



'Tools for the Hand, Language for the Face': An Appreciation of Leroi-Gourhan's *Gesture and Speech*

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At the heart of contemporary thinking about human evolution lies a deep and still unresolved problem. It concerns the very conception of what the human being *is* whose evolution we set out to explain. Is it a purely zoological entity, bounded physically by the skin and intellectually by the skull? Or does the essence of *human* being, as opposed to the being of non-human kinds, lie in a transcendence of the zoological, in the fields of our social involvement—mediated by words—with other people, and of our technical involvement—mediated by tools—with the material environment? We might agree that the hand, as a bodily organ, and language, as a capacity of mind, are distinctively human characteristics. But the hand is a hand only in its activities of manipulation, and the language capacity, likewise, exists only by way of its instantiation in speech. How, then, can we hope to give an adequate account of the evolution of the hand, or of language, in terms of a theory that looks *inside* the organism for the definitive specifications of humanity, that is to its genetic endowment, to the exclusion of its involvement in wider fields of relationship? If, to the contrary, it is precisely in these fields of involvement—extending beyond the bounds of the individual organism—that human being resides, then a theory of human evolution cannot simply be a theory of the evolution of the *species*. What might a more inclusive theory, that would accommodate the social and technical along with the zoological dimensions of human existence, look like?

One possible answer is elaborated in an extraordinary volume by the French anthropologist André Leroi-Gourhan. First published in 1964 under the title *Le Geste et la parole*, this book is the culmination of Leroi-Gourhan's ambitious

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attempt to construct a synthetic account of human evolution that would span the fields of anatomy, physiology, technology, sociology and art history. Until a few years ago, however, the book remained little known outside the francophone world. For unlike his compatriot, contemporary and erstwhile colleague, Claude Lévi-Strauss,¹ whose work soon gained international recognition and was translated into many languages, Leroi-Gourhan's reputation abroad has been curtailed by the circumstance that, of his long list of publications, the only significant one to have previously appeared in English translation was his *Préhistoire de l'art occidental* (Leroi-Gourhan, 1965). Due to the wide circulation of this work, he is principally known outside France as an exponent of the structuralist method in the analysis of Palaeolithic art. Yet in his home country, it was largely thanks to his work and influence that the branch of anthropological inquiry known there as technology—that is, the comparative study of techniques (Sigaut, 1985)—came to be so well established. To read *Le Geste et la parole*, however, is to realise that Leroi-Gourhan's contribution extended far beyond questions of art and technology, to embrace a vision of human development of quite breathtaking scope.

In 1993, the book was published in a superb English translation by Anna Bostock Berger, as *Gesture and Speech* (Leroi-Gourhan, 1993 [1964]). Now that it has been made available to an anglophone readership, its real significance stands to be more widely appreciated. It is not an easy book to digest, however, and the brief introduction to the translation by archaeologist Randall White, though helpful, comprises no more than a biographical sketch, a summary of some of the more important themes of the book, and a list of specific points on which Leroi-Gourhan's speculations have been disproved by subsequent discoveries. The present article, which is the result of my own attempts to make sense of *Gesture and Speech*, is intended to introduce Leroi-Gourhan's ideas by way of a more extensive, and intensive, critical engagement. It is not, however, an attempt at intellectual biography. To trace Leroi-Gourhan's career, and the many influences that have shaped his work, would require a separate project of research, which I am not presently equipped to undertake.² Nor do I follow through the history of Leroi-Gourhan's thinking in

¹Both men were, for a time, assistant directors of the Musée de l'Homme in Paris. Perhaps more importantly, in intellectual and institutional terms, they were colleagues at the Collège de France.

²The bare facts are these: Leroi-Gourhan lived from 1911 to 1986. He took his first degree in Russian (1931) and another in Chinese (1933), after which he went on to study for the 'Certificat d'Ethnologie' under Marcel Mauss. In 1937 he embarked on two years of ethnological research and collection in Japan, including work among the Ainu people, cut short by the impending outbreak of the Second World War. During the War he completed his major work, *Évolution et techniques*, published in two volumes: the first, *L'Homme et la matière*, in 1943, the second, *Milieu et techniques*, in 1945 (Leroi-Gourhan, 1971, 1973). In 1944 he completed his doctorate on the archaeology of the North Pacific. He was appointed assistant director of the Musée de l'Homme in 1946. Besides teaching during the subsequent years in both Paris and Lyon, he established a programme of archaeological excavations, particularly at the site of Arcy-sur-Cure, in the province of Yonne in central France, with its rich Mousterian and Upper Palaeolithic deposits. In 1954 he defended a thesis on vertebrate mechanics which, though not published for another thirty years, laid much of the groundwork for the first part of *Le Geste et la parole* (Leroi-Gourhan, 1983). For further biographical details, see special issues of the

the works that led up to *Gesture and Speech*. My discussion, then, focuses entirely on this one book. But besides offering an appreciation of the book, I do have another purpose in mind. This is to show how reading between the lines of Leroi-Gourhan's text might lead us to rethink some of our most fundamental ideas concerning the relations, in the evolution of human anatomy, between brain and body; in the evolution of techniques, between perception and action; in the evolution of language, between speech and writing; and in the evolution of art, between imagination and practice.

Roughly following the order in which these themes appear in the book, I begin with an outline of Leroi-Gourhan's understanding of the connection between technicity and language as a specific instance of the general relation between hands and face, consequent upon the evolution of bipedal locomotion. At a critical juncture, he argues, technicity was 'liberated' from the evolved architecture of the species, leading to an increasing disproportion between the powers of technology and human intellect. Rejecting the conventional dichotomy between intelligence and instinct, Leroi-Gourhan introduces the notion of 'mechanical operations', governed by programmes installed in social memory, which are neither genetically transmitted nor under explicit conscious control. Much routine human behaviour, he suggests, falls into this category, as distinct from the behaviour of animals which flows from 'species-related' memory and is 'automatic'. But these distinctions are highly problematic, and are rooted, as I shall show, in Leroi-Gourhan's understanding of the process he calls 'exteriorisation', manifested in the history of technology in the transition from skilled handling to machine automation. On one reading, Leroi-Gourhan is concerned to overturn the conventional ranking of intellectual over technical operations without questioning the distinction between them; on another, however, he appears to do just that, and to show that intelligence lies in the gesture itself, as a synergy of human being, tool and raw material. The same ambiguity is evident in his treatment of the history of writing, which he regards as a process of exteriorisation, in the domain of language, precisely equivalent to that which lies in the domain of technical operations. Finally, turning to the domain of aesthetics, I take a critical look at the argument by which Leroi-Gourhan equates exteriorisation with a move, in the history of art, from the abstraction of concrete elements to the realism of representational images, produced by a few for mass consumption.

1. Evolving from the Feet Upwards

The brain of the human being, compared with those of other mammals, is very large; compared with what would be expected for mammals of our size, it is massive (Gould, 1980, pp. 181–184). How did it get to be so big? One answer goes

back to Darwin. In *The Descent of Man*, Darwin had argued that individuals with bigger and better brains, being ‘the most sagacious’, could design more ingenious tools and strategies of subsistence. This, in turn, would give them a reproductive advantage, ensuring that intelligence-enhancing variations, more abundantly preserved in future generations, would be notched up in the course of natural selection (Darwin, 1874, p. 196). Leroi-Gourhan, however, adopts a quite different approach. Dismissing the ‘cerebral’ view of evolution as a mistake—though one that has its source in a longstanding philosophical bias in favour of mental over bodily operations—he insists that mobility, not intelligence, should be regarded as ‘the significant feature of evolution towards the human state’ (p. 26).³ The argument by which he arrives at this conclusion, reduced to its bare essentials, runs as follows.

Granted that brain size correlates, on a gross level, with intelligence, it is nevertheless the case that the brain has to fit inside a hard protective covering—the skull. And the skull is part of an apparatus of muscle and bone that must be able to support itself and get around in an environment if the creature in question is to survive at all. However a skull of human size and proportion, attached to a backbone—as in quadrupedal mammals—that is at least somewhat inclined to the horizontal, would be a mechanically unworkable combination. Indeed the only way of carrying such a skull is perched atop a vertebral column that is more or less vertical. But the converse argument also applies: a skull designed to balance on a vertical support would have to be foreshortened at the front (including the face and dental arch) but considerably extended over the convex ‘roof’ of the cranium. Viewed in transverse section, this extension appears much like the opening up of a fan, and it has the effect of greatly expanding the volume available for occupation by the brain, above all in the region of the middle cortex (Fig. 1).

If it be supposed that the size of the brain, in an adult individual, is a direct function of the cranial volume available for it to fill, then it must follow that the enlargement of the brain is an effect not of selective pressures to increase intelligence but of the shift to the vertical of the vertebral column associated with the adoption of upright posture. After all, so long as additional brain power takes up more room, it cannot be increased unless the skull can be enlarged to accommodate it. Bigger-brained creatures may indeed be smarter, but the intellectual advance is a consequence, not a cause, of brain enlargement—an incidental by-product of a more fundamental evolutionary change in posture. Yet posture, understood as a certain disposition of body and limbs, is not a fixed state of the organism but rather represents a point of dynamic equilibrium constituted within a rhythmic pattern of movement. In humans, this is above all the movement of walking on two feet. To understand the evolution of humanity we have therefore to begin with the feet instead of with the brain. Or, more precisely, we have to start from locomotion

³This and all subsequent page references, where not otherwise indicated, are to the English translation of *Gesture and Speech* (Leroi-Gourhan, 1993 [1964]).

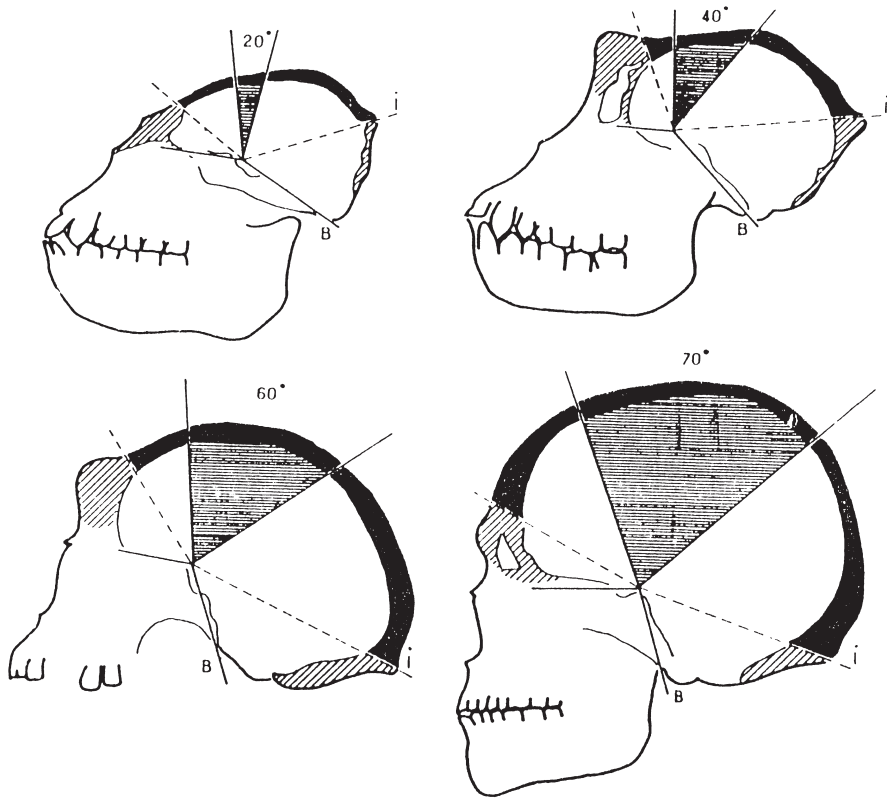


Fig. 1. The opening up of the 'cortical fan' (shaded area), illustrated through a cross-sectional comparison of the skulls of the colobus monkey (top left), the gorilla (top right), the archaic hominid or 'Palaeoanthropian' (bottom left) and *Homo sapiens* (bottom right).
Extracted from Leroi-Gourhan's Figure 42 (p. 77).

rather than cognition, from the body's capacities of habitual movement rather than the brain's powers of intelligent problem-solving.

Leroi-Gourhan's emphasis on human beings as creatures who make their presence felt through their embodied practices, whether technical, linguistic or aesthetic, runs through the entire corpus of his work. Unlike the *Homo sapiens* of the orthodox Darwinian account of human evolution, whose essential nature appears to be specified as a legacy from its evolutionary antecedents, independently and in advance of its life in the world, Leroi-Gourhan's humans are continually up to something, whether using tools, talking, gesticulating, writing, or just walking around. It is in these activities or 'operational sequences' that their humanity subsists, and in the forms generated in and through such sequences—bodily, artefactual, symbolic—that the story of human evolution unfolds. Just how Leroi-Gourhan would position his ideas in relation to Darwinism is none too clear: his remarks on the subject are limited to the rather oblique comment that far from inaugurating

a new era in science, Charles Darwin's *The Origin of Species* brought an old one—the movement in natural history begun by the Comte de Buffon—to its final conclusion (p. 8). There seems no doubt, however, that Leroi-Gourhan's intellectual roots lie less with Darwin than with the great exponents of comparative morphology such as Etienne Geoffroy Saint Hilaire and Georges Cuvier. Their works, not Darwin's, figure in his bibliography, and their strategy of seeking a unity in the world of organisms by exploring the logical space of possible transformations in the relations between morphological components, rather than Darwin's of looking for unity in the tree of phylogenetic connections, dominates Leroi-Gourhan's exposition.

In pursuit of this strategy, Leroi-Gourhan proceeds by setting up a series of divisions and subdivisions among animal species, based on formal principles of morphology. First there is the division between the radial symmetry of stationary species (such as the sea anemone) and the bilateral symmetry of mobile species. In all creatures of the latter type there is a polarisation between front and rear, such that the more complex operations of bodily positioning, orientation, and food capture are all located in the front, or 'anterior field'. The next division is made in the anterior field between the head and the forelimbs, and this provides the basis for the classification of vertebrates as either 'walkers' (such as the ungulates) whose forelimbs are used, along with the hindlimbs, exclusively for locomotion, and 'graspers' (such as rodents, many carnivorous mammals, and also primates) whose forelimbs participate actively in the operations of the anterior field. Among the latter the division between head and forelimb establishes a complementary opposition between the 'facial pole' and the 'manual pole'. It is this opposition that really forms the point of departure for Leroi-Gourhan's entire theory of human evolution. For it is, in effect, a theory of the changing relations between face and hands in the suite of activities belonging to the anterior field of responsiveness.

These changes are traced through a series of so-called 'liberations'. First of all, of course, there is the liberation of the head, which allows it to move relatively freely of the rest of the body to which it is connected by the neck. This is what distinguishes a reptile such as the lizard, for example, from a fish. Next comes the development of erect quadrupedal locomotion, and with it the distinction between walkers and graspers, setting the stage, among the latter, for the liberation of the hands (or paws) and forelimbs, which are able to take on many of the prehensile functions previously fulfilled by the head, or more particularly the jaws and teeth. Yet so long as the animal moves on all fours, the hands can be only temporarily free during those periods when it is at rest. Not until the development of erect posture were the hands fully liberated. No longer tied up in the mechanisms of locomotion and bodily support, they could take on the whole gamut of gripping and grasping operations entailed in the manipulation of environmental objects, including those that could be regarded as tools, both while stationary and on the move. In short, the liberation of the hands laid the foundation for what Leroi-

Gourhan calls 'technicity'. But this also had the effect of liberating the face from the grasping function. Unencumbered by the massive dental apparatus needed for the direct extraction of plant or animal food, the face was free to participate to the full in that most distinctive of human accomplishments, speech.

Thus the entire sequence of liberations, running all the way from fish to humans, culminates in the complementarity of speech and technicity. Leroi-Gourhan was not, of course, the first to suggest an intimate connection between the dexterity and versatility of human handiwork and the distinctive properties of verbal communication.⁴ Yet his approach remains unusual, perhaps even unique, in the way in which the connection is conceived: not as a fortunate conjuncture embedded in the particular circumstances of variation and selection shaping hominid phylogeny, but as the final resolution of a structural opposition which, in Leroi-Gourhan's own words, is 'as old as the vertebrates themselves'—namely between face and hand as complementary foci of the anterior field. 'Tools for the hand, language for the face, are twin poles of the same apparatus' (pp. 19–20). They emerged together, along with bipedal locomotion, erect posture, and the enlargement of the brain that these made possible.

There is, in Leroi-Gourhan's account, a certain inevitability about the whole process, and it comes as no surprise to find him endorsing a resolutely orthogenetic view of evolution:

All evolutionists agree that the stream upon which we are borne forward is *the* stream of evolution. Like the giant dinosaur, the lichen, jellyfish, oyster and giant turtle are no more than spray from the central jet that gushes human-ward. (p. 58)

Whatever the prevailing opinion might have been at the time when Leroi-Gourhan was writing, it would be hard today to find any evolutionist in agreement with such a manifestly anthropocentric view! One can detect, in this somewhat effusive passage, echoes of the philosophy of Henri Bergson, or, more notoriously, of the palaeontology of Teilhard de Chardin, to whom Leroi-Gourhan makes not infrequent, if sometimes critical, reference. We do not, however, have to succumb to such a view in its entirety in order to appreciate the explanatory potential of an approach that would situate the relation between technicity and language within the space of logical possibilities framed by the opposition between manual and facial poles of the anterior field, nor to appreciate the productiveness of thinking of the evolutionary process as an exploration of these possibilities. As we shall see, it is an approach that can be profitably extended to the study of writing and even of modern audiovisual technologies.

I shall return to these issues later on. At this stage, however, there is one further liberation to be considered—the final one of all. For the greater part of human evolution, Leroi-Gourhan tells us, technicity remained 'merely a zoological fact'

⁴Hewes (1993) reviews the early literature on this topic. For a discussion of more recent work on the evolutionary relationship between tool-using, toolmaking and language, see Ingold (1994).

(p. 106). But at a certain critical juncture, it broke free from its ties to the organism and began to lead a life of its own, beyond the bounds of its natural underpinning, undergoing development at a rate greatly in excess of anything previously experienced. This breakthrough coincided with the substitution of the social group for the species as the primary locus of human being, or with the transition—as Leroi-Gourhan is wont to express it—from the zoological to the sociological. The final liberation, then, was also an exteriorisation, which had the effect of ‘placing outside ourselves what in the rest of the animal world is achieved *inside* by species adaptation’ (p. 235). It was, in other words, a matter not of securing additional degrees of freedom within nature, but of achieving freedom of a kind *from* nature. It is to this liberation that I now turn.

2. The Liberation of Technology

One of the greatest enigmas of prehistoric archaeology is a particular kind of stone implement. Of pointed oval shape, and a size that fits nicely in the palm of the hand, it has two convex faces that meet at a sharp edge all round (Fig. 2). Conventionally known as bifaces, these remarkable objects have been found across the three continents of Africa, Europe and Asia in sites spanning a period of over a million years. What is most perplexing about them is the constancy of their form. Not only does it stand in marked contrast to the differentiation and diversification of artefactual forms evident in the archaeological record from the Upper Palaeolithic onwards, but it is also unlike anything attested in the annals of ethnology. As Leroi-Gourhan notes, whereas the biface ‘remained unchanged for several hundreds

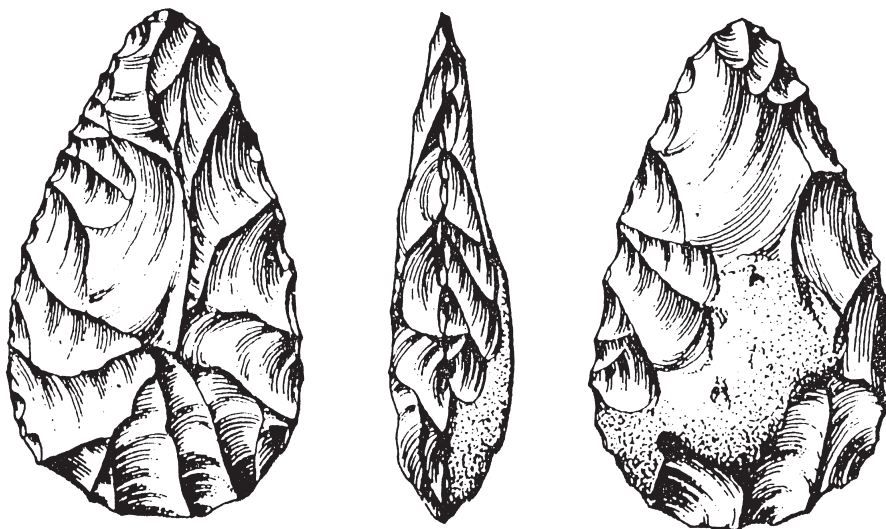


Fig. 2. The biface: front, back and side view. Extracted from Leroi-Gourhan's Figure 47 (p. 96).

of thousands of years from Great Britain to Southern Africa, more than two hundred variants of the twenty main types of tools existed in Western Europe alone during the twenty thousand years of the Upper Palaeolithic' (p. 144). To be sure, more recent research has revealed that bifaces from different regions and periods are not quite as similar as they appear at first glance, and evidence is emerging for a degree of regional variation as well as diachronic change in biface morphology and manufacture. Moreover, experimental studies and microwear analysis have revealed some clues about the possible uses of these objects, ranging from animal butchery to wood-cutting and digging. Yet the basic form of the biface does not seem to be specifically adapted to any of these functions. The relative stability of this form, compared to what came later, and its persistence over an immense span of time, remain a source of puzzlement.

Now we are inclined to think of the tools of contemporary human beings as products of intentional design, as though their makers first 'saw', in their mind's eye, the form of the completed object, and then set to work to execute it in the material. The same could hardly be said, however, of the executive equipment of our bodies. Surely my hands and teeth, for example, were not made, they simply grew, according to a design that forms part of an overall body plan established in the evolution of the species to which I belong. We would say the same of the claws of the lion, or the beak of the finch. But what of those constructions, such as the spider's web or the weaverbird's nest, that are not physically joined to the bodies of the animals that produced them but are nevertheless the products of their activity? They do not exactly grow of their own accord, nor are they made in the sense of following the directions of a preconceived project. Perhaps we could say that they are executions, but of a design which, like that of the animal's bodily architecture, is tied to its essential, species-specific nature. If so, it must follow that any change in the form of these constructions can only come about by way of corresponding change in the organism—that is, through its own evolution.

What, then, are we to make of the biface? Obviously, stone implements do not literally grow on the body like hands and teeth. At issue is the detachment not of the tool from the body, but of the *design* of the tool from the body plan. Could it be that the form of the biface was as much an expression of the essential nature of archaic hominids as the shape of the skull, the arrangement of the teeth and the skeletal architecture of the hand? In that event, one could speak just as well of the evolution of the tools as of that of the anatomy or behaviour of the creatures with whose fossilised remains they are associated. And this is precisely the conclusion to which Leroi-Gourhan moves. In his rather idiosyncratic terminology which, even at the time of writing, was already obsolete, the biface-makers are called Arch-anthropians; their predecessors, associated with the cruder implements of flaked stone conventionally known as 'choppers', are called Australanthropians. In each case, Leroi-Gourhan insists, the forces that fix or stabilise the forms of the 'natural organs' of the body should also stabilise those of the 'artificial organs', namely

stone tools, such that each conforms to an identifiable stereotype (p. 91). The Australanthropians, he observes,

seem to have possessed their tools in much the same way as an animal has claws. They appear to have acquired them, not through some flash of genius which, one fine day, led them to pick up a sharp-edged pebble and use it as an extension of their fist . . . , but as if their brains and bodies had gradually exuded them. (p. 106)

When it comes to the Archanthropians, the situation is little different. Their tools ‘were still, to a large extent, a direct emanation of species behavior’ (p. 97). Perhaps the manufacture of bifaces called for more intelligence than the production of choppers, but—Leroi-Gourhan continues—there can have been ‘only very few Archanthropians of genius, for the industrial stereotype remained unchanged for several hundreds of thousands of years’. Considering their technicity, we are still in the realm of zoology (p. 98).

In an important passage, Leroi-Gourhan ponders the distinction between the technical and the intellectual and wonders whether tools and techniques can really be regarded as products of thought or ‘things of the intellect’ at all. ‘The techniques of the Australanthropians and Archanthropians seem, in their very long development, to have obeyed the rhythm of biological evolution; chopper and biface seem to form part of the skeleton, to be literally “incorporated” in the living organism’ (p. 106). It is as though technical activity oozed from the body and congealed in the forms of the objects it brought into being. Indeed elsewhere, Leroi-Gourhan actually speaks of tools as ‘a “secretion” of the anthropoid’s body and brain’ (p. 91). Remarkably, Darwin had on one occasion used exactly the same metaphor to refer to the relation between the brain and its intellectual products. Thought, Darwin wrote in one of his notebooks, is but ‘a secretion of the brain’.⁵ That Leroi-Gourhan had recourse to a similar image may be purely coincidental; nevertheless the contrast between his and Darwin’s use of this imagery neatly encapsulates the difference between their respective conceptions of technicity—in the one case as an index of intellectual accomplishment, in the other as literally embodied in the *modus operandi* of the organism. For Darwin the brain secretes the thought, which in turn is realised in the form of the tool. For Leroi-Gourhan, to the contrary, conscious thought is bypassed, such that the tool is a direct secretion of brain and body combined.

It is difficult, however, to look upon the biface, with its regularity of form and

⁵The full passage in which the phrase appears reads as follows:

Why is thought being a secretion of the brain, more wonderful than gravity a property of matter? It is our arrogance, it [*sic*] our admiration of ourselves (cited in Gruber, 1974, p. 451).

The source of the metaphor of secretion may have lain in the work of the French philosopher and physiologist Pierre-Jean-Georges Cabanis who, in his *Rapports du physique et du morale de l’homme* (published in 1802), had claimed that the brain secretes thought as the liver secretes bile. Cabanis’ radical materialism would doubtless have appealed to Darwin. But whether Leroi-Gourhan drew on the same source is impossible to say.

properties of symmetry, and not see in it the realisation of deliberate, self-conscious design. As Ralph Holloway long ago pointed out, the bifacial form does not appear to be in any way prefigured in the raw material—consisting of naturally irregular blocks of stone—or in the knapper's relation to it. If the form is thus arbitrary, and imposed upon the material, where could it reside except in the minds of makers, in a symbolically encoded, socially transmitted tradition (Holloway, 1969)? On the basis of experimental attempts to master the skills of biface-making, Jacques Pelegrin comes to much the same conclusions. The regularity and symmetry of the biface, he argues, furnish the clearest possible evidence that its makers were guided by a 'pre-existing mental image . . . deserving of being termed a "concept"' (Pelegrin, 1993, p. 310). And Thomas Wynn (1989) has likewise shown that to conceive and execute a finely crafted biface such as the one illustrated in Fig. 2, which is symmetrical about a midline in plan, profile, and all possible cross sections, calls for a sophisticated grasp of spatial concepts fully equivalent to that of a modern adult human. In the process of final trimming, for example, the knapper would have had to be sure that by modifying one cross-section he would not be spoiling the balance of others which could not be simultaneously observed from the same point of view. 'These unobservable cross sections must have been purely mental constructs' (Wynn, 1989, p. 91). In short, like any modern artisan, the Archanthropian biface-maker must surely have started work with a model or representation of some kind, in the imagination, of the object to be produced.

This, indeed, is what Leroi-Gourhan tells us. Flatly contradicting his own assertions to the contrary, cited above, he insists that the shape of the biface 'must be pre-existent in the maker's mind', whence it governs the choice of the lump of stone from which it will be made, and the successive operations of flaking. All of this calls for an intelligence that 'was already highly complex' (p. 97). But if that is so, if the Archanthropians were 'excellent artisans capable of visualising the future shape of their bifaces . . . in a lump of raw stone' (p. 141), why were they so constrained in what they could produce? Why could they not visualise alternative forms, or realise them in other materials (such as bone), as did their successors from the Upper Palaeolithic to the present day? Though Leroi-Gourhan asks the question, he fails to answer it, weakly excusing his failure on the difficulty we all have, with our *Homo sapiens* brain, of understanding the intellectual life of a creature whose mind ran along lines so different from ours (p. 141).

Like many prehistorians before and since (for example, Holloway, 1969; Gowlett, 1984; Wynn, 1989; Pelegrin, 1993; Schick and Toth, 1993; Noble and Davidson, 1996), Leroi-Gourhan seems to be caught in a double bind. If, on the one hand, we regard the form of the biface to be as closely bound to the species-specific nature of archaic hominids as the architecture of the skeleton, then we can account for its constancy but not for the regularity and arbitrariness of its design features. If, on the other hand, we regard the biface as the product of a complex intelligence, then we can account for these features but not for the constancy of

form. For once makers have the capacity to visualise forms in advance of their construction, there is no longer any reason why the designs they create should remain tied to the body plan.⁶ This is what leads Leroi-Gourhan at one moment to emphasise the complex intellectual preconditions for Archanthropian technicity, only to deny, at the next moment, that it has any significant intellectual component at all.

I do not believe, however, that the source of the problem lies in the limitations of the *Homo sapiens* brain. It is rather to be found in the framework of concepts that has come down to us as a legacy of the Western philosophical tradition. In setting humanity apart not merely from other animal kinds but from the condition of animality itself, this framework encloses the world of nature within a frontier which it has been humanity's singular privilege (or misfortune) to have crossed. On one side of the frontier, as conceived by Leroi-Gourhan, technicity is understood to be subject to the genetic imperatives of the species; on the other side it is subject to the traditional imperatives of the social group. How, then, are we to understand the technicity of those creatures, ancestral to ourselves, whose lives were caught up in the crossing? 'The emergence of tools as a species characteristic', Leroi-Gourhan writes, 'marks the frontier between animal and human, initiating a long transitional period during which sociology slowly took over from zoology' (p. 90). Inevitably, from this perspective, the denizens of this period figure as anomalous zoo-sociological hybrids, as neither one thing nor the other but a bundle of contradictions. They are intelligent, yet their technicity seems to be devoid of creative thought; the forms of their tools are tied to the body plan and yet are represented as images in their minds.

These contradictions can be multiplied indefinitely, and they leave us with one fundamental question unanswered. Is it possible, even in principle, let alone empirically, to distinguish those events in the sphere of technical accomplishment that, so to speak, moved the transition along, from those that already fall on the 'far side'? To put it another way, can we really identify what Leroi-Gourhan calls 'a radical turning point in our biological evolution as a zoological species' (p. 137), whence the history of technology literally took off from its foundations in innate capacities? Leroi-Gourhan thinks we can, and repeatedly identifies it with an event in the evolution of the cranium—namely the complete opening up of the cortical fan, and with it the disappearance of the 'prefrontal bar', the bony ridge above the eye-sockets that in pre-human hominids divides the convexity of the skull from the facial bloc (see Fig. 1). Indeed the prefrontal bar takes on a quite extraordinary—and in hindsight, preposterous—significance in Leroi-Gourhan's account.

⁶It is thoroughly unconvincing to suggest, as Pelegrin does, that the form of the biface remained constant since progress 'at the level of mental images' was retarded by the 'inertia of tradition' (Pelegrin, 1993, p. 312). For this merely begs the question of why such inertia should have exerted a stranglehold over innovation so much tighter prior to the onset of the Upper Palaeolithic era than at any time afterwards.

More than a mere bump on the skull, it figures as a barrier whose removal opened the floodgates of symbolic imagination, and launched humankind upon the tide of fully social life. This, the 'prefrontal event', was the final liberation.

From then on, the curve of technical development⁷ rises almost vertically, while that of brain volume flattens out (pp. 137–138). The result is a rapidly widening gap between means and ends, between the reach and power of technology and the basic biological and psychological propensities of the mass of individuals in whose hands it is placed, propensities that 'hark back', as Leroi-Gourhan rather graphically puts it, 'to times when humans were fighting the rhinoceros' (p. 229). The individual, flesh-and-bone human being is constitutionally 'a living fossil, immutable on the historical scale', adapted to life as a predatory mammal rather than a cultivator of crops or a factory operative (pp. 247–248). The entire history of civilisation may, then, be understood as 'the dialogue between the physical human—borne on the same tide as the dinosaur—and technology, the child of human intelligence but completely freed from all genetic ties' (p. 173).

In this history, however, whereas technology has advanced beyond all recognition, intelligence has remained at a virtual standstill, pegged to the level it had reached by the time of the great prefrontal event and the advent of technological take-off. 'If intellectual progress is taking place at all', Leroi-Gourhan observes, 'it is still imperceptible in biological terms, and is more a matter of expanded means and fields of speculation than of improved psychophysiological equipment' (p. 173). Whereas societies may differ on the scale of technological development, the sophistication of moral, philosophical or religious thought has remained the same for all humans at all times.⁸ Thus with due allowance for particularities of historical context, says Leroi-Gourhan, 'the thinking of an African or a citizen of ancient Gaul is completely equivalent to mine' (p. 147). This line of reasoning is, of course, entirely in accord with the doctrine of the psychic unity of mankind, which is currently enjoying a new lease of life under the umbrella of evolutionary psychology (see, for example, Tooby and Cosmides, 1992).

Considering the case of the Archanthropian biface, I noted the discrepancy between the apparently complex intellectual preconditions for the manufacture of these objects and the stability of their form, which seems constrained to follow specifications built into the essential nature of its producers. The more recent history of human technology presents us with what is fundamentally the same problem in reverse: an industry of ever-increasing complexity underpinned by an intelli-

⁷Leroi-Gourhan measures technical development by two criteria: the total length of cutting edge produced in proportion to the weight of raw material, and the diversity of tool types.

⁸This does not prevent Leroi-Gourhan from claiming elsewhere that certain societies have installed in their 'great moral and religious laws' concepts as advanced as those enshrined in any technology. But the vast majority of human beings, he believes, continue to be impelled by aggressive, predatory urges left over from their evolutionary past as hunters of large and fierce animals. Rather than waiting many millennia for these innate predispositions to catch up with the moral content of social memory, we would do better, he thinks, to use the means offered by technology to channel and orient them in constructive ways (pp. 229–230).

gence which remains bound to the evolved, species-specific architecture of *Homo sapiens*. In the one case, intelligence appears to run ahead of technicity; in the other, technicity ascends 'at dizzying speed' (p. 173) while intelligence remains confined to the slow lane of evolutionary change, virtually imperceptible on the timescale of history. The root of the problem lies in the distinction between the intellectual and the technical. Is this distinction an artefact of our thought, or could it be, as Leroi-Gourhan suggests, that it 'reflects a paleontological reality?' (p. 106). I believe that the former is closer to the truth (see Ingold, 1993a), and although Leroi-Gourhan leans to the latter view, there is, as we shall see, much in his account that points us in the opposite direction, toward closing the gap between the work of the mind, facilitated by language, and the work of the hand in its engagement with the material environment—or in short, between speech and gesture.

I pursue this issue in a later section. To close the present one, however, I want to draw attention to the strong current of technological determinism that runs throughout Leroi-Gourhan's account. Technology, he insists, 'is the driving force behind all progress' (p. 184), its evolution governed by an autonomous force that is effectively outside of human control. Despite admitting that the idea of 'man outstripped by his technology' is a hackneyed one, perhaps even mistaken, Leroi-Gourhan is convinced that it still contains a kernel of truth (p. 146, see also pp. 184, 229).⁹ As the powers of technology overtook those of individual human beings, the latter found themselves collectively lending their hands, brains and muscles to a new kind of organism, greater than the sum of its individual parts, and of which they were mere auxiliaries or 'cells'. This is the difference between the primitive hunter, armed with spear and throwing-stick, and the oarsman chained to the bench of the trireme (p. 248).

Human evolution, argues Leroi-Gourhan, has taken place on three distinct levels (pp. 167–168). On the one hand is the level of biological evolution, which has brought forth the species-specific form of humanity; on the other hand is the level of technical evolution, 'that astonishing excrescence from which our species derives its efficacy but which it is not biologically equipped to control'. Between these extremes lies a third level, of *social* evolution, wherein are formed institutional structures serving to adapt the physical human to the demands of technology. But these social forms are always responsive to technological imperatives, and not the other way around; thus Leroi-Gourhan never doubts that 'technoeconomic determinism is a reality' (p. 147). It is important to realise, however, that for Leroi-Gourhan, technical and social evolution are aspects of human evolution, not opposed to it. His point is that at a critical juncture, humanity outgrows its bodily envelope, but continues to grow *into* the artificial, technical and social prostheses that extend, amplify and eventually replace its biophysical capacities. As the centre

⁹For a discussion of the role of this idea in the history of modern thought, see Winner (1985).

of gravity of human being is removed from within to without the body, so the balance of control shifts in favour of the external apparatus. The human species, in short, comes to be in thrall to the very technical means by which its 'fabulous triumph over matter' (p. 184) was originally secured. Our liberation from nature has put us in technological chains.¹⁰

3. Between Instinct and Intelligence

Let me return for a moment to the enigma of the Archanthropian biface. In his 1956 Huxley Memorial Lecture to the Royal Anthropological Institute, the distinguished biologist J. B. S. Haldane wondered why, if blackbirds raised in isolation could sing a perfect song, our hominid ancestors should not likewise have been able to shape stone to a perfect, standardised form without any instruction whatsoever. Classical Hindu sources speak of personages who were born with a knowledge of the Vedas. Could not this kind of innate knowledge have once been a reality? Perhaps, Haldane speculates, early hominids were born with techniques of working with stone:

During the lower palaeolithic period, techniques of flint chipping continued with very little change for periods of over 100,000 years. It seems to me possible that they may have been as instinctive as the making of spiders' webs, even if most flint chippers saw other men chipping flints. (Haldane, 1956, p. 9)

This suggestion, although a deliberate piece of provocation on Haldane's part, resonates closely with Leroi-Gourhan's notion of anthropoid tools as bodily secretions rather than manifestations of thought. Yet in one critical respect, Leroi-Gourhan would not have gone along with it. For he is averse to the idea of instinct, and prefers to attribute apparently innate abilities to what he calls 'species-related memory'.

Quite apart from its inherent vagueness, the problem with the notion of instinct lies in its conventional opposition to that of intelligence.¹¹ The essence of intelli-

¹⁰This is the point of departure from which the philosopher Bernard Stiegler has recently launched into a series of meditations on Leroi-Gourhan's anthropology. 'Is technics', he asks, 'a means through which we master nature, or rather does not technics, becoming master of nature, master us as a part of nature?' (Stiegler, 1998, p. 24). There is a paradox, for Stiegler, in that by the same token that technicity is constitutive of our very humanity (for the hand is only human that manipulates a tool) it also usurps, in its development, human beings' powers of self-realisation. Conceived as '*the pursuit of the evolution of the living by other means than life*', the history of technics is recast as the 'derealisation of man, his disappearance in the movement of a becoming that is *no longer his own*' (pp. 133, 135, original emphases). Human power—that is, power augmented by technicity—is the power of humanity's self-destruction. Thus, with technics, life becomes an approach to death; anticipating its own extinction, it is also a movement of time. And this, in turn, lies at the root of the discourse of human origins. For something that is conceived, in time, as eventually coming to an end must, at some earlier time, have begun.

¹¹Leroi-Gourhan's discussion of this opposition owes much to the philosophy of Henri Bergson. In his *Creative Evolution* of 1907, Bergson had argued that while animals have tools, for them 'the instrument forms part of the body that uses it; and corresponding to this instrument, there is an *instinct* that knows how to use it'. Intelligence, by contrast, 'is the faculty of manufacturing artificial objects, especially tools to make tools, and of indefinitely varying the manufacture' (Bergson, 1911, pp. 146-147). For further discussion of this contrast, in relation to human and animal tool using and making,

gence, for Leroi-Gourhan, lies in the ability, rooted in language, to project lived experience in 'lucid consciousness', transforming the operational sequences involved in ordinary activity into sequences of symbols. Through the logical manipulation of these symbolic sequences, the individual equipped with such an ability can imagine states of being alternative to those that currently obtain, compare these alternatives, and work to bring about a preferred option. Thus language, as the necessary condition of intelligence, is 'the instrument of liberation from lived experience', just as the hand-tool is 'the instrument of liberation from the genetic constraints by which an animal's organic implements are tied to the zoological species' (p. 227). The special capacity that humans have of being able to distance themselves from the conditions of their life in the environment, manifested in the detachment both of the tool from the hand that holds it and of words from the objects to which they refer, also marks the distance between society and species (p. 235).¹²

Yet for most of our waking lives, as we go about such everyday tasks as washing, dressing, eating meals and writing, we rarely stop to think about the operations involved, or to consider alternatives. We might reflect on what clothes to wear, but seldom on how to put them on; we might plan the menu for our next meal, and even the place settings, but once the meal is under way we do not wonder what to do with the knife and fork; we might think about what we write but do not usually attend to the movement of the hand as it forms the letters on the page. These and countless other operational sequences of a routine nature are performed, says Leroi-Gourhan, 'in a psychological twilight from which the individual is aroused only by some unforeseen occurrence' (p. 232). In this semi-dormant state of consciousness, wherein language intervenes little or not at all, human behaviour remains as much immersed in the current of lived experience as is that of non-human animals. It is not intelligent—not, at least, in the sense defined above.

Are we then to infer that such behaviour is instinctive? Only, replies Leroi-Gourhan, if we adopt a notion of instinct so broad as to be almost meaningless (pp. 226–227). For it would have to include far more than the kinds or aspects of behaviour to which the term originally and properly referred: namely those that arise reliably, spontaneously and in successive generations among the individuals of a species, in the absence of any instruction or example. Examples of the latter include the blackbird's song, the web-construction of the spider, and the intraspecific cooperation of 'social' insects such as ants and bees. It is not unreasonable to call these instinctive; by all accounts they are very tightly channelled within the

see Ingold (1986a; b, pp. 348–355). Leroi-Gourhan's debt to Bergson is explained at greater length by Schlander (in press).

¹²Here, as elsewhere, Leroi-Gourhan is guilty of confusing the 'liberation' that comes from the detachability of the tool from the hand with that which comes from releasing the design specifications of the tool from those of the bodily architecture. The former is common to all situations of manual tool use in the animal kingdom. The latter alone is analogous to the liberation wrought by language in the separation of words and things.

bounds of hereditary constraint. Between examples of this kind, however, and behaviour that attests to the workings of an intelligence capable of generating symbolic representations in advance of their implementation, there lies a vast field of operations which *are* dependent upon instruction or example for their reproduction across generations, but which *are not* underwritten by the symbolic imagination.¹³

In order to open up conceptual space to accommodate this field, Leroi-Gourhan substitutes for the dichotomy of instinct and intelligence a division into three 'levels' or 'stages' of operational behaviour, each of which does not so much replace as build upon the one below. The lowest level is that of *automatic* operations, 'directly connected with our biological nature'. On the intermediate level are *mechanical* operations, consisting of sequences acquired through 'experience and education' but which, for the most part, are not themselves represented in consciousness. The highest level is that of intelligent or *lucid* operations, characterised by the intervention of language and governed by symbolic representation (pp. 230–231). To this trichotomy there corresponds a parallel threefold division in the sources from which these different kinds of operations flow. Automatic operations have their source in species-related memory, that is, in the evolved specifications that every creature receives from its predecessors as a genetic endowment. Mechanical operations, by contrast, flow from a memory source that Leroi-Gourhan calls 'social' or 'ethnic' (or sometimes 'socioethnic'): that body of traditional knowledge pertaining to the collectivity by which, with the transition to full humanity, the social group transcends the species. Finally, the source of lucid operations lies in the ability of individual human beings, equipped with the facility of language, to liberate their thought and behaviour from the constraints of both species-related and socioethnic memory, and thereby to embark upon deliberate innovation or invention (p. 227).

In the following sections I intend to look more closely at the way in which Leroi-Gourhan develops his argument by focusing in turn on three of the critical distinctions on which it rests, each of which is highly problematic. The first is the distinction in the foundations of memory, between the species-related and the socioethnic. The second is the distinction in operational sequences, between the automatic and the mechanical. Thirdly, I return to a distinction that was already raised as an issue in the last section, between technicity and intelligence.

¹³Elsewhere, I have made the same point by noting the lack of congruence between the two distinctions: instinctive versus learned, and innate versus artificial. The first opposition is between genetic and non-genetic ('social') modes of behavioural transmission; the second is between practices and products that do, and those that do not, conform to a prior symbolic design. It will not do, I argued, to assume that whatever behaviour is not symbolically represented must be crudely instinctive, for this would effectively consign to oblivion all those traditional practices, by no means confined to humanity, which depend on a learning process for their transmission but which do not result from the imposition of symbolic form (Ingold, 1996, p. 193; see also Ingold, 1988a, p. 85). For reasons that will become apparent below, I am no longer comfortable with this argument, or with the distinctions upon which it rests.

4. The Embodiment of Memory

In the course of human evolution nothing has been more consequential, according to Leroi-Gourhan, than the development of the capacity to walk on two feet. Barring small infants, the handicapped and the infirm, it is a capacity common to all human beings. Surely, bipedal locomotion must count as an example, par excellence, of automatic behaviour whose roots lie in the fundamental biological constitution of humankind, passed from generation to generation in species-related memory. To all intents and purposes, humans could be said to possess a 'walking instinct'. Yet as Leroi-Gourhan knew very well from his teacher in ethnology, Marcel Mauss, people in different cultures are brought up to walk in very different ways. In his classic essay of 1934 on *Techniques of the Body*, Mauss had observed, apropos walking, that there is 'no "natural way" for the adult' (Mauss, 1979, p. 102). Leroi-Gourhan, following suit, admits that bodily automatisms such as bipedality are nevertheless 'strongly marked by ethnic nuances'. These nuances, however, are contained in the 'data of tradition' that education imprints upon the genetic base (p. 230). Their source, in other words, lies in social or ethnic memory. Now in Leroi-Gourhan's terms, behaviour flowing from this source is unequivocally classified as mechanical. On these grounds we would have to conclude that walking has both an automatic and a mechanical component, and that it draws simultaneously on two sources of memory: the species-related memory of the biological individual, and the ethnic memory of the collectivity.

Leroi-Gourhan wants us to think of memory, in general, as a kind of store in which are deposited the programmes underlying every kind of operational sequence. These programmes, it is supposed, are passed on from generation to generation to ensure a repeat performance in each (p. 220). Accordingly, the contrast between the two kinds of memory, species-related and ethnic, reappears as one between two modes of transmission, 'one of which . . . involves a maximum of genetic predetermination and the other . . . apparently none at all' (p. 222). In the former case, behavioural programmes are transferred to the organism-to-be at the moment of conception, in the latter case they are installed in a human brain 'that is virtually empty at birth' through a process of education (p. 228). The first, it seems, establish 'natural', species-specific capacities which are subsequently filled up with culturally particular, 'socioethnic' content. Thus an individual learning to walk would start off with the necessary biomechanical apparatus already in place as part of the evolved architecture of the species, to which would then be added the data of tradition to yield a culturally specific competence. Exactly the same model is frequently assumed for language learning: thus the individual is supposed to start with a genetically prescribed capacity, a 'language instinct', which forms a base for acquiring competence in the particular language (or languages) spoken in the surrounding community (Tooby and Cosmides, 1992, p. 45; Pinker, 1994).

But is this really how people develop skills in the routine operations of everyday

life? I think not, for reasons that can indeed be found by reading between the lines of Leroi-Gourhan's text. As he puts it, the problem of understanding how the same operational sequences are reproduced, generation after generation, 'is less a matter of philosophy than of neurophysiology' (p. 222). It is a problem, in other words, of explaining how the neurophysiological mechanisms underwriting such activities as walking and talking come to be established. The answer, of course, is that they are constituted within processes of maturation or ontogenetic development, 'at the confluence of the individual's internal biological environment and the exterior' (p. 221). At whatever moment in the individual life-cycle one might choose to identify a certain mechanism, a history of development already lies behind it. The same is true of features of anatomy and musculature, which likewise do not come ready-made but *grow* within a body that is alive and active in the world. Through these ontogenetic processes, the capacities to walk, talk and so on are incorporated into the structures and workings of the whole organism, indivisibly brain and body. Once acquired, they are never forgotten, unless the organism itself is damaged or degenerates. In this sense, we could say that they are sedimented in long-term memory.

Crucially, however, such memory is no more handed down, from ancestors to descendants, than are the brains and bodies with which it is consubstantial. The metaphor of transmission is misleading, for it implies that memory is somehow detachable, as a corpus of ideal information, from the material bodies that it animates, such that it can jump from one to another. In reality, memories, like the bodies to which they belong, undergo continual generation and regeneration in the contexts of individuals' life activities within an environment. Thus the capacity for bipedal locomotion is no more given in advance than the capacity for language; both emerge within processes of development under the guidance, and with the support, of more experienced practitioners.¹⁴ The contribution of such practitioners, which is absolutely critical, is not to act as vectors for the intergenerational transmission of memories—respectively genetic and ethnic, of species and social group—to be implanted in the bodies and minds of the young. It is rather to establish the conditions that are necessary, in the environment of novices, to enable them to get the feel of things for themselves, literally to grow into the activities in question. Thus learning to walk *is* learning to walk in the way people do in one's surroundings, and learning to talk *is* learning to talk the language spoken in one's home community. In the case of these and every other kind of routine bodily

¹⁴On the development of walking, see Thelen and Smith (1994), and on that of speech, see Lock (1980). Despite the work of these and many others in the field of developmental psychobiology, the metaphor of transmission continues to flourish in biology, psychology and anthropology. It underpins, for example, current theories of so-called 'gene-culture coevolution', which picture the human being as a recipient of information passed along two parallel channels, one genetic, the other cultural (Durham, 1991). The assumptions built into this way of thinking have been most cogently exposed and criticised by Oyama (1992).

practice, the development of the generalised capacity is inseparable from that of the specific competence.

Let me return for a moment to Leroi-Gourhan's image of the Archanthropian biface-maker, whose operations 'exude' from the body and brain. Could it not likewise be said that the operations of walking and talking exude, in much the same sense, from the bodies and brains of modern human beings? Indeed it could. Yet the ways in which people *actually* walk and talk, as we have seen, are not universal but vary with the social contexts of their development. The same goes for the abilities to swim, to rest for long periods in a squatting position, to whistle, and so on, which are by no means universally distributed in the human population even though all humans, in principle, should be capable of acquiring them. They cannot, then, be categorised as species related. Nor, however, can they be classed as social or ethnic in Leroi-Gourhan's terms. For far from being added on from the outside they are literally incorporated, through the developmental process, into the biological constitution of the organism—into its neurophysiology, its anatomy and its musculature.

How, then, are we to comprehend the kind of memory that consists, as Paul Connerton puts it, 'simply in our capacity to reproduce a certain performance' (Connerton, 1989, p. 22)? Though such memory shares features that Leroi-Gourhan attributes to both species-related memory (its bodily incorporation) and socioethnic memory (its cultural variability), it is identical to neither. Connerton calls it *habit-memory*—'a knowledge and a remembering in the hands and in the body' (Connerton, 1989, p. 95). Though Connerton limits his discussion to the field of human behaviour, I would like to add that there is no reason why habit memory should be limited to human beings: the operations of many non-human animals, in so far as they, too, are incorporated into normal bodily functioning through repeated practice in an environment, could likewise be characterised as habitual. This would apply, by the same token, to the fashioning of stone tools by early hominids such as our Archanthropian biface-maker. Thus whereas Leroi-Gourhan's appeal to the concept of social memory reinforces the distinction between human beings and non-human animals and sets up a Rubicon to be crossed in the evolutionary transition to humanity, the concept of habit-memory softens the distinction to the point that the differences between humans and other animals can be seen to lie within the same landscape of variation as do the differences among these other animals themselves. With respect to human beings there are not two forms of embodied memory—ethnic and species-related—but just one, corresponding to the unity of the organism whose morphology and behaviour are inseparably biological and social.

With that, the dichotomy between the zoological and the sociological, upon which Leroi-Gourhan sets such store, simply dissolves. What he claims to be 'a real fact, . . . the separation between our physical self and our external social shell' (p. 220) turns out to be nothing more than an artefact of analysis, a product of our attempts to sift the general from the particular, or to discover the lowest common

denominators of human behaviour. When it comes to habitual ways of walking, talking, eating, dressing and so on, the sociological *is* zoological, and vice versa. And once the dichotomy vanishes, so do the problems of hybridity and transition states to which I drew attention in an earlier section. We no longer have to worry about what it might be like for a creature to be less than fully zoological or halfway on the road to sociality.

Indeed, in a revealing passage, Leroi-Gourhan seems to have come close to this very conclusion. No sooner has he pronounced upon 'the essential fact that we belong to two worlds, the zoological and the sociological', than he sets off down what he calls a 'third track', along which we would perceive that the lives of both humans and non-human animals are 'maintained within a body of "traditions" whose basis is neither instinctive nor intellectual but, to varying degrees, zoological and sociological at one and the same time'. Only then, he suggests, will we be truly able to progress beyond the preoccupation with 'the search for the dividing line between the natural and the cultural' that has dominated the last two centuries of scientific thought, to break down the disciplinary barrier between animal psychology and ethnology, and to really understand 'what is animal and what is human' (p. 220).

5. The Exteriorisation of Operations

If the distinction between species-related and socioethnic memory is an analytic fiction, then the same must be true of that between automatic and mechanical operational sequences. What terms, then, would better characterise the operations of human beings and non-human animals? And where, if anywhere, in the entire field of animate operations, are the significant boundaries to be drawn, if not at the animal-human interface? Leroi-Gourhan is himself profoundly inconsistent when it comes to this latter question, at one moment limiting the scope of fully automatic operations to a rather narrow and highly specialised branch of the animal kingdom, epitomised by the ant and bee, in which behaviour is under tight genetic control, but at the next moment expanding their scope to fill the entire domain of non-human operations, in order to close the gap that would otherwise be left by the restriction of the field of mechanical operations to humanity (compare pp. 222–223 and 232). As the salient boundary shifts from that separating insects from non-insects to that separating humans from non-humans, the operations of the contemporary ape or archaic hominid are made to appear more akin to those of ants and bees than to those of modern human beings!

Rather than dismissing the distinction between the automatic and the mechanical out of hand, however, it is worth looking again at Leroi-Gourhan's reasons for drawing it. These are founded, as I shall show, in a set of concerns that have less to do with the release of human technicity from the bonds of zoological constraint than with the transfer of operations, in the subsequent history of technology, from the human body to the artificial machine. The many paradoxes in Leroi-Gourhan's

account stem from his tendency to retroject, onto the entire field of human operations from prehistory to the present day, an understanding of the relation between practitioner, tool and material whose origin lies in the modern industrial era of machine production. This is the source of the current of technological determinism, noted earlier, that leads Leroi-Gourhan to describe the human user, from the start, as the instrument of the tool rather than vice versa. Regarding the machine as a perfect substitute for the tool-assisted human organism, he feels justified not only in treating the operations of the organism as mechanical, but also in describing the machine itself as just another kind of organism whose physical existence is nevertheless external to the body.

How, then, does Leroi-Gourhan draw the line between automatic and mechanical operations? Both are supposed to follow pre-established programmes, installed in the bodies of practitioners through genetic inheritance in the first case, and in the second 'through training by imitation, experience by trial and error, and verbal communication' (p. 232). Once underway, there is little to distinguish them. However there is a crucial difference, in that mechanical sequences, although normally performed without a thought, are amenable to adjustment in the light of conscious, linguistically mediated reflection, whereas automatic sequences are not. Occasions of adjustment are typically when things go wrong, when due to some change in environmental conditions the usual flow of action is interrupted, forcing the practitioner to consider the causes of failure and to rectify the operational process to suit the new circumstances. These occasions of adjustment are moments of lucidity, which Leroi-Gourhan depicts as peaks in a sinusoidal curve of conscious awareness over time, the intervening troughs being filled by mechanical operations 'performed at a deep level of collective memory' (p. 233). In such moments lie possibilities for individual invention, for the construction of novel programmes which, once adopted by the collectivity and incorporated into customary routine, sink back to the subconscious level of mechanically implemented convention.

Mechanical operations, which combine the ever-present possibility of conscious intervention with the embodied sedimentations of social memory, are for Leroi-Gourhan at the very core of human life and survival. For the alternatives would be either to imagine a totally preconditioned brain, leaving humans no different from insects, or to suppose a continuous state of lucid consciousness in which every tiniest gesture would have to be reinvented afresh on every occasion of use, imposing such heavy cognitive demands that normal life would quickly grind to a halt (p. 233). But in Leroi-Gourhan's account the appearance of the mechanical also signifies something else, namely the onset of a process he calls 'exteriorisation'. By this he means, in essence, a displacement or decentration of the source of operational behaviour from the physiological locus of human being. It is a displacement that not long ago appeared to have reached its zenith with the advent of machine automation, but is now stretching even further with modern robotics. However, for Leroi-Gourhan, it began when humans first began to combine objects

as tools with manual gestures drawn from social memory. From that point on, individual human beings would give up some of their agency to society. And in mechanical operations, as Leroi-Gourhan envisages them, we see the workings of the social body rather than that of the individual (pp. 237–238).

Indeed, true to a long line of theorists in the history of anthropology, Leroi-Gourhan is quite prepared to treat society itself as a kind of organism with a life of its own, of which individual human beings are merely the flesh-and-blood supports, and whose evolution is revealed in the history of technics:

There is room for a real 'biology' of technics in which the social body would be considered as an organism independent of the zoological one—an organism animated by humans but so full of unforeseeable effects that its intimate structure is completely beyond the means of inquiry applied to individuals. (p. 146)

By this move, Leroi-Gourhan aims to encompass the entire history of human technology within an all-embracing evolutionary argument couched, as we have seen, in the vocabulary of successive 'liberations', and running all the way, without break or interruption, from the most primitive fish to the advanced automaton. At a certain critical juncture, the social organism broke free from, and substituted itself for, the zoological one; at the same time, mechanical operations took the place of 'instinct'. But the evolutionary progression continued, albeit on an 'ethnic' rather than a 'phyletic' level (p. 269), and in domains ever further removed from the human body. Although the steam-powered automotive machine of the nineteenth century was made of metal, breathed fire and had the most rudimentary nervous system consisting of speed and pressure regulators, it was still a 'living reality' whose advent marked a 'crucial biological stage'. The fact that its organs are extraneous to the human body is of no consequence so far as the overall evolutionary story is concerned (p. 247).¹⁵

In an earlier section, I traced out the evolutionary argument by which Leroi-Gourhan attributes the origins of technicity to the liberation of the hand. But as we have now seen, the hand having been freed for technicity the story continues with the liberation of technicity itself from the hand, which is gradually drawn from the centre to the periphery of operations, and finally removed altogether. Leroi-Gourhan divides this evolutionary progression into five stages, beginning with that of manipulative action, in which the practitioner works with bare hands. This is followed by the hand's exerting a direct motor function, by moving the tool in its grasp. In the third stage the hand exercises an indirect motor function,

¹⁵In a tantalising aside, Leroi-Gourhan speculates that an extra-terrestrial observer, unbiased by the preoccupations of earthly philosophers and historians, 'would separate the eighteenth-century human from the human of the tenth century as we separate the lion from the tiger or the wolf from the dog' (p. 247). His point is that it would not occur to the alien observer to divorce individual human beings from the organic totality formed by their technology and social institutions, a totality whose specific character was significantly different at different historical periods despite the fact that considered in isolation, humans remain much as they were when history began. Our observer would therefore perceive different species at different periods, whereas we, who insist on cutting human beings out from their sociotechnical context, are inclined to perceive the same species, *Homo sapiens*, throughout.

by applying force to a device, such as a spring, crank, lever or pulley cable, that in turn moves the tool. In the fourth the hand works to harness the energy of a non-human power source, which in turn directly or indirectly moves the tool, as with animal traction, water-driven mills, and so on. Finally, in fully automatic action, there is nothing for the hand to do but to set off a programmed process by pushing a button or throwing a switch (pp. 242–249).

What really distinguishes the last two stages in this progression from the first two is the decoupling of perception and action, or more precisely, the removal of the technically effective gesture from the context of immediate sensory participation. The potter or basket-maker, for example, feels the material as she handles it, by virtue of its direct contact with the skin. The woodcarver, too, although he performs with a tool such as a knife or chisel, feels the wood through its contact with the tool more than he does the tool through its contact with the hand. But the ploughman driving his team of oxen does not feel the pressure or resistance of the earth, nor does the driver of a fork-lift truck, operating the controls in his cab, feel the weight of the load the machine is lifting. True, of these latter two cases the first differs in that it still involves ‘a good deal of muscular participation’ (p. 246), but this effort is concentrated in the interaction between man and beast, rather than in that between the plough and the soil. The third stage is interestingly ambiguous. It is not difficult to think of examples where action and perception still coincide, even though the application of force is indirect. The sailor, hauling in a rope through a pulley block, still feels the wind in the sails. But the hurdy-gurdy player differs from the violinist in that, whereas the latter feels the vibrating strings through the bow, the former feels only the resistance of the handle of the wooden wheel that, as it is turned, rubs against the strings and causes them to vibrate.¹⁶

Leroi-Gourhan himself summarises the process of exteriorisation as a transition from an initial synergy of tool and gesture in the manipulative function of a bodily organ, the hand, to a situation in which ‘both tool and gesture are now embodied in the machine’ (pp. 237–238). This leads him to posit a third kind of memory besides the species-related and the social, namely ‘mechanical memory’ (p. 257). Subsequently the three kinds of memory are listed as animal, human and mechanical respectively: ‘Animal memory is formed . . . within narrow genetic channels prespecialized by the species, human memory is . . . based on language, and mechanical memory is constituted . . . within the channel of a preexisting program and of a code based on human language and fed into the machine by a human being’ (p. 258). Certainly, Leroi-Gourhan’s eccentric and shifting terminology allows ample scope for confusion. Thus the operations of the man-made automaton are

¹⁶I have suggested elsewhere that the crucial step in the decoupling of perception from action is the conversion of the back-and-forth or ‘reciprocating’ motion characteristic of the human body into the rotary motion characteristic of the machine. It is no longer possible to feel or to respond to the work of the tool upon the material when its principle of movement is fundamentally different from that of the hand as an empowering agency (Ingold, 1988b, pp. 162–164).

mechanical, not automatic, since they issue from a humanly created programme, designed with the aid of language, rather than one that is genetically fixed. And the direct manipulative gestures of the human tool-user are likewise mechanical, even though they do not issue from a machine or from mechanical memory, since they are also prompted by a language-based design. But the manipulative gestures of the non-human animal, using its body parts as tools, are automatic, not mechanical, since they cannot be altered through conscious intervention. In Fig. 3, I have attempted to summarise these several, cross-cutting distinctions.

The point I want to emphasise in this scheme is the formal equivalence that Leroi-Gourhan draws, under the rubric of mechanical operations, between direct manipulative action, or what he calls 'handling' (p. 243), and the functioning of the automatic machine. From Palaeolithic hunting and gathering to the era of mechanisation, operational behaviour may have been enriched in scope and content, 'but its nature has not changed' (p. 253). Whether with the hand-tool or the automaton, the essence of a mechanical performance is that the movements or gestures of which it consists follow a course that is laid down or predetermined in its initial conditions. In this sense, they are 'programmed'. Once underway, adjustments or corrections can only be made by interrupting the performance in order to recalculate the conditions and to reset the programme accordingly. This is precisely how Leroi-Gourhan envisages the periodic intervention of lucid consciousness in operations that proceed during the intervening intervals virtually on 'autopilot'. Thus, in the activities of handling, the body functions to all intents and purposes like a machine; or to put it the other way round, the workings of the machine effectively mimic those of the living body, of which it is an 'improved artificial copy' (p. 269).¹⁷

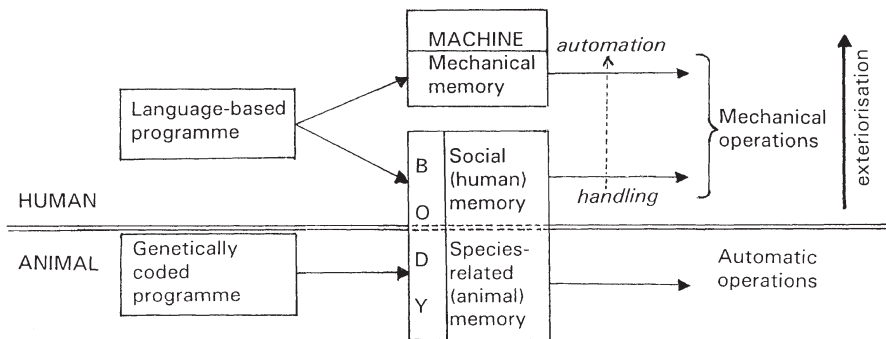


Fig. 3. Programme, memory and operations: a summary of Leroi-Gourhan's scheme of distinctions.

¹⁷Gilbert Simondon expresses a similar idea when he writes that 'what lies in the machine is but a human reality, human gesture fixed and crystallised in its functioning structures' (Simondon, 1958, my translation). Yet for Simondon the machine is no substitute for the human. People are destined to live among machines, not to be replaced by them. For while machines have a dynamic of their own, which is both beyond the scope of human intention and yet irreducible to the laws of physics, they depend on human beings for their assembly and operation.

A century before Leroi-Gourhan was writing, Karl Marx had also embarked upon a comparison between the human handling of tools and machine performance. But he came to the opposite conclusion—that far from being equivalent, they were quite different. Crucial to handling, in Marx's terms, is that the worker does not just apply motor force but actually guides the movement of the tool (Marx, 1930, pp. 393–396, 451). The skilled practitioner, in handling the tool, responds continually and fluently to perturbations in the perceived environment, including of course the material on which he or she works, without ever having to interrupt the task at hand. This is possible because the gesture is at once perceptually as well as technically effective. As the Russian neurophysiologist Nicholai Bernstein pointed out some fifty years ago, it is not in the gesture itself but in the tuning of one's gestures to an emergent task, whose surrounding conditions are never precisely the same from one moment to the next, that the essence of dexterity resides (Bernstein, 1996, p. 23). In the machine, by contrast, responsibility for the movements of the tool is transferred from dextrous hands to a mechanism which is itself indifferent to its surroundings and answerable only to the instructions that have been fed into it in advance. This, the substitution of a mechanically determining for a skilled system of constraint (see Pye, 1964, pp. 53–54) was what Marx took to represent the essential, qualitative division between the handling of tools and machine operation (Ingold, 1988b, p. 162).

Moreover it is here, too, that we find that inversion in the relation between worker and tool which seems to turn the tool into the master of its erstwhile user. This inversion, according to Marx, has its ultimate origin in capitalist relations of production, but only with the advent of machine production did it acquire 'a technical and palpable reality' (Marx, 1930, p. 451). However, what Marx attributed to mechanisation, under the specific historical conditions of industrial capitalism, Leroi-Gourhan regards as intrinsic to the human condition in general. The primitive hunter, armed with spear and throwing stick, seems to be as subservient to the demands of his technology as is the industrial operative to the demands of the automotive machine. In short, what Marx saw as the domination of labour by capital is naturalised, in Leroi-Gourhan's account, as the domination of humankind by its technology. Not for the first time, Leroi-Gourhan reads in the predicament of modernity the condition of the species at large.

For my part I would rather follow Marx than Leroi-Gourhan, in regarding the manipulative gestures of human beings in the handling of tools and materials not as mechanical but as skilled or dextrous. An alternative designation, in line with the conclusion of the previous section, might be 'habitual'. Like habits, skills are properties of living organisms, not of machines; they consist of postures and gestures which, through repetitive exercise, 'become sedimented in bodily conformation' (Connerton, 1989, p. 94). They are difficult or impossible to put into words, and do not depend on linguistic codification for their establishment in successive generations. I do however have one reservation about bringing skilled operations

under the rubric of habituality. This is occasioned by Connerton's remark that the effect of repeated exercise in certain tasks is to make their bodily execution increasingly automatic, to the point that 'awareness retreats [and] the movement flows "involuntarily"' (Connerton, 1989, p. 94). This is reminiscent of Leroi-Gourhan's view that routine technical operations take place in a twilight of consciousness, and are thus devoid of intelligence. In this view, conscious awareness or 'lucidity' intervenes only to interrupt the otherwise automatic and involuntary flow. I have argued, to the contrary, that the skilled bodily practices entailed in 'handling' are anything but automatic, but rather continually responsive to ever-changing environmental conditions. I now want to show that in this responsiveness lies a form of awareness that does not so much retreat as grow in intensity with the fluency of action, and that in this respect there is no opposition between technicity and intelligence.

6. Thinking with the Hands

To think, to represent by symbolic means the conditions of our life in the world, to configure in the imagination alternative modalities of being, and to hold these modalities up to comparison—all of this, Leroi-Gourhan assures us, depends upon the uniquely human faculty of language. Yet every natural language is a collective phenomenon, part of the heritage of a social group. Paradoxically, according to Leroi-Gourhan's account, the very possibility of liberating the human intellect from the bonds of lived experience lies in the submission of the individual, within the process of his or her education, to the programmatic requirements of a memory 'whose entire contents belong to society' (p. 228). There is a dialectic in the life of every human being between the freedom of the individual and the conditioning effects of the 'social organism', just as there is in social life between progress and routine and between invention and convention. Animal populations, whose memories are tied to their species natures, can progress at a rate no faster than that of the 'palaeontological drift'. The much more rapid rate of evolutionary advance in human societies has been made possible by 'breaking the link between species and memory', opening up the latter to the products of symbolic thought. For the collective memory is a vast and growing accumulation of such products, every one of which began as an individual invention before entering the common stock of society. Without the mould-breaking contributions of innovative individuals, there would be no social memory; without the 'capital' of social memory, there could be no innovation (pp. 228–229, 233).

The intellect, by this account, though it can draw upon the content of social memory as a resource, is itself constituted independently of the human individual's involvement with other humans or with the non-human environment. From its sovereign position at the pinnacle of consciousness, its powers released by the disappearance of the prefrontal bar, it constructs designs, plans or programmes that are then fed to the body—or to its artificial substitute, the machine—for mechanical

execution. Thus intelligence is to technicity as are the refined cerebral operations of symbolic thought to the coarse bodily practicalities of its enactment. Intelligence is on the side of the individual, progress and invention, whereas technicity is on the side of society, routine and convention. Now Leroi-Gourhan is well aware of the ranking of mental over bodily labour entailed in this view, and he makes a point of noting 'society's discrimination in favour of the "intellectual" as against the "technician", which still persists today'. Once again, however, rather than looking for the source of this discrimination in the historical conditions of industrial capitalism, Leroi-Gourhan sees in it the expression of a disposition that has deep biological roots in the human condition. It reflects, he claims, nothing less than 'an anthropoid scale of values on which technical activity comes lower down than language, and working with the most tangible elements of reality lower down than working with symbols' (p. 172). Ever since the Upper Palaeolithic, 'the world of symbols' has stood above 'the world of technics' (pp. 183–184).

Much of Leroi-Gourhan's text can be understood as an attempt to redress the balance in the relation between brain and body, or between the intellectual and technical poles of human activity. This, as we have already seen, is at the root of his critique of the 'cerebral' view of evolution. It motivates his elevation of the handiwork of the artisan as the necessary condition for the rise of civilisation and as the embodiment of all that 'is most Anthropian in humans' (pp. 171–172). And it lies behind his claim that despite the power of symbols, in the last resort it is always technology that has the upper hand in the determination of human affairs (p. 184). Yet in thus restoring the parity of technicity and intelligence, Leroi-Gourhan does not question the distinction between them. It is, for example, inherent in his assumption that in the manufacture of artefacts, from stone tools to ceramics and jewellery, an imagined form is impressed upon a lump of initially shapeless raw material (p. 141). The symbolic design comes first, whether created *de novo* or retrieved from social memory, followed by its execution in a physical medium. As so often with Leroi-Gourhan, however, while overtly arguing in one direction one finds him advancing, between the lines of his text, a more subtle argument that points in another direction altogether—namely, towards the dissolution of the distinction between the technical and the intellectual.

The second part of *Gesture and Speech* is entitled 'Memory and Rhythms', and it is above all in Leroi-Gourhan's attention to the rhythmicity of technical activity, rather than its grounding in social memory, that this counter-argument appears. A great many operations, he observes, entail the regular repetition of certain manual gestures: these include hammering, sawing and scraping. And whether or not the artisan has an idea in mind of the final form of the artefact he is making, the actual form emerges from the pattern of rhythmic movement, not from the idea. This view had, in fact, already been adumbrated by Franz Boas in his classic work of 1927 on *Primitive Art*. Boas was concerned to show how the perfectly controlled rhythmic movement of the accomplished craftsman guarantees a certain constancy

of form. 'In flaking, adzing, hammering, in the regular turning and pressing required in the making of coiled pottery, in weaving, regularity of form and rhythmic repetition of the same movement are necessarily connected' (Boas, 1955, p. 40). Leroi-Gourhan seems to have alighted on much the same conclusion: 'rhythms', he asserts, 'are . . . the creators of forms' (p. 309).¹⁸

The rhythmic repetitions of gesture entailed in handling tools and materials are not, however, of a mechanical kind, like the oscillations of the pendulum or metronome. For they are set up through the continual sensory attunement of the practitioner's movements to the inherent rhythmicity of those components of the environment with which he or she is engaged. Technical operations, as Leroi-Gourhan recognises, are conducted not against a static background but in a world which is itself in motion, whose manifold constituents undergo their own particular cycles. Thus every operation, itself a movement, unfolds within what he calls a 'network of movements'. And it is through their participation in such a network that 'active individuals have their being' (p. 282). The network as a whole does not beat to a single rhythm but to the concurrent rhythms intrinsic to the life activities of the several beings, both human and animal, caught up in it. Thus every link in the network is, in effect, an interlocking of rhythms, or what might better be described as a specific *resonance* (see Ingold, 1993c, for an elaboration of this concept). In the attunement of the individual's motor responses to these multiple external rhythms, says Leroi-Gourhan, lies the work of perception (p. 282).

We have already seen that the perceptual tuning of action to the conditions of an ever-moving environment is of the essence of dexterity. And we have seen how dexterity is lost in machine performance through the decoupling of action and perception. Now Leroi-Gourhan, too, comments on this loss. Most significantly, he depicts it as a loss of *intelligence*. This comes out most clearly in his discussion of 'the regression of the hand' in the relentless process of mechanisation. From the Upper Palaeolithic to the nineteenth century the hand has enjoyed an uninterrupted heyday as the 'ever-skillful servant of human technical intelligence' (p. 255). But the hand of the industrial operative functions merely as a claw for feeding in material, or its fingers as prods for button-pushing. Perhaps, Leroi-Gourhan speculates, to be able to feed wood into a machine programmed to turn out standard blocks of parquet flooring, without having to feel the grain or attend to the knots, represents an important social advance. But for us humans it means nothing less than our 'ceasing to be *sapiens* and becoming something else . . . Not having to "think with one's fingers" is equivalent to lacking a part of one's normally, phylogenetically human mind' (pp. 254–255).

Technical intelligence consists precisely in this: the ability to think with one's

¹⁸Whether Leroi-Gourhan reached this conclusion independently of Boas is hard to say. Though none of the latter's writings are listed in the bibliography appended to *Gesture and Speech*, Leroi-Gourhan was certainly familiar with Boas's research on the native art and design of the American Northwest Coast, to which he refers in his doctoral thesis on the archaeology of the northern Pacific.

fingers, with one's hand, or indeed with one's whole body. This is not the intelligence of an introspective, meditative consciousness suspended in a world of symbolic meanings aloof from the messy, hands-on business of real life. It is rather the intelligence of a consciousness that is immanent in practical, perceptual activity, and that reaches out into its surroundings along the multiple pathways of sensory participation. Such an intelligence does not stick out from the landscape of action—the 'network of movements'—like a rocky outcrop (p. 254), but is immanent in the network itself, in the sensitivity and responsiveness of practitioners to the nuances of their relationships with substantive components of the environment. As Leroi-Gourhan himself remarks, in the course of a discussion of the relation between function and style in the aesthetic evaluation of artefacts, 'the making of anything is a dialogue between the maker and the material employed' (p. 306).¹⁹ This dialogue is like a question and answer session in which every gesture aims to elicit a response from the material which will help lead the craftsman towards his goal. The final form, far from having been known to him all along and forced upon the material, is only fully revealed once the work is finished. Here the processes of design and execution, of deliberation and realisation, are one and the same. As in navigating through a landscape, you have found your way only when you have reached your destination.

Thinking with one's hands, then, is not a case of harnessing the instrumental apparatus of the body to an intelligence lodged within the brain. Indeed it makes no sense to ask whether intelligence lies more in the head than in the hand, or in the tool it holds. An object that might be used as a tool is, on its own, nothing but an inert lump of stone, wood or metal of a certain shape.²⁰ Likewise, anatomically speaking, the hand is merely a complex arrangement of bone and muscle tissue and the brain an immense tangle of neurons. Regarded as objects in themselves, intelligence belongs to none of these things. It rather inheres in the technical act itself, the gesture, in which they are all brought together. As Leroi-Gourhan reminds us, it is in what it makes or does, not what it is, that the human hand comes into its own (p. 240). In the intelligent gesture, at once technically effective and perceptually attentive, hand and tool are not so much used as *brought into use*, through their incorporation into a regular pattern of rhythmic or dextrous movement. And the intelligence of this use is not given in advance of the technical act as a property of the individual in isolation, but arises as an emergent property

¹⁹Nathan Schlanger (personal communication) points out that in an interview published in 1982, Leroi-Gourhan attributed his appreciation of the functional aesthetic in craftsmanship to his observations, in the course of his early ethnological research in Japan, of the work of craftsmen, sword-makers and potters.

²⁰Sigaut (1993, p. 387) has drawn particular attention to the paradox that anthropological discussions of technicity always seem to end up with an exclusive focus on tools as objects in themselves, even though it is only within contexts of use that objects can figure as tools at all. A certain conceptual blindness, Sigaut argues, leads us to see only the body and the tool-object, but not the gesture.

of the entire 'form-creating system' (p. 310) comprised by the gestural synergy of human being, tool and material.²¹

In short, manual operation, like bipedal locomotion, is a modality of what phenomenological philosophers would call 'being in the world': in handling, as in walking, the rhythmic movement of the body resonates with the contours of the environment. Moreover the rhythms of handling and of walking are intimately coupled within the organism: while the rhythms of handling are generative of form, those of walking generate a system of lived time and space (p. 310). And just as the substitution of mechanical oscillation for bodily rhythm has split technicity from intelligence in the field of form-creation, so have the substitutions not only of clock-time for the rhythmicity of lived experience but also of spatial metrics geared to mechanical means of transport—cars, trains and planes—for the 'zones of personal gravitation measured by the rhythm of walking on foot', done the same in the field of human spatiotemporal integration (pp. 315, 346). In the clock and the kilometre, both time and space have been 'exteriorised'.

Of course, were we to believe—as many psychologists and philosophers do—that every deliberate, consciously motivated gesture is no more than the mechanical output of a device in the head, an 'intelligence', dedicated to the construction of novel programmes, then there would be nothing to fear from the replacement of bodily organs with artificial devices that could perhaps do the same jobs more efficiently. 'The human species', as Leroi-Gourhan wryly remarks, 'adjusted with equanimity to being overtaken in the use of its arms, its legs and its eyes because it was confident of unparalleled power higher up'. Only now that 'the overtaking has reached the cranial box', with the advent of the electronic computer, is our humanity perceived to be under threat (p. 265). Indeed, despite his earlier remarks about how mechanisation and the consequent regression of the hand have already diminished human sapience, Leroi-Gourhan veers to this view himself. He is nevertheless a technological optimist. Once we have designed machines that can excel in the fields not only of creative thought but also of sexual love, he opines, humankind will certainly have come to the end of the line as a *zoological* species. But this will not be the end of humanity, for the machines, in which human bodily and intellectual faculties will by then be fully 'exteriorised', will be us! The *Homo sapiens* of the future, transposed into its artefacts, will have taken leave, once and for all, of the natural world (pp. 265–266, 407).

²¹Here, Leroi-Gourhan actually anticipates much of the current critique of the way in which intelligence has been modelled in the classic tradition of cognitive science—that is, as a faculty of disembodied reason, engaged in the production of symbolically coded solutions to symbolically expressed puzzles, prior to their bodily implementation in the environment. Advocates of an 'emergentist' approach (see, for example, Clark, 1997) argue, to the contrary, that the operations of intelligence should be seen as lying in computational circuits that freely cross-cut the boundaries of brain, body and world.

7. Drawing the Line at Writing

For Leroi-Gourhan, as we have already seen, technicity is intimately linked to language, not as the result of some fortuitous evolutionary conjuncture, but as the specifically human form of a generalised complementarity of facial and manual functions in the anterior field of responsiveness which is as old as the vertebrate order. ‘Tools and language’, he asserts, ‘are neurologically linked and cannot be dissociated within the social structure of mankind’ (p. 114). Supposing this is so, might it be possible to trace, in the course of human social evolution, a movement of exteriorisation in the linguistic domain equivalent to that which, in the domain of technicity, leads from the skilled handling of tools to machine automation? More particularly, could the counterpart of the transference of bodily gesture to the machine be the representation of speech in writing?

Moreover given that, at root, ‘technics and language are but two aspects of the same phenomenon’, might there not also be another aspect having to do with the ways in which the forms and rhythms generated through speech and manual gesture are perceived and evaluated? Leroi-Gourhan believes so, and brings this ‘third aspect’ under the rubric of *aesthetics*. This leads him to the hypothesis that a process of exteriorisation might have gone on in the aesthetic domain, precisely parallel to that process in the domains of technics and language: ‘for if tools and words developed into machines and writing by similar stages and more or less simultaneously, the same phenomenon ought to be observable in the case of aesthetics’ (p. 275). I shall now consider each of these ‘exteriorisations’ in turn: the first, manifested in the history of writing, in this section, and the second, manifested in the development of higher forms of figurative representation, in the section following.

Among non-human primates technical activity is evenly balanced between face and hands: the animal works by bringing the hands into close cooperation with the lips and teeth. In humans, the full liberation of the hands *for* technicity relieved the face of technical functions, allowing it to be co-opted for the purposes of speech. But with the further liberation of the hands *from* technicity, at first restricted to mercantile and administrative elites in the preindustrial city who were professionally released from manual work but subsequently generalised with the advent of machine automation, they became available to be co-opted for a linguistic function, namely writing. At this point, the original balance between face and hands was restored, though now in the domain of language rather than technicity (pp. 113, 188). The face speaks, the hand writes: each has its language, respectively of hearing and of sight (pp. 195, 210). These three stages in the evolution of the face–hand relationship—from one of technical equivalence in grasping animals, through a complementarity of linguistic and technical roles in early human societies, to an equivalence of linguistic function in literate civilisations—correspond roughly to the division in the field of memory between species-related (animal), social

(human) and mechanical. I have attempted to summarise this overall scheme in Fig. 4.

As a representation of Leroi-Gourhan's views this summary is not, however, entirely accurate. The problem for the reviewer of his work is that although he touches again and again on the question of the polarity of the face and hands, each time he does so it is expressed a bit differently, and with blithe disregard for consistency. The most interesting area of ambiguity lies in the middle range, where, ostensibly, the hands are to the face as tools to language (p. 187). Without becoming sidetracked into the issue of the gestural origins of language, we may reasonably suppose that as soon as humans were speaking in some recognisable sense, their speech was accompanied and amplified in its expressive force by manual gesture. Leroi-Gourhan is certainly of that opinion, asserting that well before the appearance of writing proper, 'the gesture interprets the word, and the word comments upon graphic expression' (p. 210). There are two points to note about this assertion. The first is that it flies in the face of the neat division of function between manual and facial poles. From the start, the hands have doubled in both a technical and a communicative capacity. Conversely, the face never entirely relinquished its technical function: for many operations, particularly involving the use of long fibrous strands such as in sewing or basketry, the lips and teeth have remained indispensable.²² Secondly, notice how Leroi-Gourhan slips almost imperceptibly from the interpretative gesture to its inscription, that is, to the relatively durable trace it leaves upon some material surface. Only when it leaves such a trace is the gesture 'expressed' as a graph.

Leroi-Gourhan brings the production of traces of this kind under the general rubric of *graphism*. Should graphism, then, be understood as a mode of drawing or of writing? This question, as Leroi-Gourhan shows, is misconceived. We are

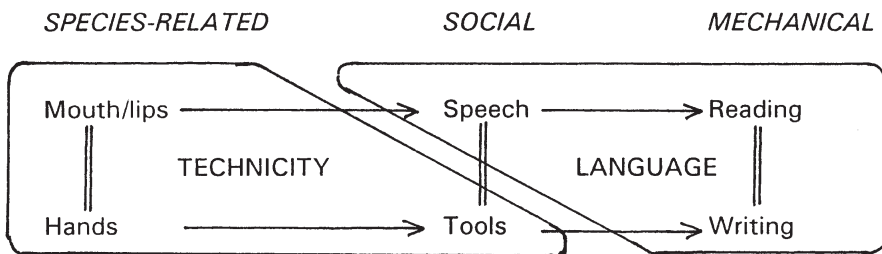


Fig. 4. A schematic representation of Leroi-Gourhan's view of the changing relations between facial and manual poles of the anterior field in the transition from non-human to human technicity, and—in human societies—from orality to literacy.

²²Added to this, numerous studies of non-human primates have confirmed the communicative role of both vocalisation, facial expression and manual gesture for these creatures. One can only conclude that throughout the entire course of human evolution, hand and face have been equally involved in both communicative and technical functions, even though the precise character of the operations has undoubtedly changed.

accustomed, nowadays, to separate drawing, as a genre of art, from writing, as a technology of language. But this distinction between art and technology is of modern provenance, a consequence of the very exteriorisation that transferred the technically effective aspect of gesture from the field of human sensibility to the impersonal machine, leaving to the field of art its residually expressive or aesthetic aspect (Ingold, 1993b, p. 459). It cannot, therefore, be retrojected onto the practices of ancient societies. To recapture the 'figurative attitude' of people in these societies, who did not—as we do—divide graphs that are expressive in themselves from those that are entirely subordinate to the requirements of representing spoken language in a visual medium, calls for a real effort of imagination (p. 192). We have to recognise, says Leroi-Gourhan, that graphism is not representational: it does not aim to produce a realistic depiction of objects or events in the environment (p. 190). Rather, every graph is the congelation, in a solid medium, of a dextrous manual movement.²³ As such, it embodies the rhythmicity characteristic of all movements of this kind (p. 195).

Following from this, the basic geometry of graphism is radial, 'like the body of the sea urchin or the starfish' (p. 211), reflecting the experience of a cosmos that stretches out towards the horizon, where sky and earth are perceived to meet, from a focus of dwelling within (pp. 327–328). Just as every concept is pinned down to a focal point, from which emanates a 'halo of associations' (p. 209), so every graph spirals out from a centre, its rhythmically repeated elements arranged in concentric rings. Writing, by contrast, is fundamentally linear—each graphic element following the next as do the sounds of speech to which they correspond—and where writing dominates the linguistic awareness of a society this linearity inevitably imposes itself upon other aspects of experience. For this reason people in modern literate societies, where 'life is molded by the practice of a language whose sounds are recorded in an associated system of writing', find the idea of radial expression 'practically inconceivable'. But in early societies it was the norm, one deeply embedded in a primarily oral context (p. 196).

Leroi-Gourhan is quick to observe that it is precisely in the contrast between radial and linear organisation that myth differs from historical narrative. In just the same way, the 'mythography' of oral societies could be contrasted with the writing of literate ones (pp. 195–196). Hence, too, mythography should not be confused with pictography. In pictography, representational graphic elements (pictograms) are strung out in sequence to correspond with the linear organisation of spoken words. In mythography, non-representational graphic elements (ideograms) are laid out in rings to correspond to the radial organisation of the perceived cosmos or lifeworld. Where we find pictography in the ethnographic record it invariably reflects the impact on indigenous peoples of colonisers who brought writing with

²³The philosopher G. H. Mead expressed this point very precisely in his notion of the durable forms arising out of human movement as 'collapsed acts' (Mead, 1977 [1938], p. 97).

them. That is why, in Leroi-Gourhan's opinion, pictography cannot be understood as an instance of 'writing in its "infancy"' (pp. 194–195).

There is, however, a catch in the argument that reflects a fundamental inconsistency not unlike that which we have already found in the discussion of manual dexterity. In this latter case, the issue was whether we can regard handling as the mechanical execution, by the body, of a language-based programme. Now we have exactly the same problem with regard to speaking. Basically, two views are available to us. The first would regard speaking, likewise, as the mechanical execution of sound sequences generated by an objective system of rules and representations, a language, stored in the mind along with the other contents of social memory. The second, by contrast, would treat speech as the phonic component of a comprehensive system of skilled and sensuous bodily movement, at once vocal and manual, by which human beings effect their presence in the world.²⁴ Leroi-Gourhan, true to form, never states explicitly what he means by either language or speech but shifts from one implicit view to the other as his argument proceeds.

On the one hand, adopting the first view, he tells us that language, by its very nature, observes a linear sentential logic, stringing words together for utterance in syntagmatic chains. There was, therefore, an original 'dualism' between the linearity of verbal expression and the radially of graphic expression, which was only resolved with the advent of 'linear graphism'—that is, writing proper—wherein the spatial arrangement of graphic elements was finally brought into line with the temporal sequence of speech sounds (p. 210). Yet, on the other hand, the notion of such a dualism directly contradicts Leroi-Gourhan's thesis that the graphism of ancient societies was the visible trace of an orality that was essentially non-linear. Only by placing speech within the context of a total system of bodily gesture, as in the second view outlined above, can it be claimed that phonation and graphic expression were 'paired', or rhythmically linked, from the outset (p. 192).²⁵ Furthermore, had speaking always been governed by a linear logic, it is hard to see why this logic should not have impressed itself upon the awareness of its speakers prior to its realisation in writing, or how it could have coexisted for so long within an oral context that was organised on quite the opposite principle.

It seems, indeed, that Leroi-Gourhan has fallen into the very trap that he warns us against: of retrojecting onto the orality of the past a linearisation born of writing, so as to make writing appear as the subordination of graphic expression to the pre-

²⁴This is the view taken by Maurice Merleau-Ponty, who argues that the intelligence of speech lies in the vocal gesture itself. 'It cannot be said of speech either that it is an "operation of intelligence", or that it is a "motor phenomenon": it is wholly motility and wholly intelligence' (Merleau-Ponty, 1962, p. 194).

²⁵If speech had always been linear, and if graphism had always been coupled to the rhythms of speech, then we would have to conclude that graphism, too, has been linear from the outset. This is what leads Foster, starting from the reasonable presumption that graphic inscription is as old as speech, to advance the hypothesis—which she herself admits 'seems quite fantastic, and is quite contrary to the conventional wisdom'—that alphabetic writing may have already existed in the Upper Palaeolithic (Foster, 1990).

existing linearity of spoken language. To avoid this trap, and to recover the original unity of speech, gesture and inscription, we need—as Jacques Derrida has pointed out—to ‘de-sediment’ from our minds the deposit of four millennia of linear thinking (Derrida, 1976, p. 86). With acknowledgement to Leroi-Gourhan, Derrida describes the hegemony of linearisation as the outcome of a struggle in which non-linear graphism was eventually defeated, splitting apart the elements of technics, art, religion and economy that had coexisted in the mythogram. Could it be, then, that writing, far from confirming a principle of ‘phonetic linearization’ already built into the structure of language, was actually instrumental in its establishment?²⁶ Or to put it another way, is language-as-we-know-it—conceived as a domain of human intelligence dedicated to the production of well-formed verbal sequences—an artefact of the codification of speech in writing, of the attempt to represent skilled vocal gesture as the mechanical output of a rule-governed system?²⁷

Admittedly, as Leroi-Gourhan recognises, not all scripts were linearised to the same degree. In some, such as Chinese, the linear component of phonetic transcription was held in balance with an ideographic component (p. 209). It was in the establishment of alphabetic writing that linear graphism was taken to its fullest extent. With that, writing was finally severed from graphic art. Just as the mechanisation of manual gesture removed the technical act from the context of immediate sensory participation, so the phonetic recording of speech lent to words a reality and an objective force wholly independent of the contexts of utterance. Where bodily operations were exteriorised in the functioning of machines, so the contents of social memory were exteriorised in printed texts, and subsequently in the card index—which is nothing less than a ‘real exteriorized cerebral cortex’ (pp. 261, 263). Eventually the typewriter and keyboard turned writing itself into a mechanical operation, separating the dextrous work of the hand from the formation of letters on the page.²⁸

In all these ways and more, the development of modern print literacy—or what Ong (1982) calls the ‘technologising of the word’—was part of the overall movement by which society was drawn ever further outside the natural world, establishing thereby the conditions for human mastery over it (p. 211). With this, the rounded cosmos of human dwelling was pierced, as Leroi-Gourhan vividly puts it,

²⁶Walter Ong observes that redundancy is much more natural to thought and speech than what he calls sparse linearity. ‘Sparsely linear or analytic thought and speech is an artificial creation, structured by the technology of writing’ (Ong, 1982, p. 40).

²⁷Just such a view has been put forward by Roy Harris (1980, pp. 6–18). More recently, David Olson has likewise argued that ‘awareness of linguistic structure is a product of a writing system not a precondition for its development’ (Olson, 1994, p. 68).

²⁸It is, of course, one thing to trace a parallel between the ‘regressions of the hand’ involved in the mechanisation, respectively, of tool-use and writing, but quite another to claim—as Leroi-Gourhan does—that the transition from the spoken word to writing is equivalent to that from the manual tool to the machine. For this ignores the fact that for much of its history, writing was a handicraft, the practice of scribes. Indeed the ‘manualisation’ of language associated with the advent of writing seems to be oriented in precisely the *opposite* direction to the ‘demanualisation’ of technicity associated with the rise of the machine.

'by an intellectual process which letters have strung out in a needle-sharp, but also needle-thin, line' (p. 200). Now subordinated to the demands of communicative efficiency, written language spearheaded the transition from cosmology to technology.²⁹ It was left to art, closely allied to religion, to compensate for the 'constriction' of thought and imagery induced by the rationalisation of language (p. 212), to express the rhythmic qualities of experience which were rendered inexpressible within its formal conventions, and to restore human beings to their true place at the centre of a multidimensional lifeworld.

8. From the Abstraction of the Concrete to the Realism of the Image

This brings me, finally, to the question of aesthetics. Has there been an exteriorisation in the aesthetic domain akin to the exteriorisation of speech in writing, and if so, how is it manifested? Leroi-Gourhan's answer is long and involved, but can be boiled down to two related claims: first, that the history of art is driven by a tendency to move from abstraction to realism; and second, that the great majority of contemporary people, having confused the real world for its more or less realistic representation, have been converted into consumers of images not of their own creation. Before turning to the first of these claims, however, a few words are necessary on the subject of the senses.

Leroi-Gourhan's delineation and ranking of the senses follows a scheme that has a long and distinguished pedigree in the history of Western thought (Synnott, 1991). This ranking is correlated, though inexactly, with a hierarchy of aesthetic functions. Thus the 'deep visceral and muscular sensibility' of the body, the sensibility of the skin to touch, and the senses of smell and taste, belong to the lowest level of 'physiological aesthetics', pertaining to basic bodily functions (pp. 289–296). They are common to humans and animals, and are often better developed in the latter. Touch, too, is critical to the next level of 'technical aesthetics', as in the exercise of a craft. The higher levels of 'social' and 'figurative' aesthetics depend, however, on the 'noble' senses of hearing and above all sight, since only these—along with the 'physical faculty of gesticulation'—can act as vehicles of symbolic reflection (p. 365). The figurative level is itself subdivided into the fields of motor representations (mimicry and dance), auditive representations (music and poetry), visual representations (such as paintings) and written literature, an order that once more reveals the preeminence of visual perception (p. 273). But this ranking of the senses, for Leroi-Gourhan, also correlates with a movement of exteriorisation, the gradual displacement of the locus of perception from the physiological locus of human being. The touch-sensitive surface of the body is in direct

²⁹Elsewhere, I have described this transition in terms of the contrasting imagery of the sphere and the globe. 'As cosmology gives way to technology, the relation between people and the world is turned inside out . . . so that what was a cosmos or lifeworld becomes a world—a solid globe—externally presented to life' (Ingold, 1993d, p. 41).

contact with the world, the ears pick up its vibrations indirectly, but the eyes look out at the world from somewhere beyond. And at the pinnacle of perception, beyond vision itself, is the ‘mind’s eye’ which has nothing to see but images, reflections of ‘the whole fabric of sensibility’ (p. 272).

Now for Leroi-Gourhan the earliest images were undoubtedly abstract. ‘We may be absolutely sure’, he asserts, ‘that graphism did not begin with naive representations of reality but with abstraction’ (p. 188). This was followed, in the ensuing millennia, by ‘the slow rise of realism’ (p. 373). By definition, he tells us, to abstract is ‘to consider a part by isolating it from the whole’. In this sense, and following a procedure precisely analogous to what Claude Lévi-Strauss (1966)—in reference to oral mythology—has called *bricolage*, early graphic art abstracts certain features from their given settings and reassembles them kaleidoscopically in the shape of a mythogram. It is important to recognise that this is not abstraction in the sense that has become conventional in the field of modern Western art, a sense that is closely bound up with the assumption that all art is representational. A modern painting might be said to be abstract because it represents an idea in the artist’s mind rather than any actual object or scene in the world. The meanings of the mythogram, by contrast, are to be found in the relations between its graphic elements, and in the positioning of the whole within the contexts of oral narrative—in the case of prehistoric societies, ‘irretrievably lost’ (p. 190)—for which it acts as a support. Thus early graphism was an art of the concrete.³⁰

Only as human consciousness, assisted by language and technics, was liberated from lived experience were the conditions established for art to become representational. Paradoxically, *realism*—conceived as the project of faithfully representing aspects of an external world whose objective existence is posited independently of human awareness—is made possible by the isolation, or *abstraction*, of the human subject from the context of his or her direct perceptual engagement in the lifeworld. As the picture is separated from the world it is said to depict, so the activity of picture-making is divorced from the contexts of sensory participation. The rise of figurative representation is thus just one more aspect of the process of exteriorisation. Not until this stage has been reached is it possible to conceive of abstract art in its modern sense, as a reaction against realism. The abstract painting hanging in the rarefied atmosphere of a gallery of modern art is, if you will, a representation of the unreal, the very opposite of the ancient mythogram which, placed at the very centre of the cosmos, is a reconfiguration of the real. Once, however, the correspondence between representation and reality has become the dominant criterion of aesthetic judgement, then, through a process of ‘imperceptible corrections’ somewhat analogous to the steady improvement of tools towards functional perfec-

³⁰This idea is exemplified in Anthony Forge’s analysis of the flat painting of the Abelam of New Guinea. Forge points out that for the Abelam, the question of whether the paintings actually ‘represent something’ is meaningless. Nor, if they do not, can they be regarded as ‘abstract’ in the modern sense of a turning away from realist representation (Forge, 1973, p. 187).

tion (and, one might add, of scientific hypotheses towards predictive accuracy), art tends toward 'the point of coincidence between the image and reality' (p. 375). At this point there is no way forward except through something in the nature of a paradigm shift, a radical change of direction, more often than not sparked off by socioeconomic upheaval.

Reasoning thus, Leroi-Gourhan ends up with a cyclical view of the history of art—somewhat reminiscent of Spengler's of the history of civilisation—as a series of long ascents, each followed by a fall and the initiation of a new trajectory. Almost as in a game of snakes and ladders, modern art is heading in its contemporary evolution to the tongue of a very long snake, which may well take us back 'to the stage of the immediate predecessors of the painters of Lascaux' (pp. 398–399). Yet in some rather acerbic comments on the pretence of surrealism, Leroi-Gourhan suggests that the predicted recapitulation may be more apparent than genuine.³¹ For however much surrealist art might mimic that of the Palaeolithic in the way it reassembles ordinary objects in extraordinary ways, it cannot be the same thing. A return to origins is impossible, since it would mean wiping from the collective memory the entire, intervening history which has shaped our contemporary aesthetic sensibilities. 'The difference between the beginning and the end', Leroi-Gourhan writes, 'is that the Palaeolithic artists were innovating whereas the Surrealists tried to renovate, . . . to construct something unconstructed out of scraps of obsolescent material' (p. 397).

In another area, too, an apparent recidivism to an earlier stage of development turns out to be illusory. The mythogram, it seems, is staging a comeback, in the form of illustrations, cartoons, films, television, and all manner of other visual imagery which comes as a relief to the mass of the population weary of making sense of lengthy written texts (p. 403). With the rapid advance of audiovisual technology, Leroi-Gourhan predicts, 'writing is probably doomed to disappear'. Does this mean, then, that human society is reverting to the condition 'that preceded the phonetic subordination of the hand'? Recall that in this earlier condition, the hand was at once the organ of graphic inscription and of direct sensory participation in the environment. The modern, electronically assisted hand, however, does not explore a real world but a virtual one of mechanically generated images. Caught up in an engagement with this virtual reality, it is more than ever removed from direct, dextrous contact with the environment. Thus Leroi-Gourhan is inclined to see the new mythography not as a return to the past but as a further instance of the 'regression of the hand', beyond what has already been achieved by mechanised industry and print technology (p. 404).

³¹Nathan Schlanger (personal communication) notes that Leroi-Gourhan's antagonism towards the surrealists (some of whom, such as Leiris and Bataille, he would have met while working at the Musée de l'Homme in Paris) reflected his political and ideological conservatism. His sympathies were much more with the traditional arts of the European peasantry, which he saw as a source of vital continuity between past and present.

This regression, for Leroi-Gourhan, gives cause for concern. It entails a reduction not just of technical intelligence but of aesthetic sensitivity, both of which are necessary for creative imagination. Thus ‘the loss of manual discovery, of the personal encounter between human and matter in the exercise of a craft, has closed one of the doors to individual aesthetic innovation’ (p. 397). For millions of people in contemporary society, this door is already closed: like the man who, on his short walk to the bus stop, avoids direct contact with birdsong by turning up the volume on his transistor radio (p. 360), the vast majority have shut themselves off from contact with the environment, leaving a sensory void to be filled with ‘experiences’ produced and purveyed by the few. This is the final exteriorisation, in which experiences, packaged and commoditised, are no longer actively lived but passively consumed. A mode of perception that consists not in the sensory exploration of the environment but in the receipt of ready-made ‘images’ is necessarily divorced from technically effective action, just as consumption is cut off from production. The ‘average person of today’, fed with images from every quarter of the globe and beyond, nevertheless has less scope for creativity than a nineteenth-century washer-woman (pp. 359, 401)!

What, Leroi-Gourhan wonders, will happen when the imagination, ‘which is nothing other than the ability to make something new out of lived experience’, has nothing left to work on? Will we be sending our artists and authors of the future to theme parks to get a suitably authenticated taste of ‘real life’, so that it can be served up to the masses in a rejuvenated form on radio and television? Are we not in danger of losing that specific attribute of our humanity, ‘the capacity of the body, hand, and brain to exercise the individual privilege of material and symbolic creation’? If so, then humankind can expect to be confronted, sooner rather than later, with the problem of its ‘rehumanisation’ (pp. 360–361). These are familiar enough sentiments in a society consumed by pre-millennial anxiety. Written in the early 1960s, however, Leroi-Gourhan’s words are truly prophetic.

9. Conclusion

In *Gesture and Speech*, Leroi-Gourhan offers glorious proof of the unity of the science of humanity. It is a work that sails over the boundaries between palaeontology, physical anthropology, archaeology, social and cultural anthropology, linguistics and art history with such ease and assurance that one is left with a genuine sense of puzzlement as to why so much scholarly energy should have been expended in their defence and reinforcement. Within the discipline of anthropology, it is commonly argued today that the kinship between its four sub-fields—biological, archaeological, linguistic and sociocultural—is no more than an accident of history or an unfortunate legacy of nineteenth-century evolutionism. No-one can read this book and still hold on to such a view. To be sure, if every anthropologist were to follow Leroi-Gourhan’s example in attempting singlehandedly to produce an equivalent of the physicists’ ‘theory of everything’, the science of humanity

might gain in colourful eccentricity but would not advance. Undoubtedly the most outrageous feature of the book is its author's almost total disregard of the work of anyone else. The 153 figures are, for the most part, unattributed, and the bibliography, though extensive, bears no relation whatever to the text. In these respects, Leroi-Gourhan does not set a good precedent. Yet what the book lacks in terms of conventional scholarly apparatus, it more than makes up in the profusion of ideas and the erudition on which they rest.

The assignment of priority in the history of scientific knowledge is a tedious and largely unprofitable exercise, and rests on a linear conception of history which is itself open to criticism. Nevertheless, if one were to catalogue the themes of contemporary debate which were already addressed—or at least prefigured—by Leroi-Gourhan over thirty years ago, the list would be very long indeed. His treatment of these themes is full of speculations that are in turn perverse, bizarre, inconsistent, provocative, revelatory and profound. For the contemporary reader, the effect is at times exhilarating, at times exasperating, but never dull. Most of all, however, Leroi-Gourhan points the way towards a vision of the human sciences that is at once informed by the lessons of evolution and has something to say to the present planetary predicament of our species. *Gesture and Speech* is not a quick or an easy read, but the time and effort involved are well spent. It is, indeed, one of the great masterworks of twentieth-century anthropology.

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