes blurred: a spider's web can be seen as one of the organs of the spider, even though it is external to its body. The artefacts fabricated by animals are what Richard Dawkins calls their 'extended phenotype', and he suggests that even the lake behind a beaver's dam 'may be regarded as a huge extended phenotype'.[28] It is well known that animals do not simply *adapt* to environments but actively *create* their environments (niche construction).[29] As Deleuze and Guattari write, 'an organic form is not a simple structure but a structuration, the constitution of an *associated milieu* . . . The spider web is no less "morphogenetic" than the form of the organism.'[30] Jacob von Uexküll pioneered the ethological analysis of such animal environments, and Deleuze frequently cites his analysis of the world of a tic, with its active, perceptive and energetic characteristics.[31]

What seems specific to the human species is that its externalised organs become *detachable*, removeable, separated from the body, which provides the advantage of mobility. A lion's fur, for instance, forces it to rather quickly halt a chase when it becomes overheated; but when fur is externalised in a coat, it can be put on and off at will, in accordance with quickly changing conditions. An important consequence follows from this detachability. Although 'tools and

skeletons evolved synchronously' (97) for most of human existence, Leroi-Gourhan suggests that, at some point, these detached technical objects, or externalised organs, began to enter their own evolutionary history – a trajectory that Michel Serres has termed an 'exodarwinism'.[32] Evolution bifurcated: one might say that we have moved from creative evolution (Bergson) to being ourselves creative of evolution. Evolution produces organisms, with their own proto-technicity; but these organisms then produce technical artefacts that interconnect with each other to produce a new body with its own moving tissue. Each of us now lives in two bodies: the organic body created by the embryo, and the eternalised technological body created by our brains and our hands, a hyperbiological body that Kevin Kelly has aptly termed the *technium*.[33] The evolution of this second body not only moves at a *faster* pace than normal evolution, but it is moving at an increasingly *accelerated* pace: it is this *other* evolutionary time people are referring to when they talk about the fast pace of modern life.[34] Each of us thus participates in two evolutionary temporalities as well: the extremely slow-moving evolutionary process that sculpted our organic body, and fast-moving evolution of our technological body, which Serres calls a movement of 'hominisation'.[35] Put differently, our life takes place between two circuits: the internal circuit of our bodily organs, and the external circuit of our technological organs.

Interregnum: The Enigma of the Biface

But this raises the question of when and why technical artefacts became so detached from the human body that they could enter their own evolutionary sequence, and Leroi-Gourhan confronts this question by considering the enigma of the biface (or hand axe). The first tool created by hominids, dating back 2.7 million years, seems to have been the Oldowan 'chopper', which was created by a single movement of striking one stone against another to create a sharp edge – the same gesture that would serve 'to split a bone, crack a nut, or bludgeon an animal' (92). The concept of an 'operating sequence' (*chaîne opératoire*) was introduced by Leroi-Gourhan as a mean of analysing the process of production of technical artefacts, and particularly lithic artefacts, and the chopper can be identified as the earliest tool because it is the product of the most basic 'operating sequence': simple percussion. Around 1.7 million years ago, the chopper gave way to the biface, which has a pointed oval shape with two convex faces that meet at a sharp edge all around. The biface, which characterises the Acheulean period of artefact production, was the product of a far more complex production process, requiring 'at least six series of operations performed in strict sequence, each series being conditional upon the others and presupposing a rigorous plan' (100). Around 300,000 years ago, the biface gave way to Levalloisian points and microliths (136–8), which seems to have been the starting point of an exponential expansion of techniques – a literal explosion of technological development

What is remarkable about bifaces is that they have been found across Africa, Asia and Europe during a period that spans 'several hundreds of thousands of years' (144). Indeed, current research indicates they persisted for close to a million years, almost five times as long as the existence of *Homo sapiens*. Despite regional variations, the form of the biface, with its bilateral symmetry, remained consistent during this entire period, and even achieved increasing precision. The Acheulean was an industry of awesome stability: the biface was the first 'standardised' tool.

But why did the form of the biface remain constant for such a long period? In *Gesture and Speech*, Leroi-Gourhan oscillates between two responses to this question. One response is that the human biface was akin to the spider's web, the bird's nest or the beaver's dam, all of which are externalised artifacts derived from the species' genetic makeup, part of its extended phenotype. In this case, 'technical activity is a faithful reflection of biological status' (137). A second, and more persistent, response presumes that the explanation of the existence of the tool must be found, not in genetics, but rather in the growing capacities of the human mind, either in the form of a 'mental image' or a 'concept' or a 'representation'.[36] The form of the biface, Leroi-Gourhan writes, can be traced back to 'a shape that must be preexistent in the maker's mind' (97), implying that, in humans at least, technical artefacts bear witness to a conscious intentionality in the maker's mind.[37] On this score, Leroi-Gourhan suggests that what he calls the 'prefrontal event' was 'perhaps the most important technical revolution in human history' (136), since it was at this point that technical development ceased to be 'a faithful reflection of biological status' (137) and 'cell development' (139) and instead started 'to exteriorize itself completely – to lead, as it were, a life of its own' (139). Until this moment, increase in brain volume and industrial progress moved in parallel: *technicity was tied to biology*. After the prefrontal event, 'brain volume had apparently reached its peak, and the industry curve, on the contrary, was at the start of

its vertical ascent' (141). In other words, at some point, technicity wound up *detached* from the body because of the expansion of the brain.

Yet Leroi-Gourhan himself nonetheless questions if it is possible to make such an easy distinction between the technical and the intellectual? 'One could ask whether techniques have a fundamentally intellectual nature, or whether the distinction often drawn between the intellectual and the technical actually reflects a paleontological reality' (106). What is at stake in these questions is what might be called 'archaeology of cognition'.[38] Deleuze, following Simondon, challenged the 'hylomorphic' (*hyle*, 'matter' + *morphē*, 'form') assumption that the production of material bifaces would have presupposed the concept of a pre-existing form for their production. In a later text, Leroi-Gourhan would note that 'the production of tools assumes the ability to preserve technological knowledge', but he argued that *this knowledge is stored in the tool itself*, and not in either the genome or the mind.[39] Recent scholars such as Gary Tomlinson, who is indebted to Leroi-Gourhan, have suggested that we should 'conceive of Acheulean workmanship without the aid of modern foresight or mental representation, without a teleological approach to a preconceived end – without, finally, a recognizably modern human agency at work'.[40] Rather, Tomlinson extends Leroi-Gourhan's concept of operating sequences to argue that the persistence of the biface form for so many millennia did not imply 'abstractable concepts' or even a 'symbolic communicative capacity', but was the result of externalised operating sequences that had become habituated patterns of movement, transmitted from generation to generation. The continuity of the biface-form was the result of the mutual interactions between the rhythmic gestures of the operating sequence and the material affordances of the stone and the environment – what Tim Ingold has termed a 'taskscape'.[41] Instead of seeing stone tools as proxies for the mind, we should see the mind as an outgrowth of the body–stone interface. Tomlinson's work at least suggests that Leroi-Gourhan's concept of the *chaîne opératoire* – the meeting of the body and the material world in a rhythmicised landscape – provides an explanation of the puzzle of the biface that is 'more in keeping with our picture of million-year-old hominins that models involving mental templates, multistep foresight, and top-down planning'.[42]

Second Pole: The Mouth (Speech and Language)

If we began with Leroi-Gourhan's analysis of technology, derived from the hand, it is in part because it becomes the model through which he approaches the externalisations of the mouth and bodily rhythms. If the deterritorialisation of the hand is linked to the genesis of tools and technology, the deterritorialisation of the mouth is linked to the genesis of speech and language, and more generally the status of semiotics or signal-sign systems – a theme Deleuze and Guattari take up in their analyses of 'regimes of signs'.[43] Karl Popper argued that an organism's most fundamental contact with external reality takes place with the ingestion of foodstuffs,[44] which led his disciple Donald T. Campbell to suggest that all types of knowing and perceiving are substitutes for *touching*.[45] Single-celled organisms such as amoebae gain most of their knowledge of the environment through direct physical contact – a mode of knowledge that is both accurate (what one touches certainly exists) and dangerous (if one encounters something hostile). From this viewpoint, one advantage of senses such as hearing, smell and vision is that they allow organisms to gain knowledge of their environment in a more distanced and indirect manner, although such modes of perception, while safer, are often less accurate and more susceptible to error. For Leroi-Gourhan, *detachment* ('thinking at a distance') is as much a theme in sensibility and thought as it is in technology, and these sensory modes of cognitive displacement are extended even further in modes of symbolic abstraction. This is why Ruyer can note that language is less a means of communication than a means of *interrupting* communication, in so far as both speech and writing interpose a sign between humans and the world.

> An immediate suspension of action and communication is the indispensable condition for symbolic behavior . . . The decisive step toward humanity was crossed when the stimulus-signal became the symbol-sign, that is, when it is no longer understood as announcing or indicating something nearby [in space] or the next object or a situation [in time], but as something capable of being used in itself in order to conceive an object even in the absence of this object.[46]

Here too, of course, we can identify a 'proto-symbolism' that exists within the organism itself, not only in its genetic structure, but in the complex chemical signalling that takes place between cells, a domain explored by the field of 'bio-semiotics'.[47] Such chemical

signalling is often externalised in the extended phenotype of species such as ants, who communicate by secreting trail pheromones.[48] In humans, however, symbolisation is primarily linked to speech, that is, the production of sound and not chemical molecules. Although Leroi-Gourhan does not speculate on the origins of speech,[49] he makes two essential points about the *conditions* of its origin. First, as we have seen, the liberation of the mouth is directly linked to the liberation of the hand and the brain: 'manual liberation and the reduction of stresses exerted upon the cranial dome are two terms of the same mechanical equation' (60).[50] His analyses constantly focus on the reciprocally determined triangle of the hand, the mouth and the sensory-motor cortex. In other words, Leroi-Gourhan does not see the hand–mouth relationship 'as the commonplace one whereby the hand participates in speech through gesticulation, but as an *organic* one, manual expertise corresponding to the degree of freedom of operation of the facial organs thus made available for speech' (36). For this reason, second, 'there is a close synchronism between the evolution of techniques and that of language' (215), between the production of the technium and the production of the symbolic world, and the evolution of the former sheds light on the latter. 'The extraordinary acceleration of the development of material techniques following the emergence of *Homo sapiens*' implies that one can track a similar evolutionary development in language. Leroi-Gourhan argues that one can track a similar evolutionary development in language (215).

Of the many riches in his analyses of human symbolisation, we will simply highlight the fact that, for Leroi-Gourhan, like many others (Havelock, Ong, Goody), the singular moment in the long history of language was the advent of *writing*.[51] Phonetic writing – a subset of the more general phenomenon of 'graphism' – constituted an externalisation of human memory, which made the archiving of knowledge possible. The implications of writing and literacy are immense, and have been the object of numerous studies, and the three remarkable chapters Leroi-Gourhan devotes to the topic (219–66) are among his most prescient. But, from Leroi-Gourhan's morphological viewpoint, what is most significant about the invention of graphic symbolism is that it signified a 'subordination' of the hand to the mouth, and thus an entirely *new* relation among the three poles of his analyses. In oral societies, the graphic system is *independent* of the voice (drawing, art), and it was the alignment and subordination of the hand to the voice that ultimately allowed

writing to *supplant* the voice In *Anti-Oedipus*, Deleuze and Guattari examine Leroi-Gourhan's analyses of this new hand–voice–graphism relation in some detail, coupling it with Nietzsche's analyses in the *Genealogy of Morality*, in order to produce their concept of the 'magic triangle' (voice–audition, graphism–body and eye–pain) that characterises ancient despotic states.[52]

Third Pole: Rhythm (space and time)

Leroi-Gourhan does not turn to the third pole of his analyses until the last part of *Gesture and Speech*, which includes a phenomenologically oriented chapter entitled 'The Body as the Source of Values and Rhythms' (281–97). For most of the living world, he notes, time and space have no other reference than the body's visceral rhythms: waking and sleeping, digestion and appetite, heartbeat and breathing; the movement of bowels and the muscles, the organs of balance (the labyrinth of the ear), and so on. '*Hunger*, *balance*, and *motion* are the tripod upon which rest the higher reference senses of touch, smell, hearing, and sight' (289). But, as with the motor functions of the hand and mouth, these bodily rhythms are likewise externalised in 'a checkerwork of scales and measures', which ensconce human behaviour in 'a time and a space proper to humankind' (283). 'For thousands of years our favorite game has been to organize time and space in rhythms, in the calendar, in architecture' (288).[53] Leroi-Gourhan is quick to point out the complexities of this externalised, artificial rhythmicity. On the one hand, it tends to produce a 'rhythmic uniformization' or normalisation, 'the reduction of individuals to a conditioned crowd' (287). On the other hand, and more interestingly, the various 'techniques of the self', as Foucault termed them, found in domains such as religion and philosophy, are largely directed towards taking human beings *outside* their daily rhythmic cycles (284). 'Acrobatics, balancing exercises, the dance, are to a large extant the material expression of the attempt to break away from normal operating sequences' (286), and philosophy has always fed on the conquest of eternity as a suspension of these rhythms.

Deleuze appropriates two important themes from Leroi-Gourhan's analysis of rhythm. The first is the concept of the 'abstract line'. Deleuze and Guattari cite with approval Leroi-Gourhan's observation that 'rhythmic markings precede explicit figures'.[54] Primitive art, in other words, begins with these abstract and prefigurative lines that are derived from the rhythms of the body and the cosmos, and the

origins of art could not have been otherwise (188–90). 'Prehistoric art is fully art because it manipulates the abstract, though nonrectilinear, line' (TP 497). The second is the concept of rhythm itself, which comes to the fore in Deleuze's 1981 book, *Francis Bacon: The Logic of Sensation*. It is not simply that rhythm lies at the origin of prehistoric painting; Deleuze argues that rhythm is the essence of *all* painting. In Bacon's paintings, in particular, it is rhythm itself that becomes the characters, the objects and the Figures. Following Messiaen, Deleuze argues that, as in music, one can find three different types of rhythm in Bacon: a steady or 'attendant' rhythm, and then two other rhythms, a rhythm of crescendo or simplification (climbing, expanding, diastolic, adding value), and a rhythm of diminuendo or simplification (descending, contracting, systolic, removing value).[55]

Conclusion

We have simply presented here the broad outlines of the vision of human evolution developed by Leroi-Gourhan in *Gesture and Speech*. If there is one aspect of Leroi-Gourhan's analyses that Deleuze and Guatarri put in question, however, it is the notion of externalisation. There is a 'classic schema', they write, that sees 'the tool as the extension and projection of the living being', but they suggest that this schema has several drawbacks.[56] It presumes that technical artefacts have their origin in the body and are coupled with it, even though the body *itself* is constituted by a proto-technicity. In other words, the concept of externalisation neglects the determinative role that assemblages (*agencements*) in evolution, technological or otherwise. 'Functioning as a component part in conjunction with other parts [in an assemblage]', they write, "is very different from being an extension or a projection.'[57] In a sense, one could argue that Deleuze and Guattari created the concept of an assemblage as a corrective to Leroi-Gourhan's analyses, and it is sometimes presented as such by them.[58] The hand–tool pole is generalised into the concept of a *machinic assemblage of bodies*, or form of content, and the mouth–language pole is generalised into the concept of a *collective assemblage of enunciation* (regime of signs), or form of expression (ATP 88), with each of these poles characterised by vectors of de- and re-territorialisations. Evolution is itself a series of such de- and re-territorialisations, and as Deleuze and Guattari write, 'maps should be made of these things, organic, ecological, and technological maps [that] one can lay out on the plane of immanence' (ATP 61).

If *Gesture and Speech* can and should be read as a work of philosophy, and not simply palaeontology, it is because one of its achievements is to have vastly extended the scope of the philosophical enterprise. One of the great successes of the contemporary sciences is their development of techniques of *dating*, which have now provided us with what Serres calls the 'Grand Narrative' of the universe: the 'big bang' (if it occurred) took place 13.79 billion years ago; the Earth was formed 4.54 billion years ago; life (the first prokaryotes) began 3.5 billion years ago; the first hominids appeared 2 million years ago; and *Homo sapiens* made its appearance 200,000 years ago.[59] Though these dates will inevitably be modified, the development of this Grand Narrative means that the history of thought itself must be extended far beyond the origins of philosophy in Greece in the sixth century BCE. Among its many ambitions, *Gesture and Speech* was an early effort to attempt such a project, analysing the nature of thought and cognition in a context that must now span thousands and indeed millions of years.

Notes

1. See the article by Françoise Audouze, one of Leroi-Gourhan's students, 'Leroi-Gourhan, a Philosopher of Technique and Evolution', *Journal of Archaeological Research* 70:4 (Dec. 2002), pp. 277–306, which not only presents an overview of Leroi-Gourhan's career and contributions, but also analyses the difficulties that hindered the more general reception of Leroi-Gourhan's work outside his technical areas of specialisation.
2. Leroi-Gourhan's writings from this period have only recently been published as *Pages oubliées sur le Japon* (Grenoble: Jérôme Millon, 2004).
3. See Pierre Lemmonier, 'Leroi-Gourhan: ethnologue des techniques', in *Nouvelles de l'archéologie* 48/49 (1992), pp. 13–17.
4. André Leroi-Gourhan, 'Les fouilles d'Arcy-sure-Cure (Yonne)', *Gallia préhistoire* 4 (1961), pp. 1–16; André Lerois-Gourhan and Arlette Leroi-Gourhan, 'Chronologie des grottes d'Arcy-sur-Cure (Yonne)', *Gallia préhistoire* 7:1 (1964), pp. 1–64.
5. André Leroi-Gourhan and Michel Brézillon, *Fouilles de Pincevent: Essai d'analyse ethnographique d'un habitat magdalénien*, 2 vols (Paris: Éditions du CNRS, 1983); André Leroi-Gourhan, *Pincevent: Campement magdalénien de chasseurs de Rennes* (Paris: Ministère de

la Culture, 1984); and André Leroi-Gourhan and Michel Brézillon, 'L'habitation magdalenienne no. 1 de Pincevent près Montereau (Seine-et-Marne)', *Gallia préhistoire* 9:2 (1966), pp. 263–363.

6. See André Leroi-Gourhan, *Treasures of Prehistoric Art*, trans. Norbert Guterman (New York: Harry N. Abrams, 1967), a translation of *Préhistoire de l'art occidental: L'art et les grandes civilisations* (Paris: Lucien Mazenod, 1965); and André Leroi-Gourhan, *The Dawn of European Art: An Introduction to Palaeolithic Cave Painting*, trans. Sara Champion (Cambridge: Cambridge University Press, 1982), a translation of *I piu' antichi artisti d'Europe* (Milan: Jaca Book, 1980).
7. For a more nuanced assessment, see Oscar Moro Abadía and Eduardo Palacio-Pérez, 'Rethinking the Structural Analysis of Palaeolithic Art: New Perspectives on Leroi-Gourhan's Structuralism', *Cambridge Archaeological Journal* 25:3 (August 2015), pp. 657–72. Paul Graves discusses Leroi-Gourhan's reception in the English-speaking world in his interesting piece 'My Strange Quest for Leroi-Gourhan: Structuralism's Unwitting Hero', *Antiquity* 68: 259 (1994), pp. 438–41.
8. André Leroi-Gourhan, *Evolution et techniques*, vol. 1, *L'Homme et la matière* (Paris: Albin Michel, 1943), and vol. 2, *Milieu et techniques* (Paris: Albin Michel, 1945). The two volumes were reprinted in 1971 and 1973, with minor additions and modifications.
9. André-Leroi Gourhan, *Gesture and Speech*, trans. Anna Bostock Berger (Cambridge, MA: MIT Press, 1993). Page numbers for references to *Gesture and Speech* are included in the text in parentheses.
10. Jacques Derrida, *Of Grammatology* [1967], trans. Gayatri Chakravorty Spivak (Baltimore: Johns Hopkins University Press, 1977), pp. 83–6.
11. See, for instance, Leroi-Gourhan, *Gesture and Speech*, p. 58: 'All evolutionists agree that the stream upon which we are borne forward is *the* stream of evolution. Like the giant dinosaur, lichen, jellyfish, oysters and giant turtles are no more than spray from the central jet that gushes human-ward.'
12. Tim Ingold, '"Tools for the Hand, Language for the Face": An Appreciation of Leroi-Gourhan's *Gesture and Speech*,', *Studies in History and Philosophy of Biological and Biomedical Sciences* 30:4 (1999), pp. 411–53 (p. 416).
13. See Leroi-Gourhan, *Gesture and Speech*, p. 8: 'When Darwin's Origin of Species was published in 1859, it bore little relation to the barely nascent science of prehistory. Rather it marked the conclusion of the movement begun by Buffon. Like the eighteenth-century naturalists, Darwin – himself a naturalist, not a prehistorian or an anthropologist – grew from the subsoil of stratigraphic zoology, paleontology and contemporary zoology, for in the last analysis . . . humans can only be understood as part of a terrestrial totality. With Darwin, the encyclopedists' thirst was satisfied once and for all.'

14. See Leroi-Gourhan, *Gesture and Speech*, pp. 64–89. Leroi-Gourhan devoted a separate book to a detailed analysis of the development of the human skull: *Méchanique vivante: Le crâne des vertébrés du poisson à l'homme* [Living Mechanics: The Skull in Vertebrates from the Fish to Humans] (Paris: Fayard, 1983).
15. See Charles Darwin, *The Descent of Man*, 2nd edn [1879] (London and New York: Penguin Classics, 2004), chapter 5, 'On the Development of the Intellectual and Moral Faculties, during Primeval and Civilized Times', p. 153: 'In the rudest state of society, the individuals who were the most sagacious, who invented and used the best weapons or traps, and who were best able to defend themselves, would rear the greatest number of offspring.'
16. Friedrich Nietzsche, *Will to Power*, trans. Walter Kaufmann and R. J. Hollingdale (New York: Random House, 1967), §532, 289; cf. §489, 270.
17. See Ernst Kapp, *Grundlinien einer Philosophie der Technik: Zur Entstehungsgeschichte der Kultur aus neuen Geschichtspunkten*) [Principles of a Philosophy of Technology: Towards a History of Culture from New Viewpoints] (Braunschweig: George Westermann, 1877). French translation: Ernst Kapp, *Principes d'une philosophie de la technique*, trans. Grégoire Chamayou (Paris: Vrin, 2007). For Kapp, the necessity for technics derives from man's organ deficiencies, and he distinguished between the principles of organic relief (*Organentlastung*), organic substitution or replacement (*Organersatzes*) and organic strengthening or improvement (*Organüberbeitung*). Kapp's work seems to have entered France through Alfred Espinas's *Étude sociologique: les origines de la technologie* (Paris: Félix Alcan, 1897). Neither Leroi-Gourhan nor Deleuze cite Kapp or Espinas. Konrad Lorenz similarly suggested that 'a behavior pattern can be treated as an anatomical organ' (cited in Richard Dawkins, *The Extended Phenotype* [Oxford: Oxford University Press, 1982], p. 2).
18. Marshall McLuhan, *Understanding Media: The Extensions of Man* [1964], critical edition edited by W. Terrence Gordon (Berkeley: Ginko Press, 2013). For an overview of the idea that technology is an 'order of extension', see David Rothenberg, *Hand's End: Technology and the Limits of Nature* (Berkeley: University of California Press, 1995), chapter 3, 'Extension's Order', pp. 28–53.
19. See Michel Serres, *Rameaux* (Paris: Pommier, 2004), pp. 179–80. In viviparous animals, such as mammals, by contrast, the embryo is reintegrated into the maternal body, and the fixed stock of nourishment in the egg is changed into a secretion from the breast, which varies according to demand.
20. Stephen J. Gould, *Wonderful Life: The Burgess Shale and the Nature of History* (New York: W. W. Norton, 1990).

21. Henri Bergson, 'Life and Consciousness', in *Mind-Energy*, trans. H. Wildon Carr (London: Macmillan, 1920), pp. 1–28 (p. 7).
22. This argument applies equally to plant life. See Stefano Mancuso and Allessandra Viola, *Brilliant Green: The Surprising History and Science of Plant Intelligence*, trans. Joan Benham, foreword by Michael Pollan (Washington, DC: Island Press, 2015). Plants are not 'individuals' (*in*, 'not' + *dividuus*, 'divisible'), since even if a plant is cut in half, the two parts can still live independently (p. 36), in part because plants have not localized their life functions in organs ('they can see without eyes, taste without taste buds, smell without a nose, and even digest without a stomach' [p. 73])
23. Renaud Barabas, 'Vie et extériorité: le problème de la perception chez Ruyer', *Les Études philosophiques* 80:1 (2007), pp. 5–37 (25), citing Raymond Ruyer, *Éléments de psychobiologie* (Paris: Presses universitaires de France, 1946), p. 22. See also Raymond Ruyer, 'Le paradoxe de l'amibe et la psychologie', *Journal de psychologie normale et pathologique*, July–Dec. 1938, pp. 472–92; and 'Du vital au psychique', in *Valeur philosophique de la psychologie*, Treizième semaine de synthèse (Paris, Presses universitaires de France, 1951).
24. Richard Dawkins, *Climbing Mount Probable* (New York and London: W. W. Norton, 1996), pp. 138–9.
25. Karl Marx, *Capital: A Critique of Political Economy*, vol. 1, trans. Ban Fawkes (London: Penguin, 1990), chapter 15, 493n., as cited in Bernard Steigler, *Technics and Time 1: The Fault of Epimetheus* [1994], trans. Richard Beardsworth and George Collins (Stanford: Stanford University Press, 1998), p. 26.
26. See Steigler, *Technics and Time 1*, p. 1.
27. James L. Gould and Carol Grant Gould, *Animal Architects: Building and the Evolution of Intelligence* (New York: Basic Books, 2012).
28. Dawkins, *The Extended Phenotype*, p. 200. Dawkins notes that these externalised organs sometimes assume persistent genetic idiosyncrasies: 'One female *Zygiella-x-notata* was seen to build more than 100 webs, all lacking a particular concentric ring' (pp. 198–9).
29. See, for instance, Richard Lewontin, 'Organism and Environment', in *The Triple Helix: Gene, Organism and Environment* [1998] (Cambridge, MA: Harvard University Press, 2000), pp. 41–68.
30. TP 51. Deleuze and Guattari have proposed a complex concept of the 'milieu': 'the living thing has an *exterior* milieu of materials, an *interior* milieu of composing elements and composed substances, an *intermediary* milieu of membranes and limits, and an *annexed* [or *associated*] milieu of energy sources and actions-perceptions' (TP 313).
31. Jacob von Uexküll, *A Foray into the Worlds of Animals and Humans* [1934], trans. Joseph D. O'Neill (Minneapolis: University of Minnesota Press, 2010), pp. 44–5. See TP 51.

32. Serres, *Rameaux*, pp. 175–6.
33. Kevin Kelly, *What Technology Wants* (New York: Penguin, 2010), pp. 11–12.
34. See, for instance, the title of James Gleick's book, *Faster: The Acceleration of Just about Everything* (New York: Vintage, 2000).
35. Michel Serres, *L'Hominescence* (Paris: Éditions Le Pommier, 2001).
36. For three instances of this claim, see Ralph Holloway, 'Culture, a Human Domain', *Current Anthropology* 10 (1969), pp. 395–412; Jacques Pelegrin, 'A Framework for Analyzing Prehistoric Stone Tool Manufacture and a Tentative Application to Some Early Stone Industries', in A Berthelet and J. Chavaillon (eds), *The Use of Tools by Humans and Non-Human Primates* (Oxford: Clarendon Press, 1993), pp. 302–14; and Thomas Wynn, *The Evolution of Spatial Competence* (Urbana: University of Illinois Press, 1989).
37. Gary Tomlinson, *A Million Years of Music: The Emergence of Human Modernity* (New York: Zone Books, 2016), pp. 57, 60.
38. Tomlinson, *A Million Year of Music*, p. 52. On the 'archaeology of mind', see Lambros Malafouris, *How Things Shape the Mind: A Theory of Material Engagement* (Cambridge, MA: MIT Press, 2013).
39. André Leroi-Gourhan, *The Hunters of Prehistory* [1983], trans. Claire Jacobson (New York: Atheneum, 1989), p. 48. See pp. 59–60: 'The tool itself sums up and keeps alive for us the thoughts of all preceding generations.'
40. Tomlinson, *A Million Years of Music*, p. 61.
41. Tim Ingold, 'The Temporality of the Landscape', in *The Perception of the Environment: Essays on Livelihood, Dwelling, and Skill* (London: Routledge, 2000), pp. 189–208
42. Tomlinson, *A Million Years of Music*, p. 69.
43. See *A Thousand Plateaus*, chapter 5 ('On Several Regimes of Signs') (TP 111–48).
44. Karl Popper, *Objective Knowledge: An Evolutionary Approach*, rev. edn (Oxford: Oxford University Press, 1972), p. 37.
45. Donald T. Campbell, 'Evolutionary Epistemology', in *The Philosophy of Karl Popper*, ed. Philip Schilpp (LaSalle: Open Court, 1974), pp. 412–63.
46. Raymond Ruyer, *L'Animal, l'homme, la function symbolique* (Paris: Gallimard, 1964), p. 97.
47. See Jesper Hoffmeyer, *Biosemiotics: An Examination into the Signs of Life and the Life of Signs*, ed. Donald Favareau (Scranton, PA: University of Scranton Press, 2009), and Steven Rose, *The Chemistry of Life*, 4th edn (London: Penguin Books, 1999).
48. E. O. Wilson was one of the pioneers in the study of ants and their chemical semiotics. Among his many works, see *The Insect Societies* (Cambridge, MA: Harvard University Press, 1971) and *The Ants*,

with Bert Holldobler (Cambridge, MA: Harvard University Press, 1990).

49. In this, Leroi-Gourhan is perhaps following the lead of the Société de linguistique de Paris, which, in 1865, famously informed its members that it would no longer accept 'any submissions concerning the origin of language' in order to avoid sterile quarrels and eccentric theses.
50. See also pp. 88–9: 'Bipdeal posture and a free hand automatically imply a brain equipped for speech.'
51. See Eric A. Havelock, *Preface to Plato* (Cambridge, MA: Harvard University Press, 1963), especially chapter 9, pp. 145–64; Walter J. Ong, *Orality and Literacy: The Technologizing of the Word* (London and New York: Routledge, 1982); and Jack Goody, *The Interface between the Written and the Oral* (Cambridge: Cambridge University Press, 1987).
52. See AO 202–4.
53. For an accessible analysis of externalised systems of measurement, see Robert P. Crease, *World in the Balance: The Historic Quest for an Absolute System of Measurement* (New York: Norton, 2011).
54. Leroi-Gourhan, *Gesture and Speech*, p. 372, cited TP 574 n. 33.
55. See FB chapter 9.
56. Gilles Deleuze and Félix Guattari, 'Balance-sheet for "Desiring-Machines"', in Félix Guattari, *Chaosophy: Texts and Interviews, 1972–1977*, ed. Sylvère Lotringer and trans. David L. Sweet, Jarred Becker and Taylor Adkins (New York: Semiotet(e), 1992), p. 92.
57. Ibid.
58. See TP 60: 'Leroi-Gourhan's analyses give us an understanding of how contents came to be linked with the hand-tool couple and expressions with the face-language couple.' (See also TP 64, 302.)
59. Michel Serres, *L'Incandescent* (Paris: Pommier, 2003), pp. 9–62.

Henri Maldiney

Ronald Bogue

In his writings on painting, Deleuze makes use of a number of commentators on art, including Hubert Damisch, Mikel Dufrenne, Elie Faure, Henri Focillon, Michael Fried, Clement Greenberg, Maurice Merleau-Ponty, Aloïs Riegl, Heinrich Wölfflin and Wilhelm Worringer. But perhaps the most important influence on his approach to painting is Henri Maldiney. Such a claim might seem exaggerated, were one to judge Maldiney's impact by the number of times Deleuze cites his work, or by the proximity of Maldiney's thought to Deleuze's. Only upon consultation of *Regard Parole Espace* (Gaze Speech Space), the sole publication of Maldiney's cited by Deleuze, does the significance of Maldiney become evident. Here one finds not only a profound meditation on art but also a source book of commentators and citations upon which Deleuze draws, as well as a history of painting whose broad outlines Deleuze makes use of in his own works.

Born 4 August 1912 in Meursault (in the Côte d'Or region), Maldiney began his studies in philosophy at the Lycée du Parc in Lyon. In 1933 he was admitted to the École normale supérieure in the rue d'Ulm in Paris, where he wrote a thesis on Fichte under the direction of Léon Brunschvicq. After completing his *agrégation* in philosophy in 1937, he taught briefly at the Briançon *lycée* before being inducted into the army in 1939. He was captured by the Germans in 1940 and spent the remainder of the war in a prison camp. There, he was able to study key texts of Husserl and Heidegger, most notably Heidegger's *Sein und Zeit*. After the war, he secured a position in the École des hautes études at the University of Ghent in Belgium, where his primary duties were teaching literature. In 1947 he met the painter Elsa Vervaene, who soon became his wife, and Jacques Schotte, one of his students, who introduced Maldiney to Ludwig Binswanger and Roland Kuhn, proponents of Dasein analysis. This encounter initiated Maldiney's lifelong interest in psychoanalysis and psychiatry and his interaction with such notable figures as Eugène