

## HOW IS HUMAN CULTURE DIFFERENT?

In the first chapter, I argued that human culture is different from anything found in other species, and I outlined, briefly, my idea of what human culture is. In this chapter, I explain the concept of human culture in more detail. Before doing so, it will be useful to offer a reminder of just how different the human way of life is from that of other species. The difference is qualitative, not just a matter of degree.

This position is not a theoretical one but a matter of empirical observation. Darwin's *The Origin of Species* situated humans squarely within nature, established that we are animals, and demonstrated that our species is related to all others both by nature and by descent. These findings have been amply confirmed by a huge body of scientific research carried out since the book's publication. Yet at the same time it is clear that human behavior differs in important respects from that of other animals.

This is not a contradiction. The observation that humans are in some ways distinct implies no rejection of our material nature, no a priori Cartesian philosophical bias. Every species must be unique in some respects, or separate species would not exist. Every species shares some of its traits with all animals, and other traits only with closely related species, but in the end some trait or traits will distinguish each species from even its nearest relatives.

Thus the fact of human uniqueness is not in itself remarkable. Yet our species has chosen a rather peculiar way to be unique. In the course of our evolution, we have done more than change our anatomy, physiology, and behavior. We have also changed, in part, the manner in which our behavior is governed.

Humans are primates, and for the most part we do essentially what other primates do. In many cases where we differ, the difference is one of degree rather than of kind. For example, it has been suggested that at least some apes have all the abilities needed to use symbolic language, albeit in less developed form than humans (see Savage-Rumbaugh et al.

1998:77-138 for an especially vigorous statement). In spite of this, it is easy to find things done by humans that other living species simply never do. Let me give three examples.

In the nineteenth century an unusual group flourished in the United States, the United Society of Believers in Christ's Second Appearing, better known as the Shakers. From an evolutionary perspective, the most remarkable thing about this group is that it was adamantly celibate. This celibacy included all Shakers, not just religious specialists such as priests or nuns. Since evolutionary success is synonymous with reproductive success, such behavior is difficult to explain. In fact, it is so rare that it seems to be confined to humans. It is certainly difficult to imagine a chimpanzee accepting a life of celibacy.

What is most human about the behavior of the Shakers, however, is not the fact of celibacy but the reasons for it. Shakers perceived all sexual relations as spiritual pollution or worse: "Every marriage, however proper for the *world and its children*, crucifies Christ afresh; every sexual congress of the twain, however necessary for the peopling of the earth, pollutes the *Christian temple*" (*Manifesto* 8 [1878]:43, in Collins [2001, emphasis in the original]).

This attitude was rooted in the Shakers' concept of the spirit and the flesh and in their reading of the Bible. In the *Testimony of Christ's Second Appearing*, published by order of the Ministry of the Society, the serpent of the Garden of Eden is equated with the devil, and lust, with the serpent's head, which was the serpent's superior part, "...his highest affection; that in which he finds the most supreme delight" (Youngs 1810:46-48).

And such is that feeling and affection, which is formed by the near relation and tie between the male and female; and which being corrupted by the subversion of the original law of God, converted that which in the beginning was pure and lovely, into the poison of the serpent; and the noblest affection of man, into the seat of human corruption. (Youngs 1810:48-49)

Shakers behaved as they did because their actions were governed by a religious worldview, a set of concepts, values, and beliefs the like of which would be utterly foreign to any other species. It is inconceivable that members of any other species would remain celibate because of theological philosophy.

The game of chess is another example of how different humans are, in certain respects, from other primates. Competition and play are virtually universal among mammals. Games like chess are not. Not only is chess based on arbitrary conventions having nothing to do with the "real" world, but the concept of chess is itself pure convention. Other species

compete, and other species know when one party to a competition has won or lost, but winning or losing is a down-to-earth matter involving physical force, territory, access to mates, and the like. No other species would define winning and losing as arbitrarily and abstractly as the International Chess Federation does in its rules:

Article 9: Check

9.1. The king is in “check” when the square it occupies is attacked by one or more of the opponent’s pieces; in this case, the latter is/are said to be “checking” the king. A player may not make a move which leaves his king on a square attacked by any of his opponent’s pieces.

9.2. Check must be parried by the move immediately following. If any check cannot be parried, the king is said to be “checkmated” (“mated”).

9.3. Declaring a check is not obligatory.

And the rules go on and on – the definitions of defeat, stalemate, and draw continue for a further 16 subarticles of Article 10.

Finally, I cannot resist including a remarkable example of something that must be considered uniquely human, the fact that we create, discuss, and take seriously fictional worlds that we know very well do not really exist. The following excerpt is from a World Wide Web site dedicated to the language of the fictional Klingons in the *Star Trek* television series:

In operation since 1992, the Klingon Language Institute continues its mission of bringing together individuals interested in the study of Klingon linguistics and culture, and providing a forum for discussion and the exchange of ideas. ... The Klingon Language Institute is a nonprofit 501(c)3 corporation and exists to facilitate the scholarly exploration of the Klingon language and culture. (From the Web site of the Klingon Language Institute, <http://www.kli.org/kli/>, June 2, 2003)

The following exchange took place on a Web site dedicated to *Star Trek* discussions. It concerns the facial morphology of Klingon characters:

*Tribble565 (6/7/02)*: what is it with the cranial ridges and how in the heck did Kang Koloth and Kor change to have them [I’m] still waiting for a reply

*Frogden (8/14/02)*: The new look Klingon derived from the need to dramatize the facial features, to appear more evil. There was some official explanation which I don’t recall, but as it is only fiction, does it really require explanation?

*Tribble565 (12/22/02)*: Yes it matters you freaking idiot. To sci-fi fans just because something isn’t real doesn’t mean that they don’t require a real explanation. (From SJ’s Realm Forums,

++<http://pub40.ezboard.com/fsjsrealmforums-startrek.showMessage?topicID=41.topic>, June 2, 2003)

It is difficult to imagine a chimpanzee becoming equally concerned about the anatomy of purely fictional beings.

The reason I cite these examples is to emphasize what everyone already knows but sometimes tends to forget: that humans think and behave in ways that other animals do not. Chimpanzees do not practice celibacy for doctrinal reasons, do not play games like chess, and do not invent and discuss fictional worlds. These differences are not differences of degree. In spite of all the other continuities between us, in ways such as these other primates simply do not behave or think as we do. Why this is so is the crux of the issue. I will argue that it is not because we are more intelligent, although intelligence is important, but because our way of life is shaped by culture.

Recall that I use the term “culture” to refer to the totality of three related phenomena:

1. Codes that we create through social interaction inform and govern our behavior. These codes are emergent in character because they cannot be understood without reference to this interaction. The codes do not replace other, private, forms of coding, but are added to them.
2. Such socially created codes not only inform and govern our behavior but also frequently *motivate* it. Because this potentially leaves individuals open to exploitation by the social group that creates the coding, our willingness to be motivated by socially created coding can be seen as a susceptibility to cultural manipulation.
3. Cultural codes form all-encompassing webs of meanings, values, and dicta that incorporate into themselves almost everything that humans perceive, think, or do. Thus culture forms an inescapable intellectual framework for human life and human action.

The heart of this chapter is a detailed explanation of what I mean by each of these phenomena. Once this has been accomplished, I flesh out my concept of culture by explaining how I see it operating in the normal course of human life. Finally, I touch briefly on two implications of my characterization of culture that, while not directly related to the subject matter of this book, are nevertheless of some interest: its implications in terms of complexity theory, and its implications for the concept of culture as a superorganic phenomenon.

## 2.1. SOCIALLY CREATED CODING

My concept of coding is an expansion of the dichotomy between genotype and phenotype. Thus coding stands in the same relationship to behavior that the genotype stands in relationship to the phenotype. By coding, however, I mean something that exists in the mind (or brain) that governs and informs behavior.

We can think of coding in terms of four categories or levels:

1. Coding that is essentially determined genetically. Note that, like all coding, this is something in the brain, not the behavior it produces.
2. Learned coding. Because of the plasticity of their brains, mammals are able to create new codes in response to their interactions with their environments.
3. Socially learned codes. These codes are initially created by one individual through individual learning, but others then learn them from conspecifics, either by observation or through teaching.
4. Codes created through social interaction.

In vertebrates, the coding that governs behavior is located in the brain. The brain works by the movement of electrical impulses through networks of neurons. The topology of these networks and the chemical states of the synapses, or connections between them, determine how sensory input is translated into motor output or behavior. We need not go into any detail concerning this process. It is sufficient to say that there are neural structures in the brain that determine how an animal will behave in the presence of given sets of external and internal stimuli. Essentially, it is these structures that I call “coding.”

The concept of coding should not be understood narrowly, as referring only to stimulus-response operations or just to rules or algorithms for behavior. Consider what must happen if a cat is to catch and eat a mouse. It must feel hungry. It must have some idea of what a mouse is and that eating a mouse will satisfy its hunger. It must go to where a mouse is likely to be found. It must search for mice, and when it sees, hears, or smells one, it must “recognize” the sound, sight, or odor as indicative of something edible. It must stalk the mouse, spring on it, seize it, kill it, and eat it. In the whole process, it must be able to walk across uneven terrain, keeping its balance and moving its limbs appropriately. It must be able to coordinate its vision, sense of balance, and sense of where its own body parts are so that when it springs it will land on the mouse. If it sees a dog approach, it must abandon its hunt and climb a tree. I include in the concept of coding everything in the brain of the cat

that makes these things possible.\* This would include sensations, emotions, motivations, knowledge, memories, categories or concepts, rules or algorithms, and much more. Thus, what I mean by coding is very broad in scope.

The relationship between coding and behavior is not rigidly fixed. An animal's behavior will depend on how the coding of the brain processes all the external and internal stimuli in a given situation, so that the end result is the product as much of circumstances as of the neural coding itself. In addition, different codes may compete for control of an animal's behavior. (This will be important to remember when we come to cultural codes.)

Consider a cat that is both tired and hungry. The sensations of hunger and of fatigue are neural codes that motivate it to behave in certain ways, but it is by no means certain how this cat will act. It may remain where it is, resting; it may go hunting; it may go hunting, but in a half-hearted, lackadaisical manner; and so forth. The same can be said about a cat that is both hungry and afraid or about a cat that is tired, hungry, and afraid. In other words, to say that there is coding that motivates a cat with an empty stomach to hunt is not to say that a cat with an empty stomach will necessarily go hunting. Rather, the cat's behavior will depend on interaction and competition among multiple codings in the context of a specific set of external circumstances and internal conditions.

### **2.1.1. Noncultural Coding**

#### *2.1.1.1. Learning*

Although genetics plays a key role in the construction of the brain, both environment and experience shape the brain during a young animal's development. In other words, the actual forms or characteristics of the neural structures of the brain are determined in part by environmental factors and by the animal's experiences during growth and development.

In all mammals, the brain continues to change in response to external stimuli during the entire lifetime of the individual. We are, in fact, genetically coded to be able to rework our neural coding. This plasticity of the brain and its neural structures – “learning,” in ordinary language – is a major part of the adaptive strategy of mammals.

Different kinds of neural structures exhibit different degrees of plasticity. Some functions are almost completely fixed, at least by adulthood. Examples include the sensation of pain in response to injury, color per-

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\* I deliberately sidestep the philosophical controversy about the relationship between “mind” and “brain” on the grounds that it is essentially irrelevant to my purposes in this book.

ception, and “knowing” where our limbs are even when we cannot see them. Other neural codes are partially plastic. Breathing is something we know how to do at birth, but a diver or musician can learn new ways of breathing. Still other coding is extremely plastic. For example, mammals are constantly learning spatial information. A pet cat learns when and where it gets fed, where its litter box is, and where the cat door is located. If its owner moves the litter box, the cat will learn the new location. Even an adult cat can learn a new algorithm or skill, such as how to use a cat door.

Thus learning is the modification of neural structures in order to create new codes or to modify existing ones. This involves an interaction between the environment and existing codes. New codes will be created that, in general, fit with existing ones. In other words, an animal will learn to do something that satisfies existing codes (e.g., hunger) and to avoid behaviors that do the opposite (e.g., eating foods that cause nausea). Both genetically determined and learned neural coding are involved. If an interaction with humans causes an animal pain (genetically based coding), that animal will learn to fear humans (both genetic and learned coding) and will therefore be reluctant to eat food that is too near a human, even when the animal is hungry. Extreme hunger may outweigh this fear, so that the animal may feed near humans. If no one bothers it and it can satisfy its hunger often enough, it will eventually unlearn its fear of humans.

The borderline between learned and genetically determined coding is not only blurred but also complex. First, nothing can be learned unless the requisite neural structures are present. This means that the kinds of things that can be learned by members of a given species is genetically delimited. A reptile cannot learn human language, for example. At the same time, there may be specialized, genetically coded neural structures for learning specific kinds of information or skills. For example, humans seem to have specialized neural structures for recognizing human faces (Alcock 2001:171-174) and perhaps for categorizing living things (Atran 1990; Herrnstein et al. 1985; Poole and Lander 1971).

In addition, there are many skills that seem to be genetically determined because under normal circumstances all members of a species learn them, yet they must be learned. Humans, for example, must learn to walk bipedally, and songbirds must learn the songs appropriate to their species (Marler and Tamura 1964).

The relationship between genetics and learning is both interesting and, in a general sense, important – but it is of little relevance to the present discussion. My main point here is to explain what I mean by neural coding. The crux of my argument depends not on the difference between

genetically determined and learned coding, but on the difference between individual coding and socially constructed coding.

Note that both inbred and learned coding (and everything in the gray area between them) is particular to the individual animal. Granted, codes may be “shared” in the same sense that blue eyes may be “shared” by two individuals. More than one individual may have similar neural structures for perceiving colors, and more than one individual may have learned that a certain food tastes good. However, these individuals do not actually share the same eyes or neural code. Each has a copy, but each copy is physically distinct and internal to the individual organism. Most important of all, the creation of each copy is in a sense particular to the individual. Learned codes are created by each individual interacting with its environment. Even if the neural structures or the behaviors they produce are similar, each individual animal must nevertheless create the codes for itself.

I emphasize this private nature of learned codes because, as I will explain, cultural codes differ fundamentally in that they are created, maintained, and modified publicly by the interactions of multiple individuals.

#### *2.1.1.2. Socially Learned Coding*

Animals, then, learn by interacting with their environment. Other individuals of the same species constitute an integral part of an animal’s environment, and members of at least some species are capable of learning by observing the behavior of conspecifics. As a result, something learned independently by one individual may spread through a population when others observe the first individual. To many scholars, this is the essence and the definition of culture (e.g., Alvard 2003; Boesch et al. 1994; Boesch and Tomasello 1998; Laland and Hoppitt 2003; McGrew 1998; Whiten et al. 1999). In my opinion, something more is going on among humans. Learning from conspecifics is an important part of human culture, but it is not the whole picture.

There are famous examples of socially learned coding among non-human species. In three species of tits (*Parus*), individual birds learned from others about opening milk bottles (Fisher and Hinde 1949). They either removed or broke through the cardboard caps of milk bottles to drink the cream and milk inside. Several lines of evidence indicate that this trick was not discovered individually by each tit, but that there were “pioneers” and learners. Apparently, more than one bird independently discovered this manner of obtaining nourishment. Often, an increasingly large portion of the local tit population would then learn and adopt the practice of opening milk bottles.



Another famous example is the washing of sweet potatoes by a troop of monkeys (*Macaca fuscata*) on the Japanese islet of Koshima (Itani and Nishimura 1973; Kawai 1965; Kawamura 1959; Nishida 1986). The troop was a wild population but was being provisioned with food. In 1953, one young female named Imo began washing sweet potatoes in a stream, presumably to remove sand. The practice was learned by a close peer of hers and then by other young monkeys and by older monkeys closely related to Imo. Offspring of females who washed sweet potatoes learned the habit from their mothers, and the practice became widespread among all but the oldest members of the troop.

In 1956, Imo discovered a way of separating wheat from the beach sand where the human providers placed it. She would throw a handful of wheat and sand into the water. The wheat would float, and she could scoop it up. This innovation, too, spread to many members of the troop. (For a more skeptical view of this example, see Tomasello 1999:519).

Such learned traditions are common among chimpanzees. Nine chimpanzee ethologists recently compiled a database of behaviors observed in different parts of Africa (Whiten et al. 1999; see also Nishida et al. 2004). They listed 39 behaviors that were customary or habitual in some areas but absent from others, behaviors for which they could find no environmental explanation. These included fishing for ants, using a hammer and anvil to crack nuts, tickling oneself with an object, and clasping one's arms overhead during grooming. These behaviors had not been invented independently by each individual chimpanzee, because in that case they would not have been common in some areas and absent in others.

Similar patterns of variation have been observed among bonobos (Hohman and Fruth 2003). Orangutans in some areas use tools to feed on *Neesia* fruits. In others, they do not, and these differences also seem indicate learned traditions (Van Schaik et al. 2003).

In fact, learning in a social context is almost inevitable among animals for whom learning is an important part of their adaptation and who are also dependent on adults during their infancy. This produces traditions that are perhaps less spectacular than milk-bottle raiding or sweet-potato washing but that are learned traditions nevertheless. Avital and Jablonka (2000:105-107) vividly described one such tradition or set of traditions:

Dusk is a good feeding time for village mice. The small, four-month-old, grayish brown female domestic mouse silently scales the outer wall of the village grocer's warehouse. She enters the warehouse through a small crack in the wall, and quickly slides down to the piles of bags containing pinhead oatmeal and canary seed. This urine-marked route leads safely to the best source of solid food around. It

was first introduced to her by her mother, three months ago, and has been used by her ever since, at least twice a day, at dawn and dusk.... Her scent survey discovers no rats, cats or strange mice, so she can now safely dive into one of the bags of oatmeal and eat as much as two grams, almost a quarter of her own weight. The pinhead oatmeal is always her first choice. But why? Mice are omnivorous and will eat almost anything, and canary seed is a well-known mouse delicacy; but, like every other mouse, this doe has some loyalty to the first solid food she ever smelled and tasted. In her case it was the oatmeal of this warehouse. (p. 105)

After her young are born and old enough to introduce to the outside world, she

leads a group of stiff-haired, hesitant youngsters up the red brick wall on their way to the warehouse. Suddenly a strong smell reaches their sensitive muzzles, the smell of a brown rat, a notorious mouse-hunter. In a split second the alarmed mother changes direction and leads a scampering group back to tool shed, nest and safety. The youngsters will remember the traumatic smell of the rat for a long time, and know what to do when they smell it again. At dusk, the same team tries again and succeeds, this time without trouble, in entering the warehouse via the well-trodden urine-marked route, and enjoys the pinhead oatmeal. From now on, the warehouse feeding site, and the special routes leading to and from it, will be the youngsters' first choices. (p. 107)

In other words, in a species in which learning leads to individual differences in knowledge and behavior, family traditions arise to the extent that young animals learn from observing or even just accompanying their mothers.

Individuals learn from interactions with their environment. In social learning, they learn by observing one part of that environment, the behavior of conspecifics. One individual creates a new code (i.e., learns something), such as opening milk bottles to get at the milk or cream inside. Other individuals observe this first individual's behavior and then use their observations to create codes in their own brains that produce the same or similar behavior.

Such social learning produces a phenomenon analogous to genetic evolution. The recognition of this fact makes possible a theoretical stance in which (1) human and much animal behavior is considered to be the product of dual inheritance (genetic and cultural), and (2) cultural evolution is seen as an essentially Darwinian process.

In this view, when behaviors are learned from conspecifics, they are replicated in a manner that is essentially equivalent to the replication of genes. The more individuals who learn a new behavior or a new bit of knowledge, the more copies of that behavior or item of knowledge exist

in the population. Dawkins (1976:192) recognized this similarity and coined the word “meme” to refer to such replicated units of culture. He chose the term deliberately to emphasize the analogy to the gene, which is the replicator in biological evolution.

This parallel between the transmission and selection of genes and the transmission and selection of memes has inspired a vast and influential literature that analyzes both human and nonhuman behavior and the codes that produce that behavior in terms of memes (e.g., Boyd and Richerson 1985; Burns and Dietz 1992; Campbell 1965; Cavalli-Sforza and Feldman 1981; Dawkins 1976; 1993; Dennett 1995; Durham 1990; 1991; Giesen 1991; Goodenough 1995; Harms 1996; Rindos 1985; 1989; Rose 1998; Shennon 2003; Wilkins 1998). This literature encompasses parts of evolutionary biology, sociobiology, and archaeological theory.

It is not my purpose to review or to critique this work, which goes under rubrics such as memetic evolution, dual inheritance, and cultural selectionism. However, I must briefly expound its basic outlines in order to show where human culture departs from the memetic model. (For the sake of convenience, I use terms such as “meme” and “memetic” as a shorthand for socially learned codes and their transmission.)

Darwinian evolutionary theory, of course, demands selection as well as replication, and selection does in fact operate in memetic traditions. Not all memes will be replicated as frequently as others. In genetic evolution, an allele is replicated when it is passed on to a viable son or daughter. The more often this happens, the more copies of an allele exist in the gene pool of a population. Thus (genetic) evolutionary selection depends on how many viable offspring the bearers of a given allele leave behind, and differential reproduction lies at the heart of competition between alleles.

The process is very similar in memetic evolution. Replication consists of the learning or adoption of a meme by a new individual. The more individuals who adopt a meme, the more copies of that meme there will be in the “meme pool” of a population. Competition between memes is based on how many individuals adopt each meme.

Of course, the process is not entirely analogous to biological evolution. What causes an individual to accept or reject a meme is, essentially, how well or how poorly it fits with that individual’s already existing coding. The same is true of nonsocial learning:

In a variable environment, it is clearly useful to be able to develop the locally adaptive phenotype. But how does the organism determine what that phenotype might be? There are many ways, but in most species these processes share the same general features. The organism inherits criteria that determine what feels good and what feels bad; feelings of security and satiation are good, and feelings of fear

and hunger are bad. ... The organism tries a variety of behaviors and retains those which are associated with rewarding sensations. In this way, complex patterns of behavior appropriate to local conditions can be generated. (Boyd and Richerson 1985:14)

A tit, then, will attempt to open a milk bottle if the behavior of another tit leads it to believe that doing so will satisfy its hunger. It will not do so if, because of some previous experience, it does not believe this, or if a fear of humans keeps it from approaching houses. Thus the preexisting neural codes that determine whether or not an animal will accept a given meme consist of those that are genetically determined (e.g., hunger), those that have been learned independently (e.g., the taste of a certain kind of food), and perhaps even those that have been learned from another individual or individuals (e.g., fear of humans).

Essentially, memetic or socially learned coding resembles individually learned coding in that each individual animal creates its own codes. In the individual case, it creates codes in response to its own direct interactions with its environment. In the memetic case, it does so after observing the behavior of other individuals – and this means that memes are replicated. How often a meme is replicated depends on how many individuals have preexisting neural coding that leads them to adopt that meme. Therefore the successful meme is one that adapts not to the physical environment but to the existing pool of neural coding in a population. The locus of memetic selection is the neural coding of the individual.

There are other differences between genetic and memetic evolution that are of less interest to us here (Rose 1998; Tracy 1996; Weiss and Hayashida 2002; see also Daly 1982). Genes are indubitably coding, not behavior. In the case of memes, this is much less clear. If a mother explains to a child how to do something, then a code is being replicated; but if the child learns a behavior through observation, then the behavior, not a code, is replicated. In either case, however, the individual adopts a meme by creating its own internal neural coding, just as it does when it learns something on its own. In no case is a code transmitted physically from one individual to another, as in genetic replication.

Among humans, of course, memes may be transmitted by deliberate teaching and by means of language. Deliberate teaching has also been claimed for some nonhuman primates as well, albeit on a much smaller scale (Boesch 1993; King 1999). I will come back to this claim in chapter 4.

Among humans, there are certainly codes that resemble memes. Dennet (1995:344) gave a list of examples:

These new replicators are, roughly, ideas. Not the “simple ideas” of Locke and Hume (the idea of red, or the idea of round or hot or cold), but the sort of complex ideas that form themselves into *distinct memorable units* – such as the ideas of

arch  
wheel  
wearing clothes  
vendetta  
right triangle  
alphabet calendar  
the Odyssey  
calculus  
chess  
perspective drawing  
evolution by natural selection  
impressionism  
“Greensleeves”

Dawkins (1976:192-193) gave another example in the chapter in which he coined the term “meme”:

Consider the idea of God. We do not know how it arose in the meme pool. Probably it originated many times by independent ‘mutation.’ In any case, it is very old indeed. How does it replicate itself? By the spoken and written word, aided by great music and by great art. Why does it have such high survival value? Remember that ‘survival value’ here does not mean value for a gene in a gene pool, but value for a meme in a meme pool. The question really means: What is it about the idea of a god that gives it its stability and penetrance in the cultural environment? The survival value of the god meme in the meme pool results from its great psychological appeal. It provides a superficially plausible answer to deep and troubling questions about existence.

There is certainly something very meme-like about all these ideas. They are indeed learned socially from other humans. Some such ideas survive and spread; others die out. Thus meme-like entities are common to both humans and other species. For most of the scholars whom I have cited, “culture,” including human culture, is synonymous with the social learning of particles of either behavior or coding.

However, I believe there is an element to human culture – and to most if not all of the examples just listed – that goes beyond and sets it apart from the memes found in other species. Social codes are not just transmitted from one individual to another; they are *created* by interactions among individuals. This makes cultural codes, unlike memes, *emergent* phenomena. Many of the meme-like ideas listed above differ in this respect from memes found in other species.

### 2.1.2. Emergence

In order to explain the foregoing, I must clarify what I mean by emergence. There is nothing complicated about the concept, but it is essential for understanding what I have to say.

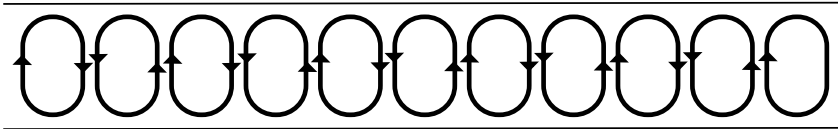
The concept of emergence is most often used today to refer to the process by which patterns or global-level structures arise from interactive local-level processes. This “structure” or “pattern” cannot be understood or predicted from the behavior or properties of the component units alone. (Mihata 1997:31)

“Emergent” phenomena, as I use the term, are those that arise from the *interaction* of multiple individual “agents.” An emergent phenomenon cannot be fully understood without understanding the properties of the individuals involved, including the rules that govern their behavior. However, such understanding is not sufficient. Understanding the *interactions* of the individuals is also necessary. In short, I am talking about the kinds of systems that are the subject of complexity theory (e.g., Babloyantz 1986; Jantsch 1980; Kauffman 1995; Kohler and Gumerman 2000; Mainzer 1997; 1989; Nicolis and Prirogine 1977). I will make little reference to the details of this body of theory, but two examples of such systems will serve to illustrate the salient aspects of emergence.

In a thin layer of water, the movement of individual molecules is uniform if the temperature of the water is uniform throughout – that is, the movement of the molecules is uniformly disordered. If we begin to heat the bottom of this layer of water, the system becomes unstable, because the denser water near the surface tends to sink while the water near the bottom tends to rise. As the temperature at the bottom continues to rise and heat continues to be dissipated from the upper surface, there comes a point when the uniformity of the disordered movement of the molecules is broken. Convection currents form as warm water rises and cool water descends. These currents are not random but are linked in a pattern of alternately rising and descending currents called Bénard cells (Figure 2.1). (For a more detailed discussion see Nicolis and Prigogine 1989:8-15; Velarde and Normand 1980).

The movement of the water molecules is controlled by relatively simple physical laws that can be understood at the level of the molecule. Understanding what makes an individual molecule behave in the way it does is necessary – but not sufficient – for a complete understanding of Bénard cells. The processes by which these cells form cannot be understood without reference to the interactions of many molecules. Another way of saying this is that, in a system of Bénard cells, the trajectory of one molecule of water is causally linked to that of another molecule with

which it has no direct interaction and that may be spatially separated from it by a distance of many convection cells. Both molecules are playing an active part in creating the system and are also controlled by the system. The pattern of Bénard cells is thus an emergent phenomenon that transcends both molecules and whose analysis cannot be reduced to the level of the individual molecule.



**Figure 2.1.** Viewed in cross section, Bénard cells consist of convection currents moving in opposite directions (after Nicolis and Prigogine 1989, figure 3a). Viewed from the surface (not shown), they form a honeycomb pattern (see Velarde and Normand 1980:92).

Cellular slime mold (*Dictyostelium discoideum*) is an unusual organism that spends part of its life cycle as individual, unicellular amoebas and part of its life cycle as a multicellular organism. The multicellular organism is capable of spatial movement, presumably in search of nutrients. In the course of its life cycle, it becomes differentiated into various kinds of cells and eventually produces spores that germinate into a new generation of individual unicellular amoebas. At each stage, emergent phenomena play a role, but for illustrating the nature of emergence it is sufficient to describe how individual cells aggregate to form a multicellular organism.

In response to lack of nourishment, a few individual amoebas begin to emit a chemical signal called cAMP (cyclic adenosine monophosphate). As the cAMP reaches other amoebas, they respond in two ways. They begin to move up the chemical gradient toward the “pioneer” amoeba. They do so not en masse but in waves of moving and stationary amoebas (Figure 2.2). The reason for the waves lies in the second response:

An amoeba that is stimulated by cAMP releases it so that the concentration rises and the molecule diffuses into adjacent regions. Amoebas nearby are then stimulated by this diffusing cAMP to produce the signal, which then diffuses and stimulates other amoebas. So the signal propagates across the lawn of cells in a petri dish. But this is not enough to ensure an effective signal: it must also be destroyed; otherwise the whole dish of amoebas would become a sea of cAMP, and no signals would be visible. The amoebas secrete an enzyme, phosphodiesterase, that destroys cAMP. So the substance has a brief life-

time, and the diffusion profile of the signal from a stimulated amoeba has a steep gradient, generating an effective directional signal that allows other amoebas to use it for chemotaxis (directed movement in response to a chemical). However, there is a problem here: cAMP released from an amoeba diffuses symmetrically in all directions away from the source, so amoebas anywhere within the effective range of the signal could respond. This means that each stimulated amoeba could become the center of the propagating wave. The result would be total chaos. This does not happen, as is evident from [Figure 2.2]. The reason is beautifully simple and natural: after an amoeba has released a burst of cAMP, it cannot immediately respond to another signal and release another burst. It goes into a refractory state during which it is unresponsive, recovering from the previous stimulus and returning to its “excitable” condition. Therefore, the wave cannot travel backward, and the signal travels one way. (Goodwin 1994:50-51)

Thus, the patterning of the movement of amoebas during aggregation depends on the chemical responses built into the phenotype of the cell by its genotype. However, the pattern also depends on the *interactions* of those cells. It cannot be understood without considering that interaction, and it is therefore an emergent phenomenon that cannot be reduced to the understanding of the individual cells alone.

Emergent phenomena can be understood only in terms of the interactions of multiple units – “agents” in the terminology of complexity theory. In both of the preceding examples, the overall pattern of movement is *created* by the interactions of multiple agents, and in this sense it transcends the individual agent. Emergent phenomena that change through time also *evolve*, not by natural selection but through the interactions of individual agents. For example, if we were to revisit the slime mold amoebas shown in Figure 2.2 at a later time, the waves of movement would have altered as the amoebas converged on a few centers. The pattern changes because of the interactions of the amoebas. Such emergent systems are ubiquitous in nature. From snowflakes to hurricanes to the V formations of flying geese, patterns are created by and evolve through the interactions of multiple agents.

Much of complexity theory is concerned with systems with very large numbers of agents whose “rules” of behavior do not change. Bénédict cells and the movement of slime mold are examples of such systems. Primate social systems are likewise complex, but they differ in two ways. The number of individuals in a group is likely to be much smaller, and each individual can learn from its interactions with other members of the group. This adds an interesting twist, but it does not change the fact that primate social systems are emergent phenomena. (The emergence in this case is at the level of behavior, not of coding.)





**Figure 2.2.** Movement of cellular slime mold amoebas during aggregation occurs in concentric waves. Light bands are moving organisms; dark bands, stationary. (Photograph courtesy of Grégoire Nicolis.)

A good example is an account by de Waal (1982) of the activities within a group of captive chimpanzees when the alpha male, Yeroen, was deposed by another male, Luit. This was by no means simply a matter of Luit overpowering Yeroen. Rather, the process took a considerable period of time and involved a third, younger male, Nikkie, as well as the female members of the group. Luit and Nikkie formed a coalition, but Nikkie did not support Luit in his fights with Yeroen. Instead, when Luit and Yeroen were fighting or bluffing, Nikkie confronted the females, who normally would have come to Yeroen's support (and whom Yeroen was often begging for help). Eventually, when Luit supplanted Yeroen, the females ceased to give Yeroen the kind of respect they once had. Nikkie went from having virtually no social standing to second place in the hierarchy. What is more, the trio of Luit, Nikkie, and Yeroen now began to spend more time together and to interact with one another much more than with the females.

In short, the changes in the social configuration of this particular group of chimpanzees involved different sets of interactions among various individuals and groups. Each of these sets of interactions affected other sets of interactions, and the social configuration that emerged was produced by them. It would have been impossible to understand either the process of change or the end result by studying the behavior of individual chimpanzees in isolation. Rather, these could be understood only as emergent phenomena that arose from and in fact consisted of interactions.

Patterns of convection cells or of slime mold signaling are much less diverse and much more monotonous than patterns of primate interactions, even though they involve many more individual agents. Two variables are involved. The first is the complexity of the rules governing the agents' behavior. For water molecules these are the rules of physics; for slime mold, they are chemical and cytological. In a primate society, the "rules" consist of mental coding. The second variable is the extent to which the rules governing the behavior of an individual agent may change as a result of interactions with other agents.

The fact that the rules governing the interactions of water molecules are both few and invariant means that patterns of convection cells differ little from one another except in detail. Primate and human societies are much more variable, because the codes governing individual behavior are more complex, and also because these codes can always change.

This does not mean, however, that social configurations are any less emergent. If we define social configurations as patterns of interaction among individuals, then these configurations are as much products of interaction as are patterns of convection. They too are emergent, and they too transcend the individual. Individual water molecules are active agents in constructing a system of convection cells and at the same time captives of that system. In the same way, individual apes and individual humans are active agents in and captives of the social configurations in which they find themselves.

### 2.1.3. Socially Constructed, Emergent Coding

I suspect that most scholars who hold culture to be essentially synonymous with social learning or socially transmitted traditions (e.g., Boesch et al. 1994; Boesch and Tomasello 1998; McGrew 1998; Whiten et al. 1999) consider that the differences between human and nonhuman culture are *quantitative*. Our larger brains make it possible for us to learn more complex memes, and language and deliberate teaching make transmission of those memes more efficient. Basically, there is in this view still no *qualitative* difference between human culture and that of other culture-bearing species.

In an evolutionary progression, if one passes from primates to man the amount and the complexity of the culture increases enormously. If we ask what is different about man that makes this possible, the answer lies in the fact that besides possessing the improved ability to make multiple choice responses and to learn, man has also greatly increased the art of true teaching. One human being cannot only instruct another, but can impart a wealth of information. Furthermore, that information can be transmitted by a powerful language, and it has even been possible to develop ways of writing the language so that communication can take place through the means of artifacts. Finally, because of such storage methods, we have been able to accumulate information. This most recent accomplishment has meant a logarithmic increase in the total stored knowledge that includes all the inventions and innovations of the past. (Bonner 1980:179)

While this is entirely true, it does not cover all that is new in human culture. There is also something qualitatively different – emergent, socially constructed coding.

Among nonhuman species, memes are not emergent phenomena. They do have a certain public character in that they are “shared,” but this is analogous to “sharing” the gene for blue eyes with other members of a population. The coding represented by memes is understandable at the level of the individual. An individual interacts with its environment, and on the basis of those interactions either constructs or modifies neural codes that will govern its behavior in the future. It matters little if the relevant part of the environment is the behavior of running water, the behavior of a predator, or the behavior of a conspecific. Each individual constructs coding that it perceives (in terms of its already existing coding) as being beneficial. The codes created in response to this interaction can thus be understood in terms of the individual creating them, and they are therefore not emergent phenomena.

Certainly, the interactions of multiple individuals whose behavior is governed in part by memetic coding will produce emergent social phenomena at the *behavioral* level. The example given earlier of the struggle involving Yeroen, Luit, and Nikkie is a good illustration of this point. However, these emergent phenomena arise in the domain of behavior, not that of coding. The agents in the emergent system are individual animals. Their behavioral interactions produce emergent social systems or social configurations that cannot be understood without analysis at the level of social interaction, but the coding governing each agent’s behavior can still be adequately understood at the individual level.

This does not mean that nonhuman social systems cannot be very complex, or that the individuals in such systems are not behaving according to complex, sophisticated, and highly flexible coding. Primate ethology has provided abundant evidence to the contrary (e.g., Byrne and Whiten 1988; Chapais 1995; de Waal 1982; 1989; Dunbar 1988; Goodall

1986; Hinde 1983; McGrew et al. 1996; Quiatt and Itani 1994; Quiatt and Reynolds 1993; Smuts et al. 1986; Tomasello and Call 1994 ). It simply means that the coding involved is not emergent.

Humans, on the other hand, are governed (in part) by coding that cannot be understood at the individual level alone.\* It is easiest to grasp this fact by considering codes that are both based on arbitrary convention and serve to coordinate the behaviors of multiple individuals. Take, for example, the red, yellow, and green lights at a highway intersection. These represent an arbitrary convention that facilitates the safe flow of traffic by coordinating the behavior of all the drivers who approach the intersection. While a driver may understand the benefit of traffic lights for himself or herself, this benefit exists only if the convention is "agreed" to by *all* drivers. In the absence of such agreement, the individual's best strategy at an intersection is not adherence to a convention but a combination of caution and bluff.

The latter strategy resembles the monkey Imo's throwing wheat into the water to separate it from sand, because it will work for the individual regardless of whether or not other individuals are guided by it. By contrast, even if there are traffic lights at an intersection, the convention on which they are based will work only if everyone understands and accepts it. Thus wheat washing can be created and understood at the individual level; conventions for traffic signals can be created and understood only at the emergent level.

Examples of indubitably emergent socially constructed coding abound in human life. A chess game, for example, can exist only if the concept of the game, the definitions of the pieces, and the rules of play are agreed on by at least two individuals. One player alone is insufficient. Exogamous clans can organize a society only if everyone agrees on the definition of a clan, the definition of marriage, and the rule of exogamy. If only one person adheres to the concept of exogamous clans, society will be organized along other lines in spite of him or her.

Among the most important of emergent codes are the semantic and syntactic conventions that make up languages. Unless everyone in a conversation uses the same conventions, linguistic communication will not exist. If one wants to talk to another English speaker, one has no choice but to use English words and English conventions for indicating tense, number, and so forth. It is possible for one individual to make up his or her own language, but no communication will take place unless at least one other person adheres to the same linguistic coding.

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\* Eve, Horsefall, and Lee (1997:36) have also argued that culture is an emergent phenomenon and that the individual and emergent levels can be neither separated nor reduced one to the other. However, their concept of culture is rather different from mine.

Coding can become emergent only if it is created and maintained or modified through social interaction among multiple individuals. For example, until 1967, everyone in Sweden drove on the left side of the road, by legally binding convention. In 1967, the Swedish government decreed that, as of a given date, everyone would instead drive on the right. Thus a new convention was created that governed the behavior of all Swedish drivers. This convention was created by Swedish society – by the interactions of Swedish administrative, political, and legal institutions and Swedish voters – and it worked because it was accepted by Swedish drivers. For this reason, the new convention was emergent in nature.

This does not mean that an individual cannot create a code that becomes emergent. For example, I have acted individually in creating an idiosyncratic definition of the word “culture.” As I sit at my desk writing this paragraph, the definition has not been adopted by anyone else and so does not constitute emergent coding. I hope that by the time you, the reader, reach this paragraph, you will have understood and adopted the definition for use within the limited context of this book. If you have, then by that act you have turned an idiosyncratic code into an emergent code. It is not necessary that you agree with me or with my analysis of culture for this to be the case. All that is necessary is that when you read my word you take it to mean what I meant when I wrote it. If so, then communication exists, because we share an emergent code. It is this social interaction between me as writer and you as reader that gives the code its emergent nature.

In certain cases, one individual has the power, for whatever reason, to impose idiosyncratic codes on others, so that they govern everyone’s behavior. For example, during the 1980s, my parents’ mailing address was changed. A Postal Service employee in central Oregon had decided that it was more logical to number rural postal boxes according to a map grid system than sequentially along a delivery route. This produced very long numbers that were hard to remember and that few people liked. Nevertheless, anyone who wanted mail delivered to the right place was obliged to use the new system. That it was imposed by one bureaucrat, without consulting postal customers, did not make the new system any less emergent. What made it an emergent coding system was not people’s motive for adopting it but rather the fact that it worked because everyone adopted it. Residents informed their correspondents of the new numbers, and when new mail arrived, postal workers knew where to deliver it.

To avoid confusion, I must pause here to clarify my terminology. The reader may wonder what distinction I make between “socially created coding” and “emergent coding.” The answer is none. The difference is one of emphasis only. To avoid introducing new jargon, I will gener-

ally use the former rather than the latter term. However, either term should be read to mean “coding that is created and maintained or modified through social interaction among individuals and that is therefore intrinsically emergent.”

Note that the “creation” involved is the creation of a code that transcends the individual. This is necessarily a social, not an individual act. In the examples just given, one individual created an idiosyncratic code. The adoption of this code by others constituted its social creation and moved the code from the idiosyncratic to the emergent level. (By contrast, the adoption of a meme does not move the meme from the individual to the emergent level. There is no social creation involved, just social transmission.)

It may further clarify the difference between emergent and memetic codes if we consider (1) the consequences to the individual of rejecting each of them and (2) what the individual must do in order to change each of them.

If an individual either fails to learn or simply rejects a meme, the consequences depend on the nature and value of the meme. A young mouse from the example cited earlier who fails to learn that the smell of a rat indicates danger may well pay with its life. The macaque who does not adopt sweet-potato washing will eat gritty potatoes, a matter of much less import. In either case, the consequences come directly from the environment as a result of the way the individual deals with that environment.

If an individual fails to learn or opts out of an emergent code or coding system, there are three classes of consequences. The first is analogous to what happens if one fails to adopt a meme. If, for example, a stubborn Swedish farmer had refused to drive on the right side of the highway, he likely would have paid with his life. This example differs from those of the mouse and the macaque only because the environment involved is not the natural environment but the behavior of conspecifics. This is not a significant difference – the behavior of conspecifics is still a part of any organism’s environment. For example, among vervet monkeys,

in a typical interaction involving two playing infants, one or both of the infants will scream when play becomes rough, and both mothers will come running. The dominant mother will then threaten or supplant the subordinate mother and her infant, and the subordinate pair will retreat. ... from a very early age group members behave differently toward the infants of high- and low-ranking mothers. High-ranking infants are often more sought after as play and grooming partners, and in many other ways interactions with them are carried on in a more careful manner than are interactions with infants of lower rank (Lee 1983; Nicholson 1987; Whitten 1982). ... In rhesus

macaques (Datta 1983), juveniles consistently challenge adults who rank below their mothers but rarely challenge adults who rank above their mothers. This suggests that a juvenile monkey learns about her "expected" dominance relations with others at a very early age. She seems to do so both through her own experiences and by observing interactions between her mother and other group members (Altman 1980; Berman 1980; Datta 1983; Horrocks and Hunte 1983). (Cheney and Seyfarth 1990:31)

In other words, one of the things any primate must learn is how other individuals are likely to react under given circumstances. The reason, of course, is that the behavior of other individuals will have an effect on one's own life. In all primates, not just humans, this ability to observe, predict, and adjust one's behavior to social facts is highly developed, with the result that primate social systems tend to be both complex and flexible.

The penalties for failing to predict the behavior of other individuals come from the behavior of conspecifics. The young macaque who fails to recognize that his mother is subordinate to his playmate's mother risks a painful lesson if he is too rough with that playmate, just as the mouse risks being eaten by a rat because it fails to learn that rats are dangerous. In this respect, the death of a stubborn Swedish farmer who refuses to accept that everyone else is driving on the right side of the road is no different just because it stems from a refusal to accept an emergent code rather than from an inability to learn, as an individual, about the behavior of others.

A second kind of consequence faced by an individual who fails to accept an emergent code or system of codes is simply that he or she is left out of the social system or social activity that the code produces. This may be of little consequence. For example, I personally do not feel handicapped because I never learned the rules of bridge. However, because I have not done so, I cannot join in a game. In other cases, the consequences may be more severe. For example, in the unlikely event that someone in a hunter-gatherer band refused to learn the conventions controlling communal hunts, he would be unable to participate in those hunts and might be denied a share of the prey.

This kind of exclusion is not the same thing as not learning how to deal with others socially. All social mammals, whatever their individual social skills, are nevertheless involved in social interactions. Being socially inept means failing to accomplish one's goals in a social setting, whether these have to do with rank, access to food, access to mates, or something else. If one does not learn to play bridge, the consequence is not that one fails but that one cannot even play the game.

In many cases there may be a third kind of consequence. An emergent coding system may include the requirement that all individuals ac-

cept and adhere to that system, and that those who fail to do so be punished. This is typical of some religious systems, many moral codes, and of virtually all legal systems. In such cases, if one fails to accept and adhere to a code, one will be punished by other members of society. The punishment will be prompted by the same set of codes that one has rejected. Sometimes the punishment is harsh, including torture or death. Sometimes it is limited to mild ostracism or simply the withholding of social approval, as when someone wears a necktie that is unfashionably narrow or eats his salad with the wrong fork. It is true that even in the absence of emergent coding, individuals will still use coercion to enforce their own interests or those of relatives or allies. Yet among humans, individuals often use coercion to enforce an emergent cultural code, regardless of their own individual interests.

If an individual animal is dissatisfied with a meme, it is free to change it. For example, the tits I described earlier all opened milk bottles, but they opened them in different ways. Moreover, different birds apparently preferred milk bottles with different colored caps (Fisher and Hinde 1949). Modifying a meme is done in accordance with one's own internal codes and one's own experiences. An individual has no such freedom with regard to an emergent code. An emergent code is not emergent until it is accepted by more than one individual. Therefore, in order to either create or modify an emergent code, one must somehow influence others to adopt it. In some cases, such as that of the Oregon postmaster, one individual may have the power to impose his or her will on others. More often, the process involves persuasion, negotiation, and compromise. In all but very small social groups, even a tyrant depends on the loyalty and support of his subordinates to impose his will on others.

Thus, from the laws that govern a nation to the rules of a children's game, emergent coding is usually the result of a more or less complex process of coercion, negotiation, persuasion, and compromise, a process that involves at least a portion of those affected by the outcome. This does not mean that everyone is equally influential in the process, but simply that the process involves more than one person. One person may invent a new game, but the game will not exist as a game unless at least one other person is persuaded to learn its rules.

The emergent nature of cultural coding is the central concept in this book. As will be seen in chapter 4, such coding appears to be unique to humans. This is not to say that no emergent phenomena are to be found among other species. It is becoming apparent that, because different genes interact with one another, the genotypes of all species are characterized by emergent phenomena (Kaufman 1993). The same is true of the phenotype, where different parts of the body interact with one another



and where ontogenetic development is characterized by emergent phenomena (Goodwin 1994). Networks of interacting neurons make the functioning of the brain an emergent phenomenon. Above all, social interactions, being interactions among individuals, produce emergent phenomena at the *behavioral* level, patterns of social behavior that cannot be understood without investigating those interactions. What seems to be unique to humans is the emergent nature of a significant portion of the codes that exist in our minds or brains and that influence our behavior.

Socially constructed, emergent coding makes the human way of life different from that of all other animals. It lies at the very core of human culture. There is, however, much more to human culture than just socially constructed coding per se.

## 2.2. SOCIALLY CREATED CODING AND HUMAN CULTURE

For a large set of Holocene humans – those people living today and those for whom we have reasonably good historical or ethnographic records – we can be confident that we understand the general characteristics of their cultures. It is clear that for all of them (whether the people are hunter-gatherers, agriculturalists, or members of urbanized, industrial societies),

- Culture is based on socially created codes.
- Socially created coding provides motivation for the individual's behavior.
- An all-inclusive system of emergent coding pervades and absorbs into itself almost all other coding and almost everything else perceived or thought of by humans.

Yet there is no a priori reason that socially created coding could not at one time have existed without the two other characteristics of Holocene culture. Socially created coding can, at least theoretically, be a very simple phenomenon. This may not be obvious from the examples given earlier in this chapter, most of which were drawn from modern contexts. An imaginary heuristic example might be clearer.

Wolves hunt large game such as moose (*Alces alces*) cooperatively. Whereas it would be difficult for a single wolf to kill such a large animal, a group can tire its prey by taking turns pursuing it and can kill the victim by mobbing it. Since a moose is large, it yields enough meat for many hunters. As a result, it makes sense to hunt cooperatively as a pack.

Imagine a group of early humans setting out to hunt large game with relatively unsophisticated weapons. For them as for the wolves, it would pay to hunt as a group. If they were capable of agreeing beforehand on a *modus operandi*, their chances of success would be even greater. For ex-

ample, they might agree on a strategy for driving a herd of bison or other large bovids over a cliff, so that each individual would know where he or she should be and what he or she should do. This would certainly be a form of socially constructed, emergent coding. Let us suppose, however, that for our imaginary group the creation and use of socially constructed coding stopped there, and that in all other respects their behavior was governed only by the kinds of codes characteristic of wolves and chimpanzees. Clearly, their way of life would be very different from that of living humans.

### 2.2.1. Motivation and Susceptibility to Socially Created Coding

First, the *motives* of each individual would be no different from those of a wolf in a cooperative hunt. The codes that stimulated him or her to hunt as part of a group would not be emergent. The motives would be hunger, on the one hand, and a calculation (conscious or otherwise) that cooperation would be advantageous for satisfying that hunger. In our imaginary group, the individual's behavior during the hunt would be governed by the emergent codes constituting the agreed-upon strategy, but the *motivation* would be of an entirely private, individual nature. The socially created coding would provide instructions for how to hunt cooperatively but not a reason for doing so.

In all known present-day human cultures, socially created coding also seems to provide motivation for behavior. People are moved to remain celibate by the hope of eternal life in heaven, to die in a suicide mission by the desire to serve their emperor or God, or to toil in low-paying jobs by dreams of academic glory.

This raises an interesting problem from an evolutionary perspective. Because emergent codes are created through the interactions of multiple individuals, there is no a priori guarantee that they will produce behavior that will benefit any given individual. If natural selection acts on the individual, it follows that it should quickly destroy any tendency to obey codes that might reduce the individual's evolutionary fitness.

When codes are generated externally – by multiple individuals – no one person can be assured that the results will be beneficial to him or herself, or even that they will not be downright deleterious. In addition, it is a characteristic of complex (i.e., emergent) systems that their evolution is unpredictable. As a result, whenever multiple individuals interact to create coding, it is always possible that the system will produce unintended consequences, trapping individuals in a system of coding that benefits no one.

All organisms are parts of systems (ecosystems, social systems, etc.) that may threaten their individual evolutionary success. Such systems constitute environments in which the individual competes. Natural selec-

tion tends to produce (private) codes that let individual organisms interact with these environments in ways that maximize their chances of reproductive success. These could include a code for accepting socially created codes such as procedures for carrying out a game drive – as long as following those codes contributed to the individual's fitness. This is exactly what our imaginary group of hominids is doing. However, as soon as individuals permit emergent codes to motivate their behavior, they run the risk of permitting those codes to cause them to behave in ways that lessen their individual evolutionary fitness. The codes are no longer just part of the environment, but part of their coding for dealing with the environment.

The question therefore arises, how could natural selection have failed to prevent the evolution of a willingness to let socially created (and therefore external) codes motivate one's behavior? The same question arises with regard to the apparent propensity of our species to act altruistically, helping others at one's own expense. This is a complex question that is the subject of a large body of literature. As will be seen in the next chapter, nothing about the question is simple –not even the definition of evolutionary fitness. But until we understand when, how, and why cultural coding came to provide the motivation for individual behavior, we will not understand the evolution of human culture and of the human way of life.

### **2.2.2. Socially Created Coding as All Encompassing**

The way of life of our imaginary group of early humans differs from that of recent humans in another fundamental way. In their lives, socially constructed coding is restricted to a narrowly circumscribed activity. Yet among all the humans who are living today, or who are known ethnographically or historically, such coding is pervasive rather than restricted.

Let us give our imaginary group a second set of socially created coding, a simple language. The language consists of phonological, semantic, and syntactic conventions that permit these people to express and to understand ideas about their environment. Thus, their language may have words for concepts such as “berry,” “ripe,” “three,” and “day,” as well as syntactic conventions for expressing relations among them, such as, “The berries on the other side of the ridge will be ripe in about three days.” Clearly this language constitutes a set of emergent coding, and it would be of great utility in teaching children, organizing cooperative activities, and exchanging useful information.

It is limited in scope, however, in comparison with the language and culture of present-day humans. All it does is to permit communication about things in the natural world or about concepts about those things that would probably exist anyhow. For example, a father could explain to

his not-too-bright son that a spear must be sharp if it is to be effective. However, he is only communicating something about the real world that he knows already, without language or symbolism.

We humans, however, use language to construct a large repertoire of “things” that have no existence outside a symbolic cultural context and that depend on that context for their very existence. Such “things” pervade the entire environment in which we as humans live our lives. They come in an almost infinite variety: beings (deities, ghosts), social roles (presidents, bridesmaids), objects (scepters, stop signs), concepts (sin, authority), acts (baptizing, promising), values (virtuous, chic), and so forth.

Still, this tendency to create cultural entities that have no existence in the concrete world around us is not the most important difference between the language or emergent coding of our imaginary group and those of living humans. Whatever its origin, the effect of this tendency is to make possible a much more significant development. Socially constructed codes merge into pervasive, all-encompassing, ubiquitous systems of thought that incorporate almost everything that humans think or perceive. Animals may become totems, assimilated into a framework of kinship and religious belief that is entirely cultural. Natural relationships such as motherhood or siblinghood are given cultural meaning beyond their biological meanings. Indeed, kinship is usually defined culturally, with cultural definitions taking precedence over biological ones.

Even private codes are incorporated into emergent coding. Emotions such as anger, sexual desire, and fear are given cultural meanings and cultural values that depend upon the culturally defined contexts in which they occur. In short, almost everything a person does, thinks, or feels comes to have cultural meaning.

It is not that socially constructed coding displaces or replaces either the natural environment or individual or memetic coding. Rather, it assigns them cultural meanings and values and uses them as cultural symbols. The result is that while the behavior of an enculturated individual is still guided in part by individual and memetic coding, everything he or she does, feels, or thinks is now enmeshed in a cultural system. Although it is possible and even desirable to distinguish analytically between the natural and the cultural environments, or between individual and emergent coding, in practice the enculturated individual can never ignore the cultural meanings of natural phenomena or the cultural meanings and consequences of behavior guided by individual coding.

By contrast, the members of our imaginary group of early humans, in common with wolves and chimpanzees, use private coding to perceive and interact with their environment. When they do make use of socially

constructed codes, it is in the limited context of specific social activities that are coordinated by simple emergent codes.

I am certainly not the only person to argue that culture provides an all-pervading matrix of meaning to human experience and human behavior (e.g., Durkheim 1915 [1965]; Geertz 1973:5; Rappaport 1999:8-9). These authors' theoretical perspectives on culture differ from one another's and from mine, but I follow in their footsteps by seeing culture as an all-encompassing intellectual or ideational environment.

### **2.2.3. Memetics in the Context of Human Culture**

Human culture, then, is based on a form of coding that at some point in the course of our evolution was added to already existing forms of coding, whether genetically determined, learned, or memetic. Thus, in principle, present-day human culture includes a memetic element. However, the emergent and all-encompassing aspects of human culture affect memetics in three ways:

- First, in the presence of language, most memes will be codes, not behavior.
- Second (and this is much more important), when socially created codes guide and motivate individual behavior, and when all things (including memes) come to have cultural meaning and positive or negative cultural value, memetic selection can no longer be assumed to take place at the level of the individual.
- Third, a new entity, the culture trait, comes into being. As I use the term, a culture trait is in some ways analogous to a meme, but it consists of coding created socially and transmitted from group to group rather than from individual to individual.

With the advent of language, there can be little question that some memes will belong to the domain of coding. Earlier in this chapter I mentioned that among nonhuman species, what was transmitted from one individual to the next was usually not a code but a behavior. When one individual explicitly teaches another, however, what is transmitted is information about how to do something, when to do it, or something similar. Such information is coding, not behavior. I discuss in a later chapter claims that such deliberate teaching takes place, without language, among apes.

In the case of humans, it would be difficult to believe that, in the presence of language, coding was not transmitted from one individual to another. As a medium, language transmits information – that is, coding – rather than behavior. The very act of creating or learning a language involves a mindset based on shared coding. Thus, in the context of emergent culture, many but not all memes will consist of coding rather than

behavior. For example, there are many ways of making chili con carne, and it may be that in some cases one person learns how to make it by watching another person. When a recipe for chili is written down in a cookbook, or when someone explains verbally how to make his or her version, then the recipe or explanation is clearly a form of coding.

Human culture has another, much more significant effect on the way ideas are transmitted socially. It is the independent selection of memes by individuals that makes memetic evolution an essentially Darwinian process. In the context of human culture, this independence is seriously compromised. The reason is that memes, like virtually everything else humans either do or pay attention to, are caught up in the web of culture in the sense that they are assigned cultural meanings, values, and so forth that transcend the private coding of the individual. When an individual either adopts or rejects a meme, he or she is also, like it or not, performing a cultural act. As a result, the individual's decision is guided not only by internal private coding but also by external cultural coding.

For example, when a chimpanzee makes a wand to fish for termites, she needs to consider whether it is stiff enough, flexible enough, smooth enough, and of the right size to do the job. Unlike humans, she need not worry about whether the particular form or color of the wand is too flamboyant, too passé, too masculine, and so on. Thus she can make a wand on the basis only of her own internal coding, which informs her of how well it will function physically. If she were human, she would also need to worry about how well it would function socially, in terms of socially created cultural coding.

This is not to say that ideas and behaviors do not spread among humans as memes spread among nonhumans. However, the process virtually always involves not only private decisions but cultural factors as well. Let me give two examples from modern life. Someone, somewhere, invented the pocket protector, a plastic insert that protects the breast pocket of a shirt from ink leaking from pens. Although it does this job well, it is almost never seen today, at least in North America, because it has also become the stereotypical symbol of the nerd, of someone with an enthusiasm for unfashionable activities such as engineering combined with an embarrassing lack of social graces. Of course, there is nothing inherent in the pocket protector that gives it this meaning. The meaning is assigned by culture, but it has nevertheless played a major role in selecting against the adoption – by individuals – of pocket protectors.

Another example is provided by fast-food hamburger restaurants. These are very popular in the United States and are becoming popular in France as well. Interestingly, the cultural meaning of fast-food restaurants is quite different in the two countries, and as a result the customers in the two countries differ.

In the United States, the most common positive response to fast-food restaurants is that they are a quick, inexpensive, and convenient way of getting a meal. The most frequent negative response is that the food tends to contain unhealthy levels of fat, cholesterol, and sugar. The clientele at fast-food restaurants includes people of all ages, as individuals, in families, and in groups of unrelated people. In France, on the other hand, there is a sharp age division in attitudes toward fast food. For teenagers and young people it is a way of identifying with popular culture and with one's age group, and a way of distinguishing oneself from the older generation. For older people, it is a threat to French culture, to traditional norms and attitudes concerning meals and eating. The result is that older people and families frequent fast-food restaurants much less often than they do in the United States.\* In this case, emergent cultural attitudes affect which segments of the population have adopted the fast-food meme.

This example illustrates the problem of analyzing the evolution of human culture in a situation where socially created as well as private coding determines the adoption or rejection of a meme. It also illustrates the third change brought about by the appearance of culture. A new phenomenon arises in the context of socially created culture, one that resembles a meme but that actually belongs to the emergent rather than the individual level. This is what has traditionally been referred to as a "culture trait" or by some similar term. Culture traits are units or complexes of socially created coding that originate in one society and then are adopted by other societies or subsets of other societies.

For example, a religious movement arose among the native tribes of the western United States in the late nineteenth century, tribes undergoing severe stress as a result of white conquest. The movement foresaw a return of the dead ancestors, a renewal of game now become scarce, and a general return to better times. This revival was to be hastened by the performance of a Ghost Dance, which gave the movement its name. The Ghost Dance had its roots in the Prophet Dance of the tribes of the Northwest (Spier 1935). In 1870 and again in 1888, the Ghost Dance was stimulated by prophets of the Paviotsos in northern Nevada. From there it spread to the tribes of the Great Plains, where it became one cause of warfare against whites (Mooney 1896).

It is instructive that among the Lakota, an emphasis on fighting against and destroying or driving out whites became a part of what, among the Paviotsos, had been an essentially peaceful if not pacifist

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\* I admit that this discussion of fast-food restaurants is based on my own observations, which would hardly meet scientific ethnographic standards. My purpose is simply to illustrate a point, not to provide a comparative ethnography of French and American eating habits.

movement (Lowie 1954:181). It is equally significant that in spite of its appeal to a large number of tribes, the Ghost Dance was rejected by the Navajos, who for religious reasons considered the dead to be extremely dangerous and who looked upon the possibility of their return with serious misgivings (Hill 1944).

Thus, the processes by which culture traits spread (or fail to spread) among groups are equivalent to the processes by which memes spread among individuals. Culture traits are adopted when they are perceived as potentially beneficial and rejected when they clash with existing codes. However, they belong to the emergent level of society and culture, not to the individual level where memes reside. Like all emergent codes, they are created by interactions among multiple individuals, and they can be adopted only by groups of individuals.

The emergent nature of human culture poses a challenge for memetic analysis. Some very meme-like phenomena are indeed present in human culture. Moreover, these meme-like entities are in fact transmitted from one individual to another. The problem is that what makes a Darwinian analysis of memetic evolution possible is selection at the level of the individual. In the context of human culture, this aspect of memetics breaks down.

The meme is also an inherent part of the cultural system, so it becomes in a very real way an emergent as well as a memetic code. Its evolution is determined (at least in part) by the processes that drive the evolution of emergent or complex systems. This mechanism does not involve selection but consists of interactions among multiple agents.

This does not mean that adherents of memetic or dual inheritance models of human culture have it all wrong. There is a strong component of this kind of transmission in human culture. However, the analysis of even the memetic component of human culture does need to be altered to accommodate and account for, in some way, the emergent aspects of human culture.

### **2.3. FURTHER OBSERVATIONS ON HUMAN CULTURE**

To this point, I have presented only a definition of emergent coding and human culture. The resulting picture is so stripped down that it risks being misunderstood. It would be a good idea, therefore, to flesh it out by discussing a few additional points concerning the way I conceive of human culture.

Socially constructed coding, by its nature, arises from the interactions of more than one individual. However, the ways in which such codes are created are varied. At one end of the continuum, they may be



created cooperatively. At the opposite extreme, they may be imposed by force. Coercion as a source of emergent coding cannot be eliminated.

I gave an example earlier of one form of “coercion,” the imposition of an unpopular postal box numbering system by a Postal Service bureaucrat. In that case, the creation of the numbering system could be attributed to a single person. Mail delivery, however, depended on the use of that system by people who addressed mail, sorted mail, and delivered mail. Thus the emergent nature of that system of addressing mail was unaffected by the fact that it was its having been imposed by fiat. In addition, the power of the bureaucrat in question derived from a whole set of cultural coding (the definition of the United States Postal Service, its rules and regulations, its personnel structure and table of organization, etc.).

Yet we can easily imagine a very small society in which social codes for, let us say, the coordination of foraging activities is controlled by one individual, X, through the threat or use of purely physical force. Assuming that the codes in question can be understood only in terms of the interactions of multiple individuals (e.g., X lies in ambush while Y and Z are ordered to drive game toward him), then the coding is emergent, regardless of the fact that Y and Z have no desire at all to hunt with X. Nor should this situation be confused with, for example, the forceful stealing of food by a dominant individual. In the latter case, only behavior is involved. In the former, it is coding that is imposed by force.

Examples of cultural coding that is accepted involuntarily are easy to find. In both the southern United States until the 1960s and in South Africa until the 1990s, black citizens were forced to live by oppressive rules that they did not accept voluntarily and for which they saw no moral justification. In spite of their unwillingness, most by necessity obeyed the rules of segregation and apartheid. For example, they understood and obeyed rules about where to sit on a bus or which drinking fountains to use. It is because these rules governed their behavior, and not because they were accepted willingly, that I would include them within my definition of socially constructed, emergent cultural codes.

Many cultural codes, of course, are not imposed by pure brute force. Rather, they are the products of less one-sided processes, such as discussion and voluntary agreement. The process may consist of negotiation or of political deal-making, in which each individual aims for a result that is as close as possible to what he or she would like.

This raises the next point that I want to make about human culture. In the process of social interaction, each individual acts according to his or her own coding. This includes genetically determined coding, individually learned codes, memetic codes, and emergent, cultural codes.

These codes at times reinforce each other, but at other times they conflict and compete with one another for control of the individual's behavior.

Because genetically determined codes such as hunger, sexual desire, and fear are so fundamental and so strong, they have a very important influence on the individual's behavior. To a great extent, individually learned coding and memetic coding are constructed by the individual because they are perceived as satisfying genetically determined coding. As a result, each individual to a large extent acts in terms of his or her evolutionary self-interest, even in the context of human culture.

When cultural coding requires behavior that is perceived as not being in the interest of an individual, that individual is likely to try to change the cultural coding. Because other individuals are doing the same, and because cultural coding is created by the interactions of multiple individuals, it is almost inevitable that not all individuals can be successful in this attempt.

Culture would represent the cumulative effects of inclusive-fitness-maximizing behavior ... of the entire collective of all humans who have lived. ... If this theory is appropriate, then aspects of culture would be expected to be adversary to some of the wishes of each of us; few aspects of it would be viewed with equal good humor by all of us. (Alexander 1979:68)

Culture is far from being a static, immutable force that rigidly determines the behavior of all members of a society. Rather, it is a dynamic phenomenon, of which individuals are at the same time both the creators and the captives, and which is also only one of the factors determining their behavior.

It is true that we as individuals either voluntarily or involuntarily accept the dictates of cultural coding even when they conflict with our individual, internal coding. However, this trait also gives the individual a new weapon in the competition with others. Culture becomes a way of manipulating the behavior of other individuals. Cultural codes (rules, values, etc.) can variously be invoked, manipulated, or altered in order to influence their behavior. The result is that culture is at one and the same time an arena in which the struggle for individual success is, in part, played out, an object of competition, and a means of competing. Marx's (1884 [1970]) famous characterization of religion as the "opium of the people" reflects this dual propensity to submit to culture and to use culture to manipulate the behavior of others.

To give an example: if one wants a playground for one's own children, but wants it built at someone else's expense, one might do two things, both of which involve changes in cultural coding. One might try to manipulate the political system to have the local government fund a

new playground in one's neighborhood. One might also try to change the tax code to shift the burden to someone else. Thus cultural coding becomes a weapon in social competition. It can also become a weapon in the struggle to determine what the culture will be. In the United States, liberals and conservatives, Democrats and Republicans all invoke cultural icons such as the "founding fathers" or the "framers of the Constitution" not only to convince voters to elect them but to convince voters to support or oppose changes to the laws governing the country.

Finally, it should be noted that not all individuals will have the same set of cultural codes (Chase 2001b; Hutchins 1995; Netting 1974). There are several reasons for this. Many such codes are specific to particular activities or to particular groups of people. Males and females, for example, may each possess specialized cultural knowledge not shared with the other sex. Initiates or members of secret societies may have closely guarded cultural codes. Specialists have cultural expertise that others do not. In some societies, only scribes can read and write. Mathematicians, lawyers, and astrologers have mastered subsets of culture that others are less familiar with.

However, there is another important reason why different individuals possess different cultural codes. In the segregated South, everyone understood that blacks were required to sit at the back of a bus, behind the white passengers. Both blacks and whites shared this cultural code. There was no such agreement, however, on the cultural coding used to justify this rule. Southern whites (for the most part) had one set of beliefs and values concerning the nature and meaning of race, which was most emphatically not shared by blacks, who had a whole different set of values and beliefs. For decades, blacks were coerced into obeying the laws and rules of segregation even though they did not accept their moral authority.

Eventually, partly through civil disobedience and partly by using shared cultural beliefs and values to sway public opinion, they succeeded in getting the laws changed. The laws and all the conflicting beliefs and values were parts of the culture of the United States; all arose from the interactions of multiple individuals. The dynamic nature of culture is reflected in the fact that one group of people within the society used one subset of the culture to bring about change in another part of the culture, a change that was advantageous to them.

Finally, there is room for some more or less random variability in cultural coding. Emergent coding will work as long as every individual's version produces behavior that is consistent with the "purpose" of the coding. Language provides an excellent example. Individual speakers of a language and speakers of differing dialects have somewhat variant phonemic coding. That is, they tend to pronounce words somewhat dif-

ferently. A considerable degree of such variation is possible before people fail to understand each other.

As another example, the Commonwealth of Pennsylvania has on its books a very specific regulation about how far one must park from a fire hydrant. I learned this rule when I took my written driver's test and promptly forgot it. Yet I have never been ticketed for violating the rule – my own idiosyncratic idea about how much space I must leave is sufficiently close to that of the police to avoid punishment. The same is true of millions of other Pennsylvanians who have forgotten the official distance and whose idiosyncratic ideas of what is appropriate undoubtedly differ from mine.

In short, an emergent culture is not a static, monolithic entity shared equally by everyone and rigidly controlling everyone's behavior. It is a varied conglomeration of different sets of coding produced by the interactions of different groups of individuals for different reasons, sometimes very specific and sometimes very general, sometimes widely shared and sometimes contentious, sometimes in a stable state but always potentially subject to change.

Nor, for that matter, are the boundaries of a culture clear-cut. If one group of people were completely isolated from all others, then their culture would have clear-cut boundaries. But in a world where one group of people interacts with other groups, those interactions will produce emergent codes. These may vary in scope and complexity from simple arrangements for periodic trading between tribes of hunter-gatherers to the international air traffic control system, but they nevertheless are shared by different peoples. One set of cultural codes (a religion, a recipe, a decorative motif) may be shared by peoples who, on the whole, have quite different bodies of culture. Pilots and air traffic controllers around the world share a body of socially created coding with one another that is not shared with most of their compatriots. Yet in other respects, the cultures of pilots or air traffic controllers from various nations are quite different.

Isolating a single culture, then, is much like isolating a weather system. It is more or less an arbitrary matter. There may be a storm on the east coast and a high pressure system on the west coast, but they both share the influence of the jet stream. By the same token, French culture may differ in many ways from Mexican culture, but they share Catholicism.

### **2.3.1. Culture as Superorganic**

The idea that culture is in some way a “superorganic” phenomenon that transcends the individual is an old one in the history of anthropology and sociology (e.g., Durkheim 1938 [1964]:xlvi-lvi, 1-13; Hanson 2004;

Kroeber 1917; White 1949; 1975). This raises a somewhat difficult issue, in that the only real locus of culture is the individual. In other words, the only physical reality that culture has is in the neural structures of individuals' brains. Some scholars have dealt with this apparent problem by arguing that culture represents an abstraction – a sum, average, or other summary – of individual codes, or else the distributions of codes over various individuals in a population (e.g., Atran 2003; Hannerz 1992; Rodseth 1998; Sapir 1938; Schwartz 1978). My notion of culture sides with the first group of theories insofar as I see culture as in some way transcending the individual – but with some significant differences.

It is beyond the scope of this book to address these issues in any detail, but they merit a brief comment. The notion of culture as an abstract summary or a distribution of individual coding is applicable to the memetic model of culture, but it misses the point of human culture as an emergent phenomenon. Human culture shares with all other emergent phenomena the strange fact that in one sense it is based on the level of the individual agent and yet at the same time it transcends that level. Thus the emergent pattern of Bénard cells consists of individual water molecules and their movements, yet it transcends the individual water molecule. It is neither the sum nor the average of their movements. In fact, both the sum and the average of the movements of all the molecules equal zero, since the upward movement of rising molecules is offset by the downward movement of sinking molecules, and horizontal movements are likewise balanced.

Rather, the emergent phenomenon consists of the patterning of movement. Movement belongs only to individual molecules, but the patterning of these movements is as real as the movements themselves, and this patterning arises from the interactions of those same individual molecules. Moreover, that patterning is not just an empirical distribution of movements, but a system that both results from and determines those movements.

By the same token, neural codes exist only in the brains of individuals. Nevertheless, they have a patterning that is just as real as the neural structures themselves, and one that arises from the interactions of the individuals involved. Thus, for both convection cells and individual molecules and for emergent codes and individual neural structures, the two phenomenal levels are as closely linked as the two sides of a coin. There is no inconsistency in seeing both as equally real (pace O'Meara 1997).

### 2.3.2. Complexity Theory and Culture

There is, however, one way in which the emergent patterns of cultural coding differ from those of convection cells, waves of moving slime

mold, and most of the other phenomena studied by complexity theorists. In addition to the dichotomy between the levels of individual agent and emergent phenomenon, culture also involves a dichotomy between coding and behavior. Two kinds of feedback are involved. In classical complex systems, feedback exists between the behavior of one agent and the behavior of other agents. This is true for humans as well, in the behavioral (social) domain. There is also a feedback between coding and behavior. Social interaction produces coding that in turn affects the social behavior that then acts upon the coding. Cultural codes influence individuals' behavior in social interactions. One product of social behavior is the creation and maintenance or alteration of those same cultural codes.

Many applications of complexity theory to human behavior deliberately bypass the emergent level of cultural coding. They consist of models that use very simple, invariant codes to account for complex patterns of behavior. A good example is an intriguing study of the Balinese system of subaks, or rice-farming cooperatives (Lansing 2000). Briefly stated, subaks are rice-farming cooperatives associated with tertiary-level irrigation systems that cover about 50 hectares and include about 100 farmers. A complex pattern of cooperation exists among subaks. Damage from insect pests is reduced as the number of adjacent subaks that plant rice simultaneously is increased. Yet as more adjacent subaks plant simultaneously, they face greater problems with water shortages at early stages in the crop cycle. Many patterns of simultaneous or nonsimultaneous planting are possible, and finding an advantageous one is difficult, yet somehow the Balinese farmers succeed.

Lansing found by computer simulation that if each subak simply imitated the immediately adjacent subak with the best yield, eventually a pattern of cooperation would emerge that closely resembled the pattern on the ground. As this particular pattern developed, yields would increase until all subaks had reached a local optimum. Thus, a very simple rule that does not change as a result of interactions among subaks can account for the complex pattern of simultaneous and nonsimultaneous planting found on the ground. Note that the only feedback in this system (once the rule has been agreed upon in the beginning) is in terms of the behaviors of the various subaks.

Such applications of complexity theory to human or animal behavior consider feedback at the behavioral level, with the coding involved held constant. Research is also being done, particularly in economics, into complex systems in which the behavior of the agents changes in response to the state of the system as a whole (eg., Arthur 1999). To illustrate how such an analysis might work, a change in the characteristics or behavior of one species in an ecological community may lead to evolutionary changes in the behavior of other species that interact with it. Because the

“rules” governing their behavior changes, one must usually conclude that the coding of individual agents is changing. But even analyses such as these bypass the level of emergent coding. It is the individual coding of the agents that is considered to change, not emergent, socially constructed coding. (In the ecological community example, it is the genetic coding of the individual species.)

I am in no way challenging either the validity or the usefulness of such analyses. I cite them only to point out how the existence of emergent coding adds a new level of complexity to the analysis of human social behavior and of human culture, because behavioral interactions among people or groups of people can also change the codes that drive the behavioral interactions.

Any deeper analysis of complexity theory is beyond the scope of this book. Suffice it to say that it is a fundamental finding of complexity theory that feedback produces nonlinearity, change that is not additive but exponential. Nonlinear processes turn out in many cases to be impossible to predict, at least in detail. Since emergent coding involves two kinds of feedback – among individual agents and between behavior and coding – there is a double nonlinearity that merits analysis in terms of the mathematics of nonlinear systems.

## 2.4. CONCLUSION

In summary, then, human culture consists of the following:

1. Codes are created and maintained or modified through social interactions among individuals. These codes, along with genetically determined, individually learned, and socially learned (memetic) codes, govern the behavior of individuals. However, cultural codes are emergent, in that they cannot be understood without understanding the interactions that created them.
2. Among all living humans, socially constructed codes appear to motivate as well as inform the behavior of individuals. This means that individuals may be led to behave in ways detrimental to their own individual evolutionary fitness.
3. Cultural codes, in all present-day societies, have come to form ubiquitous, all-encompassing systems that assign cultural meaning, value, and so forth to almost everything that humans perceive, think, or do.

When I use the term “human culture,” I do so because these three items describe what culture is like for all humans today. It is possible that we share certain aspects of culture with other primates or even nonprimate species. Certainly we share the propensity to learn from con-

specifics and to create local traditions with other species, but this is not what I mean when I use the word “culture.” In chapter 4, I review the currently available primate literature, looking for evidence that we share any of the three aspects of culture just listed. The results are, in my estimation, negative, but either new data or a more sophisticated reading of the existing data may change this. Moreover, it is possible that some, perhaps many, of our hominin ancestors lacked one or more of these three aspects of modern human culture. One thing I do later is to try to pinpoint in time the origins of each of these three phenomena.

Another thing I attempt to do, starting in the next chapter, is to formulate hypotheses to explain each of these three aspects of culture. I then evaluate these hypotheses in view of the available archaeological and fossil data.



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