Tim Ingold

How We Walk

Human beings are restless creatures. They are always moving about. But far from being haphazard these movements are, for the most part, highly controlled. In many cases this control is achieved through long and frequent practice; we may then speak of it as a skill. Now it is evident that people raised in different environments, and following different ways of life, also possess a range of different skills. As an anthropologist I am particularly concerned to understand the nature of these differences. It has long been conventional to attribute them to something called 'culture'. Whether culture is genuinely unique to human beings, or present – albeit in rudimentary forms – in non-human species, has been much debated. All agree, however, on two points. First, humans rely on culturally acquired skills to an extent unparalleled elsewhere in the animal kingdom. Second, whatever biological differences may exist among human beings, they are irrelevant so far as their acquisition of culture is concerned. Or, to put it another way, every creature born of man and woman should, in principle, be capable of acquiring the skills appropriate to any form of cultural life. 'One of the most significant facts about us', wrote the anthropologist Clifford Geertz, 'may finally be that we all begin with the natural equipment to live a thousand kinds of life but end in the end having lived only one.'[1]

Consider, for example, that most widespread of human movement skills: the ability to walk on two feet. Every human newborn, barring accident and handicap, has the potential to develop full bipedality. In that sense we are inclined to suppose that walking is an innate capacity, one for which – as Geertz would say – humans are naturally equipped. It is part of our biological make-up, given from the start rather than culturally acquired. Yet we also know that people in different societies are brought up to walk in very different ways. One of the first to recognise the significance of this fact, as an index of cultural variation, was the French ethnologist Marcel Mauss, who set out to classify the extraordinarily diverse postures and gestures adopted by people around the world in their most ordinary activities, whether at rest (sleeping, squatting, sitting, standing) or in movement (walking, running, jumping, climbing, swimming). Thus:

> The *habitus* of the body being upright while walking, breathing, rhythm of the walk, swinging the fists, the elbows, progression with the trunk in advance of the body or by advancing either side of the body alternately (we have got accustomed to moving all the body forward at once). Feet turned in or out. Extension of the leg. We laugh at the 'goose-step'. It is the way the German army can obtain the maximum extension of the leg, given in particular that all Northerners, high on their legs, like to take as long steps as possible. In the absence of these exercises, we Frenchmen remain more or less knock-kneed . . .

For the adult in any society, Mauss concluded, walking is an acquired technique. There is no 'natural way' of going about it.[2]

How are we to reconcile these two views of walking: as innate capacity and acquired skill? One

commonly proposed solution is to argue that while humans are naturally endowed with the anatomy that makes bipedal locomotion a practical possibility, and the behavioural propensity or 'instinct' to put it to effect, precise directions about *how* to walk are passed on from generation to generation as part of a cultural tradition. This tradition includes rules and representations laying down standards of propriety, perhaps specific to age and gender, that walkers are enjoined to follow, and in terms of which their performance is evaluated and interpreted. Thus while the capacity to walk is a biological universal, particular ways of walking are expressive of social values. Would it not suffice, then, to combine the biology of human nature with the sociology of cultural difference to produce a complete 'biosocial' account of the ways people walk?

Mauss thought it would not. For the link between human nature and culture can only be established by way of a third term, namely what is called the 'human mind'. Any account of the relation between biological and sociological dimensions of human existence must leave room, said Mauss, for the 'psychological mediator'.[3] More recent contributions to culture theory, drawing much of their inspiration from developments in cognitive science, have gone on to propose that if rules and representations for the generation of culturally appropriate behaviour are to be transmitted from one mind to another, across the generations, then certain devices must already be in place. These must enable the novice to 'decode' the input of sensory data drawn from observations of the behaviour of experienced practitioners and thereby to reconstruct these rules and representations inside his or her own head. Or as Roy D'Andrade, one of the pioneers of cognitive anthropology, claims, the transmission of specific cultural content, in the form of *programmes*, depends upon the functioning of universal cognitive capacities, or *processors*.[4]

Thus in language learning it is supposed that the child's acquisition of his or her mother tongue depends on the pre-existence, in the mind, of an innate language acquisition device (LAD), able to process the input of speech sounds so as to establish a system of grammatical and syntactical rules for the production of well-formed and comprehensible utterances. (But see Annette Karmiloff-Smith's chapter.) Likewise, there ought to exist a 'walking acquisition device' – a cognitive module dedicated to the construction of a culturally specific programme for bipedal locomotion from observations of other people's movements. Such a device should, in principle, be universal to the human mind. To complete our picture of the walking, talking human being we therefore have to put together three things: (i) the human body with its built-in anatomical structures and capacities of movement (limbs for walking, vocal tract for speech); (ii) the human mind with its hard-wired, computational architecture of processing mechanisms, and (iii) the assemblage of culturally specific representations or programmes whose transmission across the generations these mechanisms make possible.

I refer to this idea of the human being as the sum of three complementary parts, namely body, mind and culture, as the *complementarity thesis*. It is backed by a formidable intellectual alliance between the theoretical paradigms of neo-Darwinism in biology, cognitive science in psychology and culture theory in anthropology. Far from advocating this alliance, I shall argue that it is dangerously misconceived. Before doing so, however, I should explain how its constituent parts fit together, beginning with biology.

The Complementarity Thesis

1 Evolutionary biology. The central claim of Darwinian biology is that human beings, along with

creatures of every other kind, have evolved through a process of variation under natural selection. This claim, however, rests on the critical assumption that the growth and maturation of the individual organism – its ontogeny – is a separate matter from the evolution of the species to which it belongs. While what an organism does during its life is both a consequence of, and has consequences for, the evolution of its kind, its life history is not part of that evolution. In its neo-Darwinian conception, evolution is *not* a life process. If we ask what evolves, it is not the living organism itself, nor its manifest capabilities of action, but rather a formal design specification for the organism, its genotype. By definition, the genotype is given independently of any particular environmental context of development. Its evolution takes place over numerous generations, through gradual changes brought about by natural selection in the frequency of its information-bearing elements, the genes. Ontogeny is then understood as the process whereby the genotypic specification is translated, within a certain environmental context, into the manifest form of the phenotype.

Most contemporary biologists regard the phenotype as the outcome of an interaction, over the course of a life cycle, between genotype and environment. Indeed this is often called the 'first law of biology'. But the formula is misleading on two counts. First, since 'environment' apparently includes everything relevant to the development of an organism barring the genes themselves, genes cannot interact *with* an environment but only *in* an environment with other entities that are, of course, also interacting with one another. So why should the environment always be defined in relation to the genes rather than to any other of the myriad interactants in the cell? The answer, second, is that the equivalence accorded to genes and environment in the interactionist formula is an illusion. For the distinction between genes and environment is mapped on to a more ancient distinction in Western thought, that between form and substance. Thus the genotype is privileged as the locus of organic form, while the environment is supposed merely to provide the material conditions for its substantive realisation. While an organism may develop different features in changed environments, these differences are regarded as merely alternative phenotypic 'expressions' of the same basic design. Only when the design itself changes is evolution said to occur.

For humankind, it follows that it must be possible to specify what a human being *is*, independently of the manifold conditions of development under which humans live. This possibility is entailed in the assumption that human beings together make up a species – that is, a class of entities that may be grouped together on the grounds of their possession of certain design features transmitted along lines of descent from a common ancestral source. The sum of these features amounts to what many call 'human nature'. This idea was around long before Darwin. What Darwin added was the claim that human nature is the product of an evolutionary process. So if walking is part of human nature, it must have its basis in a design specification – a programme for the assembly of a functioning bipedal apparatus – that has evolved alongside the rest of the genotypic endowment each of us receives at conception. Thus humans are said to be universally equipped with an innate capacity to walk on two feet, regardless of how they walk in practice, or of whether they walk at all – or go everywhere by car! Specific ways of walking have not themselves evolved, they are just alternative phenotypic realisations of a pre-established, genotypic trait.

2 Cognitive science. Just as neo-Darwinian biology presumes a context-independent specification for the design of the body, so cognitive science posits an independent specification for the architecture of the mind. This includes the various cognitive mechanisms or processing devices which would have to be in place before any kind of transmission of cultural representations could take place. Cognitive scientists generally assume that the problem of the origin of these mechanisms has

already been solved by evolutionary biology. Since the information specifying the mechanisms cannot be transmitted culturally, there is only one possibility: it must be transmitted genetically. Indeed, by and large in the literature of cognitive science, the postulation of innate mental structures receives no more justification than vague references to genetics and natural selection.

Just as evolution has provided humans with a body that can walk and a vocal apparatus that allows them to speak, so, we are told, it has also furnished a mind with the acquisition devices that enable them to take on representations for walking in culturally particular ways and for speaking particular languages. However, this union of evolutionary biology and cognitive science is not without its contradictions, which are proving to be a particular source of difficulty for the new discipline of evolutionary psychology to which it has given birth. The trouble lies with the distinction between innate and acquired structures (see Pat Bateson's chapter). This distinction lies at the heart of cognitive science's account of how the mind works. A mind without innate mechanisms – that is, one conceived as a 'blank slate' – apparently could not learn, since it would have no way of making sense of the data of experience. And without learning there could be no transmission of representations across generations and hence no culture.

Yet the majority of evolutionary biologists have long since discarded the innate/acquired dichotomy. The architecture of the organism, they say, is neither innate nor acquired, but the outcome of a lifelong interaction between endogenous, genetic factors and exogenous, environmental ones (see e.g. Steven Rose's chapter). It is one thing to claim that every organism starts out with a design specification (the genotype) encoded in the materials of heredity, quite another to claim – as does cognitive science – that every human is born with a preformed mental architecture. For such an architecture, in order to function, would have to exist not merely in the virtual guise of a design, but already 'hard-wired' in the brain. Somehow or other, in order to kick-start the process of cultural transmission, strands of DNA have magically to transform themselves into information-processing modules (see Gabriel Dover's chapter). This is rather like supposing that merely by replicating the design of an aircraft, on the drawing board or computer screen, one is all prepared for take-off. I return below to the attempts of evolutionary psychology to resolve this dilemma.

3 Culture theory. The final component of the trilogy is a certain notion of culture, conceived as a corpus of knowledge or information that can be transmitted across generations independently of its practical application. This notion goes back to a celebrated definition by anthropologist Ward Goodenough, who in 1957 pronounced, 'A society's culture consists of whatever it is one has to know or believe in order to operate in a manner acceptable to its members.'[5] Notice how this definition effectively separates the process by which cultural knowledge is acquired from the way it is expressed in observable behaviour. One obtains the knowledge *in order* to be able to operate or function in the world. The underlying logic of this separation is identical to that which separates genotype from phenotype in biology. Just as the genotype contains a context-independent specification for the design of the organism, so the transmitted cultural information contains a context-independent specification for its behaviour, consisting of what have variously been described as plans, programmes, schemata, representations, recipes, rules and instructions. And where the genotype is said to be 'realised' in the context-specific form of a certain phenotype, through a process of development within an environment, so is culture said to be 'expressed' in the life history of the individual by way of his or her environmentally situated behaviour.

This analogy, in turn, underwrites theories of so-called gene-culture co-evolution, which start from the premise that in human populations two mechanisms of inheritance or information transmission

operate in parallel: one genetic, the other cultural.[6] Each of us receives from our predecessors one set of genes and another set of cultural instructions or 'memes'. (See Mary Midgley's chapter.) Together these pull the strings in the development of behaviour. Though recently popularised by Richard Dawkins, the idea that culture consists of particles of heritable information analogous to genes is scarcely novel. In 1956 the anthropologist Clyde Kluckhohn coined the expression 'cultural genotype' to refer to the pattern of rules and representations underlying manifest behaviour. Numerous similar suggestions have been advanced since then, one of the more recent coming from sociobiologist E. O. Wilson and his collaborator Charles J. Lumsden, who christen the analogue of the gene the 'culturgen', even going so far as to recommend how the term should be pronounced![7]

To sum up the relation between processes of biogenetic and cultural transmission, as generally understood within the framework of the complementarity thesis, consider a human lineage. In each generation bodily anatomy and mental information-processing capacities are built to genetic specifications established through natural selection. And in each generation the mind's capacities are filled with information from which are built the programmes that put the bodily equipment to use in culturally specific ways. Thus the genes provide the necessary instructions for building a workable bipedal apparatus and vocal tract, as well as for the assembly of the walking acquisition device and the LAD. With the aid of these devices, individuals of each generation are able to take on board the rules that enable them to walk, to paraphrase Goodenough, in a manner acceptable to the members of their society, and to speak correctly in the language of their community.

Thus evolutionary biology, cognitive science and culture theory conspire to produce a synthetic account of the living, acting human as a creature of three components, of genotype, mind and culture. Moreover, all three approaches – in biology, psychology and anthropology – share one fundamental premise: that the bodily forms, intellectual capacities and behavioural dispositions of humans are specified independently and in advance of their involvement in practical contexts of environmental activity. Yet in each of the three disciplines the dominant paradigms have come under attack, and for similar reasons. Neo-Darwinism has been criticised for its inability to offer an adequate account of ontogeny, cognitive science for its removal of the mind from human bodily engagement in the world and culture theory for its separation of knowledge from practical application.

By combining these lines of criticism, coming respectively from developmental biology, ecological psychology and the anthropological theory of practice, it should be possible to produce a counter-synthesis much more powerful than the prevailing biopsychocultural orthodoxy. In this, to which I now turn, the conventional divisions between body, mind and culture would be dissolved, though not as in the more extreme versions of sociobiology or cultural constructionism, by reducing everything to one or other of these terms. Rather, the synthesis offers a unitary focus on the whole organism-person, undergoing a process of growth and development within an environment and contributing through its presence and activity to the development of others.

Developmental Biology

To begin, I return to the analysis of walking. What does it mean to say, as in the conventional account, that I, along with all my fellow humans, possess a capacity to walk? Do we all, likewise, have a capacity to swim, to relax for long periods in a squatting position or to carry things on our

heads? I can indeed swim, though plenty of people cannot. Yet like everyone else who has been brought up to sit on chairs, I find that having to squat for any length of time is acutely uncomfortable – though I am told that, with sufficient training, this can be overcome. Along with the great majority of inhabitants of the Western world, however, I am quite incapable of carrying things on my head, at least without manual support.

Are we to conclude, then, that unlike walking carrying things on the head is not innate to humans but culturally acquired? What of the capacity to read and write? Any catalogue of alleged human universals tends to project the image that people of affluent, Western societies have of themselves. Thus where *we*, as privileged members of such societies, can do things that *they* – people of 'other cultures' – cannot, this is typically attributed to the greater development, in ourselves, of universal human capacities. But where they can do things that we cannot, this is put down to the particularity of their cultural tradition. This is to apply just the kind of double standards that have long served to reinforce the modern West's sense of its own superiority over 'the rest', and its sense of history as the progressive fulfilment of its own ethnocentric vision of human potentials. Once we level the playing field of comparison, however, only one alternative remains: that all human beings must have been genotypically endowed, at the dawn of history, with the 'capacity' to do everything that they ever have done in the past, and ever will do in the future – not only to walk, talk, swim and squat but also to read and write, do the pole vault, ride on horseback, drive cars or fly aeroplanes.

Of course, human babies are no more born walking and talking than they are born swimming or squatting: these are bodily skills whose development presupposes an environment that includes already competent care givers, a range of supporting objects and surfaces, and a certain medium or terrain. Given the requisite environmental conditions, these skills are more or less bound to develop; yet in every case their development depends on a process of learning through interaction with other persons and things. This must be true of every bodily skill that humans have ever practised, regardless of its degree of cultural particularity, or the level of social or artefactual scaffolding entailed in its acquisition. Thus the notion of capacity is vacuous unless it refers back to the overall set of conditions that must be present, not only in the individual's genetic constitution but also in the surrounding environment, to make the subsequent development of the characteristic or capability in question a realistic possibility. A negative example clarifies the point. Humans may nowadays be able to fly planes, but despite determined attempts, they cannot fly unaided.

Does this not, then, establish some kind of 'bottom line'? Whatever the environmental conditions, there are certain things that humans potentially can do and others that they definitely cannot. Doubtless a great deal of genetic change would be needed to turn a human into something like a bat – enough to rule out the possibility for our immediate descendants! But while the genetic difference may provide some of the explanation for why humans cannot fly and bats cannot walk, it would be a serious mistake to infer from this that the particular genetic constitution of the bat encodes, within itself, a design for constructing the mechanism of flight, or conversely, that human genes encode a design for building the apparatus of bipedalism. The source of the error lies in the identification of genetic differences with formal traits, a trick which, as Paul Weiss noted long ago, automatically vests genes with exclusive responsibility for organisation and order.[8] It is one thing to claim that without certain genetic modifications having taken place in the lines of descent leading, respectively, to bats and humans, bats could not fly and humans could not walk. But it is quite another to speak of the establishment, in these lineages, of 'genes for flying' or 'genes for walking'.

This is not to deny that every organism starts life with its complement of DNA in the genome. But for the genome to encode any kind of design specification, it would be necessary to suppose that some

means exists of 'reading off' this specification from the sequence of DNA base pairs which is independent of any developmental process. No such means has ever been demonstrated. There is only one reading of the genome, and that is the process of ontogeny itself. Hence there can be no design for the organism other than its actual phenotypic form, as it emerges within a particular developmental context. The genotype, conceived as a context-independent design specification, does not exist. It follows that the forms and capacities of human and other organisms are attributable, in the final analysis, not to genetic inheritance but to the generative potentials of the developmental system, that is, the entire system of relations constituted by the presence of the organism, including its genes, in a particular environment. As the philosopher of biology Susan Oyama has pointed out, only within the context of such a system can we possibly say what any gene, or cluster of genes, is 'for'.[9] And so too, in the particular case of human beings, there can be no determination of what a human being is, no human nature, apart from the manifold ways in which humans become, as they live out their lives in diverse communities and environments.

Thus an infant learns to walk in the approved manner of his or her society: it is not as though the latter is somehow added on to a generalised bipedality that has appeared of its own accord, in advance of the infant's entry into the world. Hence there is no such thing as 'bipedal locomotion', as distinct from the various ways in which people actually walk; no pre-programmed 'essence' of the activity that is isolable from the real-time performance of the activity itself.[10] And since ways of walking are properties of neither genes nor 'culture' (conceived as a package of transmissible information), but rather of developmental systems, to account for their evolution we have to understand how such systems are constituted and reconstituted over time. The key to this understanding lies in the recognition that humans, like all other creatures, create through their own actions the environmental conditions both for their own future development and for that of others to which they relate. Thus they figure not as passive 'sites' of evolutionary change but as creative agents, producers as well as products of their own evolution (see Steven Rose's chapter). Far from having been fixed genetically, at some time in the ancestral past, skills such as walking continue to evolve in the very course of our everyday lives.

Clearly, neither orthodox evolutionary biology nor its complement in the field of culture theory is able to offer a coherent account of human development. According to the complementarity thesis, every human being is in part ready-made genetically, in part moulded through the superimposition, upon this preformed substrate, of pre-existing norms and values. Thus in childhood, as anthropologist Walter Goldschmidt puts it, the infant is transformed 'from a purely biological being into a culture-bearing one'.[11] Real humans, however, are not like that. Rather, they grow in an environment furnished by the presence and activities of others. To be sure, as people go through life, they grow out of certain ways of doing things and grow into others. But no one has ever grown out of biology or grown into society or culture. We do not progress, in the course of our lives, from a stage of biological incompletion as 'mere' organisms, to one of social completion as fully fledged persons. We are all fully and indissolubly organism and person from beginning to end.

Walking is certainly biological in that it is part of the way human organisms work. But it is only thanks to the person's involvement in a social world that he or she can undergo normal development as an organic being. A condition for learning to walk is that there is a ground surface to walk on and that this condition is universally fulfilled. Yet how could the infant, taking his or her first steps, encounter 'ground', as a concrete condition of development, not only as distinct from, but also prior to, such diverse 'walk-on-able' surfaces as sand, asphalt, meadow and heath, all of which call for different modalities of gait, balance and footwork? Human infants do not learn to walk in isolation,

and even adults rarely walk alone. In everyday practice a person's movements, his or her step, gait and pace, are continually responsive to the movements of others in the immediate environment. Indeed it is largely in this responsiveness that the skill of walking lies. And it is in this respect, too, rather than in its expression of values that somehow reside in an extra-somatic domain of collective representations, that walking is preeminently social.

Ecological Psychology

Thus a design specification for the organism cannot be derived from its genetic constitution alone, independently of the conditions of development in an environment. Turning now from evolutionary biology to cognitive science, the problem is further compounded. If the theory of learning as the transmission of cultural information is to work, the requisite processing devices must already exist, not merely – as it were – 'on the drawing board', but in the concrete hard-wiring of human brains. Attempts to resolve this problem, insofar as it is even recognised, are confused and contradictory, and boil down to two distinct claims. One is that the concrete mechanisms making up what evolutionary psychologists call the mind's 'evolved architecture' are reliably constructed, or 'wired up', under all possible circumstances. The other is that these universal mechanisms work on variable inputs from the environment to produce the diversity of manifest capabilities that we actually observe.

Consider the case of language acquisition. Here the alleged universal mechanism is the so-called language acquisition device. All human infants, regardless of the language or languages they may end up speaking in later life, are supposed to come pre-equipped with such a device. The evolutionary psychologists John Tooby and Leda Cosmides (without citing any evidence) claim that even individuals raised in isolation, though they may never learn to speak, will nevertheless possess 'the same species-typical language acquisition device as everyone else'.[12] During a well-defined stage of development, this device is said to be activated, operating on the input of speech sounds from the environment so as to install, in the infant's mind, the grammar and lexicon of the particular language spoken in his or her community. It would thus appear that language acquisition is a two-stage process: in the first, the LAD is constructed; in the second, it is put into service in order to furnish the capacity so established with specific syntactic and semantic content. Notice how this model of cognitive development depends on factoring out those features of the environment that are constant, or reliably present, in every conceivable developmental context, from those that represent a source of variable input from one context to another. Only the former are relevant in the first stage (the construction of innate mechanisms); only the latter are relevant in the second (the acquisition of culturally specific capabilities). The notion that competence in his or her mother tongue is acquired upon the base of a preformed 'language instinct' partitions out the child's experience on the environment just as in my walking example.

Of course, for comparative analytic purposes it is sometimes helpful, even essential, to sift the general from the particular, or to establish a kind of 'lowest common denominator' of development. But real environments are not partitioned in this way. In the case of language development, from well before birth infants are sensitive to the surrounding ambience of sound and above all to the mother's voice. Thus the baby comes into the world already attuned to certain environmentally specific sound patterns. From birth onwards, it is surrounded by an entourage of variously accomplished speakers who provide support in the form both of contextually grounded interpretations of the infant's

vocalisations and of demonstrations, or attention-directing gestures, to accompany their own. This environment, then, is not a source of variable input for a preconstructed 'device', but rather furnishes the variable conditions for the development of the neurophysiological structures underwriting the child's capacity to speak. As the conditions vary, so these structures will take manifold forms, each 'tuned' both to specific sound patterns and to other features of local contexts of utterance. These variably attuned structures, and the competencies they establish, correspond to the diverse languages of the world. In short, language – in the sense of the child's capacity to speak in the manner of his or her community – is not acquired. Rather, it is continually being generated and regenerated in the developmental contexts of children's involvement in worlds of speech. And if language is not acquired there can be no such thing as an innate language-learning device.[13]

What applies in the case of language and speech can be extended to other aspects of cultural competence. Thus learning to walk, like learning to talk, is a matter not of acquiring *from* an environment representations that satisfy the input conditions of some preconstituted cognitive device, but of the formation *within* an environment of the necessary anatomy, neurological connections and musculature that underwrite the skill. In short, the systems that actually generate skilled activity are not hard-wired but 'softly assembled'.[14] This conclusion, however, puts paid to one of the key ideas behind the thesis of the complementarity of body, mind and culture, namely that cultural learning is like filling a universal, genetically specified container with culturally specific content. The notion that culture is transmissible from one generation to the next as a corpus of knowledge, independently of its application in the world, is untenable for the simple reason that it rests on the impossible precondition of a ready-made cognitive architecture. The condition is impossible because no matter at what point in the life cycle one might choose to identify a particular structure or mechanism – even before birth – a history of development in a certain environment already lies behind it.

In truth, nothing is really transmitted at all. For the growth of practical knowledge in the life history of a person is a result not of information transmission but of guided rediscovery. In each successive generation, novices learn through being placed in situations in which, faced with certain tasks, they are shown what to do and what to watch out for, under the tutelage of more experienced hands. To show something to someone is to cause it to be made present for that person, so that he or she can apprehend it directly, whether by looking, listening or feeling. Placed in a situation of this kind, the novice is instructed to attend to this or that aspect of what can be seen, touched or heard, so as to get the 'feel' of it for him- or herself. This is not a matter of replicating memes, culturgens or any other such particles of cultural information. For what each generation contributes to the next are not rules and representations for the production of appropriate behaviour, but rather the specific circumstances under which successors, growing up in a social world, can develop their own embodied skills and dispositions, and their powers of awareness and response. Learning in this sense is what the ecological psychologist James Gibson calls an 'education of attention'.[15]

Ecological psychologists reject the view that individuals acquire the knowledge needed to operate in the external world through a processing, in the mind, of sensory inputs delivered to it from the receptor organs of the body. This view artificially separates the activity of the mind in the body from the reactivity of the body in the world, and in so doing merely perpetuates a mind–body split that has bedevilled our thinking since the days of Descartes. An ecological approach, on the contrary, takes as its point of departure the condition of the whole organism-person, indivisibly body and mind, actively engaged with salient components of the environment in the practical tasks of life. Humans, like other animals, get to know the world directly by moving about in the environment and discovering what it affords, rather than by representing it in the mind. Thus meaning, far from being added by the mind to

the flux of raw sensory data, is continually being generated within the relational contexts of people's practical engagement with the world around them.

In line with his ecological principles, Gibson maintained that we learn to perceive by a fine-tuning or sensitisation of the entire perceptual system to particular features of our surroundings. Through this process, the human emerges not as a creature whose evolved capacities are filled up with structures that represent the world, but rather as a centre of awareness and agency whose processes resonate with those of the environment. Knowledge, then, far from lying in the relations between structures in the world and structures in the mind, mediated by the person of the knower, is immanent in the life and experience of the knower as it unfolds within the field of practice set up through his or her presence as a being-in-the-world. With this conclusion we have reached the point where we can cross the final barrier, from the psychology of perception to the anthropology of cultural difference.

The Anthropological Theory of Practice

According to the complementarity thesis, culture consists of packages of rules and representations available for transmission across generations, independently of their practical application. These add up to what cognitive anthropologists call 'cultural models'. Culture, suggests Bradd Shore in a recent volume, is best seen as a very large and heterogeneous collection of such models. Corresponding closely to the schemas of psychologists, these models are said to furnish people with 'what they must know in order to act as they do, make the things they make, and interpret their experience in the distinctive way that they do'.[16] But just as an organism's genotype is allegedly unaffected by the vagaries of its life history, so the knowledge held in the cultural models is supposed to remain aloof from the 'hands on' business of doing, making and experiencing. Acquired from predecessors and stored in memory, whence it will be passed along to successors, this knowledge is supposed to be expressed in practice, but not to be generated in it.

However, this view of culture – as what Roy D'Andrade has called ' "pass it along" type information'[17] – has not gone unchallenged. Indeed there is a powerful counter-movement that would reject it altogether. One of the most influential figures in this has been Pierre Bourdieu. In a series of works dedicated to the elaboration of a theory of practice, Bourdieu has attempted to show how knowledge, rather than being imported by the mind into contexts of experience, is itself generated within these contexts in the course of people's involvement with others in the ordinary business of life. He is referring to the kind of practical knowhow that we associate with skill – a knowhow that we carry in our bodies and that is notoriously refractory to codification in terms of rules and representations. Think of the technique involved in tying shoelaces, or breaking an egg, or doing the ironing. Such skills are developed not through formal instruction but through the repeated and often wordless performance of tasks involving specific postures and gestures. Together these furnish a person with his or her orientations in the world.[18]

One could say that such skills and orientations are 'embodied'. This is not to suggest, as some cultural theorists do, that the human body should be understood as a kind of surface upon which social and cultural content can be inscribed. Such a view would render the body passive and reduce its movements to mere signs, directing attention elsewhere in the search for what they stand for: a realm of attitudes, beliefs or mental states that floats like a mirage above the road we tread in real life.[19] The point is rather that in treading this road the body undergoes processes of growth and decay, and

concomitantly particular skills, habits, capacities and strengths, as well as debilities and weaknesses, are enfolded into its very constitution – in its neurology, musculature, even its anatomy. To adopt a distinction suggested by the social historian Paul Connerton, this is a matter of incorporation rather than inscription.[20]

Having arrived at this point, however, I can see no further justification for upholding a distinction between the body and the organism. Surely the body – with its powers of autonomous movement, active and alive to the world – *is* the organism. But so, for that matter, is the mind. Indeed, one could just as well speak of 'enmindment' as of 'embodiment', for to develop certain patterns of movement in the world is, at one and the same time, to develop certain modalities of attending to it. If mind, as Gregory Bateson so passionately argued, 'is not limited by the skin', but rather extends outwards into the environment along the multiple pathways of sensory involvement,[21] so likewise the body is not a static, self-contained entity but given in movement, undergoing continual growth and development along the lines of its manifold environmental relationships. Body and mind, therefore, are not two separate things but two ways of describing the same thing – or better, the same process, namely the activity of the organism-person in his or her environment. What, after all, is movement, as Thelen asks, 'but a form of perception, a way of knowing the world as well as acting on it?'[22] Walking, for example, could be described as a way of getting about, but equally as a way of getting to know the environment, primarily by way of contact through the feet, but also thanks to the sights and sounds that the movement affords.

These observations offer a new resolution to one of the oldest of anthropological conundrums. Take two people from different backgrounds, and place them in the same situation: they will differ in what they make of it. Why should this be so? Cognitive anthropologists would respond that it is because they are handling the same input of sensory data in terms of dissimilar cultural models or representational schemas. The theory of practice, however, suggests an alternative answer. Our two characters perceive their surroundings differently because they have been trained, through previous experience of carrying out diverse practical tasks involving particular bodily movements and sensitivities, to orient themselves in relation to the environment and to attend to its features in different ways. The difference, in other words, lies not in the ways in which people represent the environment inside their heads, but in the ways they discover what it affords for their activities. Crucially, this implies that how people perceive will depend upon how they move, including how they walk. I have noted already that a large part of the skill of walking lies in the responsiveness of one's movement to the movements of others in the vicinity. But it responds, too, to ever-changing conditions in the non-human environment. That it does so is immediately apparent if we pause to imagine what walking would be like if it did not.

As an illustration, let me return to Marcel Mauss's observations on the subject of walking. We laugh, he said, at the goose-stepping German soldier. Why? Because his movements are so oddly mechanical. No one naturally walks like that: indeed if they did, they would forever be tripping over things. The goose-step is only possible on the level parade ground. Under ordinary conditions the human gait, though rhythmic, is never metronomic, nor do the feet or knees follow exactly the same trajectory from step to step. Thus walking cannot be reduced to the mechanical application of a fixed motor programme or formula. Nor can any other form of skilled practice. Hence also, it cannot be through the replication of such formulae that skills are passed from generation to generation. Traditional models of social learning, as we have seen, separate the intergenerational transmission of information specifying particular techniques from the application of this information in practice. First, a model or generative schema is said to be established in the novice's mind from observations of the

movements of already accomplished practitioners; second, the novice is supposed to imitate these movements by running off exemplars of the technique in question from the schema. Undeniably, the learning of skills involves both observation and imitation. My contention, however, is that the novice's observation of accomplished practitioners is not detached from, but grounded in, his own active, perceptual engagement with his surroundings. And the key to imitation lies in the intimate co-ordination of the movement of the novice's attention to others with his own bodily movement in the world.

This is what is meant, colloquially, by getting the 'feel' of things. And it is this, too, that marks the progression from clumsiness to dexterity. The clumsy practitioner is one who implements mechanically a sequence of received instructions, while remaining insensitive to the evolving conditions of the task as it unfolds. Conversely, to have a feel for what one is doing means moving in a way that is continually and subtly responsive to the nuances of one's relations with relevant aspects of the environment. To achieve such fluency of performance it is not enough to observe; one has also to undertake repeated practical trials. But in these trials it is the task, rather than the precise trajectory of movement, that is repeated. The novice engaged in such trials is not 'acquiring culture', as though it could be simply downloaded into his or her head from a superior source in society, but is rather embarked upon the process that anthropologist Jean Lave has called 'understanding in practice'.[23] And our conclusion, that such understanding calls for a fine tuning of skills of action and perception through repeated trials within an environment, is fully consistent not only with the ecological approach in psychology, reviewed above, but also with a biological focus on the generative dynamics of developmental systems.

Conclusion

At this point we can return to the claim of Clifford Geertz that while all humans come into the world with the 'natural equipment' to live any kind of life, in the end they live only one. Human life, in this view, is conceived as a movement from the universal to the particular, or from biology to culture, entailing a gradual filling up of capacities and a closing down of possibilities. This view, I argue, is fundamentally mistaken. Our bodily equipment is not ready-made but undergoes continual formation in the course of our lives. Even the skeleton, for example, grows in a body that is actively doing things, and its precise form may bear the mark of these activities.[24] Bodily growth, moreover, is an aspect of the very same developmental process by which we gain proficiency in the skills appropriate to the particular kind of life we lead. So what is already in place at the moment of inauguration of a new human life cycle? Not an open-ended design specification in the guise of the genotype, but rather the total system of relations comprised by the presence of the fertilised egg with its complement of DNA, in a womb, in the body of the mother-to-be, who in turn is alive and active within a particular environment. In short, what each of us begins with is a developmental system.

Humans are not born biologically or psychologically identical prior to their differentiation by culture. There has to be something wrong with any explanatory scheme that needs to base itself on the manifestly ludicrous claim – in the words of John Tooby and Leda Cosmides – that 'infants are everywhere the same'.[25] Even parents of identical twins know this to be untrue! The source of the difficulty lies in the notion that culture is an extra ingredient that has to be 'added in' so as to complete the human being. On the contrary, all those specific abilities that have classically been

attributed to culture are in reality incorporated, through processes of development, as properties of human organisms. In that sense, they are fully biological. Culture, then, is not super-organic or supra-biological. It is not something added to organisms but a measure of the differences between them. And these differences arise from the ways in which they are positioned vis-à-vis one another, and non-human components of the environment, in wider fields of relationship.

Now if, by evolution, we mean differentiation and change over time in the forms and capacities of organisms, then we must surely allow that skills like walking in a certain way, speaking a certain language, and so on, being biological properties of organisms, must have evolved. We cannot, however, attribute this evolution to changing gene frequencies. No one would seriously suggest that people from different backgrounds walk and talk in different ways merely because of differences in their genetic make-up. But nor does it make sense to suppose that the differences are due to something else, namely culture, which overwrites a generalised biological substrate. Walking and talking are no more the operations of an enculturated mind than they are of a body designed by natural selection. They are rather the developmentally enhanced achievements of the whole organism-person, at once body and mind, positioned within an environment. And to account for these achievements we need nothing less than a new approach to evolution, one that sets out to explore not the variation and selection of intergenerationally transmitted attributes, but the self-organising dynamics and form-generating potentials of relational fields.

Of course, cumulative changes may take place, over successive generations within a population, in the frequencies with which particular genes are represented. These changes can be explained, at least in part, by the logic of natural selection. However, what I do deny is the existence of any link between changes in gene frequencies, and in the forms and capacities of organisms, which is independent of the dynamics of development. In orthodox evolutionary biology this link is established by way of the concept of the genotype. Remove this concept and you take away the keystone, without which the entire edifice of neo-Darwinian theory collapses. Natural selection, in short, may occur within evolution, but does not explain it. Only by going beyond the theory of evolution through variation under natural selection, and by considering the properties of dynamic self-organisation of developmental systems, can we hope to discover the possible consequences of those changes that can be explained by natural selection for the evolutionary process itself.

The root source of the explanatory poverty of neo-Darwinian theory is not hard to find. It lies in what one of its principal architects, Ernst Mayr, calls ‘population thinking’.[26] Modern biology, Mayr insists, requires us to think of evolutionary change as aggregated over populations of numerous discrete individuals, each of which is uniquely specified in its essential constitution independently of, and prior to, its life in the world. This way of thinking, however, systematically disrupts any attempt to understand the generative dynamics of developmental systems. How can one hope to grasp the continuity of the life process through a mode of thought that can only countenance the organic world already shattered into a myriad of fragments? All it can do is to count up the pieces. What we need, instead, is a quite different way of thinking about organisms and their environments. I call this ‘relational thinking’. It means treating the organism not as a discrete, prespecified entity but as a particular locus of growth and development within a continuous field of relationships. It is a field that unfolds in the life activities of organisms and that is enfolded (through processes of embodiment or enmindment) in their specific morphologies, powers of movement and capacities of awareness and response. Our conception of evolution, then, is more topological than statistical. But only with such a conception can we understand the evolutionary process from within, recognising that we ourselves are no more capable of watching from the sidelines than are creatures of any other kind, and that like

them, we participate with the whole of our being in the continuum of organic life.

Notes and References

1 Clifford Geertz, *The Interpretation of Cultures* (New York, Basic Books, 1973), p. 45.
2 Marcel Mauss, *Sociology and Psychology: Essays*, trans. B. Brewster (London, Routledge & Kegan Paul, 1979), pp. 102, 114–15.
3 Ibid., pp. 101.
4 Roy G. D'Andrade, 'The Cultural Part of Cognition', *Cognitive Science*, 5 (1981), pp. 179–95.
5 Cited in R. G. D'Andrade, 'Cultural Meaning Systems', in Richard A. Shweder and Robert A. LeVine (ed.), *Culture Theory: Essays on Mind, Self and Emotion* (Cambridge, Cambridge University Press, 1984), p. 89.
6 William H. Durham, *Coevolution: Genes, Culture and Human Diversity* (Stanford, CA, Stanford University Press, 1991).
7 R. W. Gerard, Clyde Kluckhohn and Anatol Rapoport, 'Biological and Cultural Evolution: Some Analogies and Explorations', *Behavioral Science*, 1 (1956), pp. 6–34; Charles J. Lumsden and E. O. Wilson, *Genes, Mind and Culture* (Cambridge, MA, Harvard University Press, 1981), p. 7.
8 Paul Weiss, 'The Living System: Determinism Stratified', in Arthur Koestler and J. R. Smythies (ed.), *Beyond Reductionism: New Perspectives in the Life Sciences* (London, Hutchinson, 1969), p. 35.
9 Susan Oyama, *The Ontogeny of Information: Developmental Systems and Their Evolution* (Cambridge, Cambridge University Press, 1985).
10 This point has been powerfully argued, with specific reference to walking, by Esther Thelen. See Esther Thelen, 'Motor Development: A New Synthesis', *American Psychologist*, 50 (1995), pp. 79–95.
11 Walter Goldschmidt, 'On the Relationship Between Biology and Anthropology', *Man* (N.S.) 28 (1993), pp. 341–59.
12 John Tooby and Leda Cosmides, 'The Psychological Foundations of Culture', in Jerome H. Barkow, Leda Cosmides and John Tooby (ed.), *The Adapted Mind: Evolutionary Psychology and the Generation of Culture* (New York, Oxford University Press, 1992), p. 45.
13 A. DeCasper and M. Spence, 'Prenatal Maternal Speech Influences Newborns' Perception of Speech Sounds', *Infant Behavior and Development*, 9 (1986), pp. 13–50; Patricia Zukow-Goldring, 'A Social Ecological Realist Approach to the Emergence of the Lexicon: Educating Attention to Amodal Invariants in Gesture and Speech', in Cathy Dent-Read and Patricia Zukow-Goldring (ed.), *Evolving Explanations of Development: Ecological Approaches to Organism-Environment Systems* (Washington, DC, American Psychological Association, 1997); C. H. Dent, 'An Ecological Approach to Language Development: An Alternative Functionalism', *Developmental Psychobiology*, 23 (1990), pp. 679–703.
14 On this idea, see Thelen, 'Motor Development'; and Andy Clark, *Being There: Putting Brain, Body and the World Together Again* (Cambridge, MA., MIT Press, 1997), pp. 42–5.
15 James J. Gibson, *The Ecological Approach to Visual Perception* (Boston, Houghton Mifflin,

1979), p. 254.

16 These lines are quoted from Naomi Quinn and Dorothy Holland, 'Culture and Cognition', in Dorothy Holland and Naomi Quinn (ed.), *Cultural Models in Language and Thought* (Cambridge, Cambridge University Press, 1987), p. 4. See Bradd Shore, *Culture in Mind: Cognition, Culture and the Problem of Meaning* (New York, Oxford University Press, 1996), p. 44.

17 D'Andrade, 'The Cultural Part of Cognition', p. 179.

18 Pierre Bourdieu, *Outline of a Theory of Practice* (Cambridge, Cambridge University Press, 1977), p. 87.

19 On these points, see Michael Jackson, *Paths Toward a Clearing: Radical Empiricism and Ethnographic Inquiry* (Bloomington, Indiana University Press, 1989), pp. 122–3.

20 Paul Connerton, *How Societies Remember* (Cambridge, Cambridge University Press, 1989), pp. 72–3.

21 Gregory Bateson, *Steps to an Ecology of Mind* (London, Granada, 1973), p. 429.

22 Thelen, 'Motor Development', p. 89.

23 Jean Lave, 'The Culture of Acquisition and the Practice of Understanding', in James W. Stigler, Richard A. Shweder and Gilbert Herdt (ed.), *Cultural Psychology: Essays on Comparative Human Development* (Cambridge, Cambridge University Press, 1990), pp. 309–27.

24 See, for example, Theya Molleson, 'The Eloquent Bones of Abu Hureyra', *Scientific American*, 271 (1994), pp. 60–5.

25 Tooby and Cosmides, 'The Psychological Foundations of Culture', p. 33.

26 Ernst Mayr, *The Growth of Biological Thought* (Cambridge, MA, Harvard University Press, 1982), pp. 45–7.