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Introduction

"Small Consequences of One General Law"

Bachan was born into a world in which his mother's salwar kameez and his father's turban, his sister's favourite pakora and his brother's bhangra collection already existed. His parents are British Asians, and he inherits a culture as different from his grandparents' native Punjabi culture as it is from his best friend's native English culture. His grandparents had no electricity in their homes when they were his age. The mobile telephone did not exist when his parents were born. The Harry Potter books had not been written when his sister was born. Bachan's world includes the Fairtrade Foundation and reality television, ongoing debates about bioethics and the environment, and a previously unimaginable range of purchasing options for every type of product, from snacks to satellite navigation systems. His world is bounded by the assumptions and rules that his parents make on his behalf: he absorbs, without even noticing what is happening, his parents' behavioural standards, moral judgements, religious beliefs and practices, educational values and parenting methods. He speaks English with the characteristic Midlands Asian accent, but he can only understand Punjabi, not speak the language. He wears his hair uncut, covered by a patka, but he attends an Anglican primary school. Would he pass Norman Tebbit's cricket test? Probably not. Nor would I, for that matter, if you asked me whether I'd support Yorkshire in a cricket match against the county where I now live. Like Bachan, however, I consider an emotional attachment to the place of my family's origin irrelevant to questions about where I make my home, how integrated I am into the local community, or indeed what I can give to that community.

Our genes are fixed. We cannot choose to inherit one parent's perfect eyesight in preference to the other's astigmatism, or to be taller than we are. This is not to say that the same genes are always expressed in identical

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ways: nutritional variation will affect a child's height, and educational variation will affect how she performs in an IQ test; identical twins are not identical people – but nor can they choose to alter their genes, in the way that they can choose to alter their appearances or to develop different skills, to study different subjects or to practice different religions. We can make choices about our culture in a way that we simply cannot about our nature. We can choose, for example, how we respond to our genetic inheritance. We cannot choose not to have been born with poor eyesight, but if we live in a country where the options are available then we can choose whether to wear glasses or contact lenses to correct our vision, or even to opt for surgery. We can also choose how we respond to our cultural inheritance. We cannot choose not to have been born into a family that practices a particular religion, speaks a particular language or takes a particular view of education, but we can choose whether to adopt that religion ourselves, whether to learn to speak a different language, and whether we agree with that view of education.

Crucially, our responses to our cultural inheritance will also be passed on to our children, in a way that our responses to our genetic inheritance will not. Eye surgery does not alter a person's genes: her children stand as great a chance of inheriting her poor eyesight if they are conceived after she had surgery as they do if they are conceived before it. If she rejects her parents' atheism, however, and becomes a Christian, then her children will be brought up not as atheists but as Christians. If she regrets the fact that her parents did not put a high value on education, so that she left school barely literate and numerate, then she might make an effort to improve her own skills and will also pass on to her children an entirely different attitude to school from the one that her parents gave her.

Culture of this kind is unique to the human species. Debates continue about the extent to which nonhuman species, the primates in particular, are capable of using language or tools, of learning from one another and possessing what might be called a culture, but incontrovertibly no other species has developed anything like the depth and breadth of human culture. The inherited tendencies of many species can be given direction by exposure to an environmental stimulus: newly hatched goslings or ducklings, for example, have an inherited tendency to become socially bonded to the first moving object they encounter, and this tendency is directed by whichever moving object happens to provide the right environmental stimulus. As well as the information that they carry in their genes, which gives rise to these inherited tendencies, many species also

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carry information in their brains: they are able to make and remember associations between events, and their behaviour is subsequently influenced by these associations as well as by the environment and their biology, as when Pavlov's famous dogs drooled at the ringing of a bell because they had learned to associate its sound with the arrival of food. In addition to information like this, which they have learned by themselves, members of some species can imitate the behaviour of conspecifics: the behaviour of these creatures is influenced by their genes and by their environment, by the information in their own brains and also by the behaviour of other creatures. Members of only one species, so far as we can tell, carry information around externally as well as in their brains and in their genes. Human behaviour is influenced by our genes and by our environment, by the information in our own brains, by the behaviour of others and – uniquely – by the information in conspecifics' brains, which we can access via their speech and via written symbols. We are alone in having set information free from the confines of genes and brains, and the result is human culture.

How has what we humans learn from one another become so much more complex and diverse than what members of any other species learn from one another? It will be apparent that genetics can offer only partial answers to questions about culture. Our capacities for learning, and for putting into practice what we learn, are shaped by our genes; the ways in which we respond to what we learn will often be influenced by our genes; but vast swathes of human culture are immune to the explanatory power of genes – if for no other reason than that they change much too quickly for our genes to keep up with them. Human culture develops so rapidly and radically that it can be hard for us to see what is happening. It can be difficult enough to keep up with the impact of its changes on our everyday lives, never mind to reflect on them and analyse their structure. Nor is it correct to suppose that just because a particular trait is biologically adaptive for humans it will therefore be genetic rather than cultural in origin: it would be ridiculous to suggest that the adaptive advantages of modern inventions like computers and passenger airbags are the product of modern changes in the human genetic code. This means that Daniel Dennett's famous question, "Cui bono?" (1995: 325), will not always be a reliable guide to behavioural origins: culturally inherited behaviour can be biologically adaptive even though it is not the product of biological evolution. The situation is further complicated by the fact that humans are able to choose, in at least some circumstances, whether to heed the promptings of our genes or to serve our own self-interests as individual

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human beings. In a Darwinian creature like a bee, there is no conflict between its own goals and those of its genes: the bee's goals simply are its genes' goals, and it will sacrifice itself to those goals if necessary (Stanovich and West 2003). Humans, on the other hand, are uniquely capable of putting our own individual interests above those of our genes: many people choose to use contraception, for example, and members of the emergency services regularly put their own lives in danger for the sake of strangers.

Given both how much more of human behaviour than of any other creature's is learned rather than inherited, and the immense complexity and variety of human behaviour, it would be surprising if it were a straightforward matter to separate the biological from the cultural influences on our lives. The decision will be more difficult to make about some traits than about others. Yet evolutionary theory offers a methodology for studying the patterns of cultural change, in the same way that it has unified our understanding of biology. Charles Darwin (1859: 263) described inherited instincts as "small consequences of one general law," which he summarised as "multiply, vary, let the strongest live and the weakest die." The theory of cultural evolution sees each element of culture's complex diversity as another small consequence of the same general law operating in a different jurisdiction: the realm of culture. It is not uncommon to hear about the "evolution" of a car design, religious doctrine or recipe, and there is a consensus among many researchers that we can take this talk literally (e.g., Blute 2007; Deacon 1999; Dennett 2006b; Henrich, Boyd and Richerson 2008; Marsden 1998; Mesoudi 2007a). The theory of cultural evolution contends that the changes and developments in all areas of human culture can truly be said to evolve: that they, just as much as the changes and developments in nature, can be described by an evolutionary algorithm; and that a convincing theory of cultural evolution can play the same unifying role across the social, psychological and behavioural sciences as evolutionary theory has played in biology.

Towards a Better Understanding of Culture

To what extent is cultural evolution genuinely analogous to the more familiar biological evolution, which all life on earth has in common? Strictly speaking, cultural evolution is a different example of the same type of process as neo-Darwinism rather than a simple analogue of it. Our familiarity with biology can therefore be exploited as a resource

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for our growing understanding of culture, but we should not expect the particular details of biological evolution to carry over into cultural evolution.

Evolution is a gradual, intergenerational process of change in a population's characteristics, and cannot happen unless variations in that population's characteristics are inherited across many generations. Our knowledge of biology indicates that we can usefully describe this process in terms of the *information* that inheritance mechanisms make available to each generation. In the opening chapters of this book I develop a theory of information and its inheritance, which not only brings all aspects of biological and cultural information under one explanatory umbrella, but also enables us to understand how cultural evolution has taken off in humans as a process independent from biological evolution. My conclusion is that information can never exist in isolation, but must always be transmitted to a receiver *that can interpret it and respond appropriately*. Information is any variation that a receiver discretely represents, and it can only be acquired from a representational source if the receiver discretizes it in the same way that the source does. This means that evolution depends on each generation's ability to interpret and express the information that it inherits. Genetic variants, for example, rely for their interpretation and expression on the next generation's cytoplasmic inheritance of the cellular transcription and translation machinery. Viral DNA achieves the same aim by hijacking that machinery in organisms. Variations in cultural information rely for their inheritance and expression on the existence of receivers who understand the particular system in which they are represented.

In the light of this theory of heritable information, the significance of language for cultural evolution becomes apparent: the emergence of natural language created generation upon generation of receivers for the information that it represents, ensuring the persistent heritability on which evolution depends. This theory also explains why cultural evolution is unique to our species: only humans have developed a system that ensures the persistent heritability of both cultural information and its means of interpretation and expression. Why this should be the case, and how natural language evolved, are the subjects of Chapters 4 and 5.

Natural language is an immensely powerful tool of communication, but by itself it cannot account for the nature of the changes in human culture over the millennia since it first emerged. I describe how the result of natural language evolution was an explosion in the amount of information that early humans were able to trade – and there is only so much

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information that we can hold and manage in our brains alone; even in our collective brains. There came a point at which there was too much cultural information available for individuals to manage reliably using memory and speech alone. When cultural information had expanded beyond the point that the brain could manage independently, humans began to develop artefactual symbols in order to store and manipulate this excess cultural information. The result is that cultural information is represented not only in natural languages like English, Mandarin and Nicaraguan Sign Language, which use the biologically evolved media of human vocal chords and gestures, but also in what I shall call artefactual languages, like the written word or mathematical notation, the conventions of cartography or the vocabulary and formatting requirements of computer programming languages: languages that use the culturally evolved media of artefacts like paper and ink or keyboard and text editor.

Evidence from fields as diverse as archaeology and economic development, engineering and music, psychology and the history of technology, all points to the role of artefactual languages in providing substrates for the cultural evolution of information that natural language cannot contain and human brains cannot manage without support. In the competition between cultural information, artefactual representational methods had advantages like stability, capacity and accuracy. It is not until we acknowledge the role of artefactual as well as natural languages in cultural evolution that we can really begin to explain how cultural complexity is maintained and transmitted.

The advantage of my approach to this subject is that it enables the evolution of human culture to be explained as a token of the same type of process as the evolution of the natural world, and simultaneously makes clear why it is unique: human culture, which has its origins in information that is represented in natural and artefactual languages, cannot be shared by receivers that are not biologically prepared to learn those languages. Perhaps the most significant aspect of human preparedness[1] for language acquisition is our capacity for metarepresentation: thinking not only about the content of our representations but also about the representations themselves, lifting information out of its original context, reflecting on it in the abstract, choosing how best to represent it and in what medium. Languages do not only act as receptacles and conduits for

[1] Evolution, needless to say, has no foresight and is not in the business of preparing species for anything, but nonetheless, there came a time when our ancestors were both language ready and culture ready, as a result of prior evolutionary processes.

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information; they also play a crucial role in shaping our cognition, by restricting us to a particular way of thinking about the particular information that each is capable of carrying. Metarepresentation enables us to escape the conceptual limitations of a particular language, freeing us from its cognitive constraints so that we can re-represent the information that it carries, or recombine it with information from another source.

Evidence from research into giftedness and rationality indicates that there is a spectrum of innate metarepresentational ability in humans, which can also be affected by educational levels. This diversity among the human receivers of cultural information is bound to affect the course of cultural evolution, and in particular it will help to shape the patterns of cultural taxonomy. Drawing on lessons that have been learned only recently in the fields of prokaryotic and viral taxonomy, I show how cultural variations are sometimes subject to the restrictions of species-like barriers; how the porousness of these barriers varies; and how cultural taxonomy, as a consequence, will often need to chart reticulate relationships between polythetically defined classes of cultural artefacts and behaviours. Nonetheless, evidence from a range of studies has shown that in a surprising number of cases cultural phylogenies are tree-like, providing further support for the thesis that there are some species-like barriers in culture.

An understanding of the relationship between cultural information and human agents, of metarepresentation, and of the distinction between communicative and representational uses of language, casts new light on a range of cultural phenomena. In my exploration of the evolution and modern use of money, I draw together evidence from archaeology, economics and (rather surprisingly) the Eurovision Song Contest, for the claim that money can helpfully be seen as an artefactual language in which information about value is represented and exchanged, and I show how this representational view of money can explain a host of monetary phenomena.

The concluding chapter submits that a representational theory of cultural evolution has a broader application and a greater explanatory value than is often acknowledged. Indeed, perhaps it can even account for the varying reactions that readers will have to this book. If information is, as I shall argue, any variation that a receiver can discretely represent, then the heritability of information is crucially dependent on receivers. If writing is, as I shall argue, an artefactual language for the representation of cultural information, then the heritability of that information is

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crucially dependent on its readers. All writing carries information, but the precise content of that information will be shaped by each individual reader. The message that you take from this book will not be identical to the message that any other reader takes from it. You exert a unique force on the currents of cultural evolution.

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PART I

THE INHERITANCE OF CULTURAL INFORMATION

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What Is Information?

At the heart of my theory of cultural evolution is the claim that human culture, as much as our nature, is the product of evolving information. Culture is the behavioural and artefactual product of interactions between humans and cultural information, and cultural evolution is the product of heritable variations in that information. This means that our understanding of cultural evolution must be founded on an understanding of heritable information.

Informational language provides biologists with a handy conceptual tool, particularly when thinking about genes: it is common to hear talk of genetic *information* being *transcribed*, *translated*, *edited*, *expressed* and *transmitted* from one generation to the next. It is a little surprising, then, to find that there is no clear consensus about what information is, exactly. If evolution can really be understood as the product of heritable information, then there seems to be a major conceptual omission at the heart of our understanding of evolutionary theory.

In this chapter and the next, I develop a theory of heritable information that is broad enough to encompass biological as well as cultural information but detailed enough to provide answers to individual questions in both fields. It enables us to distinguish, for example, between inheritance mechanisms that can contribute to long-term evolution and those that cannot. It helps to resolve debates about whether genes carry a causally special type of information in nature, and why human culture is so uniquely complex and extensive. It brightens the light that earlier information theories have shed on information's receivers, and it manifests a range of empirical predictions about what happens to information if we keep the source fixed but vary the receiver, and about which sorts of receivers will be able to acquire and transmit which types of information.

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