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The Human Nature

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CHAPTER IX

CULTURE AND NATURE

Animals have two systems with which to process information: our genome and our brain. The genome processes information slowly, but is a highly reliable transmission and storage mechanism. The brain processes information much more quickly, although it is also more prone to failures of transmission. These two systems differ mainly in their *tempo*. When environmental changes are slow and take place over long periods of time, the genome is the most efficient processor. However, when changes take place quickly over a short period of time, the genome can't deal with them directly. In some lineages, genes have solved this problem by "inventing" the brain. Brains register changes instantly, process information quickly and transmit it from one brain to another, thus creating the informational network that is culture. Culture is information transmitted between brains; it is information transmitted through social learning.

BASIC CONCEPTS OF CULTURE AND NATURE

The Latin verb *colere* means to cultivate. Thus, *agrum colere* means to cultivate fields and *vitem colere*, to cultivate vines. The supine form of *colere* is *cultum*, and this is the origin of the Spanish word *cultura*, culture, which in Latin originally meant agriculture. Therefore, *agri culturae* are the different methods for cultivating the land, and *cultura vitium* are those used in the cultivation of vineyards. From this root we get Spanish words like *viticultura* (wine growing), *silvicultura* (tree growing), *fruticultura* (fruit growing), *floricultura* (flower growing) and *piscicultura* (fish farming). The Latin adjective *cultus* describes a field that has been cultivated. Even today, in Spanish, the term *incultos* is used to refer to fields that lie fallow. Originally then, *cultura* (culture) meant agriculture and *culto* (cultured) meant cultivated. A person who cultivates a field takes constant care of the land. This led the noun *cultus* to take on the meaning of careful and to be applied to the actions priests carried out in caring for the gods, or worshiping them (in Spanish, *rendirles culto*). This meaning was passed on to Spanish as religious worship (*culto religioso*). Later came the metaphor comparing an unmannered person to an un-cultivated field, and their education to the cultivation of that field, and we began to speak of *cultura animi*, cultivation of the soul.

The popular usage of the term 'culture' has only been introduced relatively recently, reducing it to describe the pastimes educated people undertake to fill their leisure time: activities like reading novels, visiting art exhibits or attending concerts and plays. This superficial concept of culture (which is still reflected in the culture sections of newspapers as well as Ministries and Departments of Town and Regional Councils) was later eclipsed –at least in scientific circles– by the usage of the term 'culture' that has been employed from the beginning by cultural anthropologists. When anthropologists describe the culture of the people they study, they refer as much to their agricultural techniques, handicrafts, and modes of transport; how they build their houses and manufacture their weapons; as to their social organizations and pastimes. The Roman notion of culture as agriculture and the popular notion of culture as a prestigious pastime, both incorporate some of the components of the current scientific concept of culture which encompasses all the activities, procedures, values and ideas transmitted through social learning, as opposed to those that are genetically inherited.

The anthropological and biological definitions of culture highlight its social, acquired nature, as opposed to that which is congenital, innate, inborn. In fact, the form *natus* of the verb *nasci* (*nacer* in Spanish, to be born) comes from the Latin word *natura*. Nature refers to the characteristics one has from birth or that are determined by birth, that is to say congenital, meaning that which is genetically programmed and acquired during the development of the embryo or fetus. Obviously, social conventions are not inherited genetically nor are they

present in the embryo, therefore they are not part of our nature. For this reason, the Greeks made a distinction between *nómos* (convention) and *phýsis* (nature), inherent characteristics independent of conventions.

By nature we have hair, which is a specific color. By culture, we cut, style or dye our hair. Those who go bald lose their hair naturally. Buddhist monks, punks or skinheads who shave their heads lose their hair culturally. By nature we have the ability to speak (in general) and by culture we are able to speak precisely in French, for example. By nature, congenitally, we know how to carry out the most difficult tasks, like reproducing; we also know how to do those tasks that are most essential to our survival (and how to do them even in our sleep): breathing, regulating blood flow, maintaining a relatively constant body temperature, blood pressure, sugar level and hydrogen ion level. Seemingly trivial natural abilities like recognizing the faces of our friends are beyond even the most powerful computers and most sophisticated software to date. However, we recognize these faces with ease, thanks to specific coprocessors devoted to this task, which are located in the occipital lobe of our brains.

Culture encompasses all the activities, skills and knowledge that we learn. Growing tomatoes, Islamic fundamentalism, stamp collecting, shaving, eating with chopsticks, holding a fork correctly, avoiding the number 13, paying taxes, surfing the Internet, riding a bike, dancing the Charleston, tying our shoes, driving a car, dressing a salad, solving second grade equations, playing the piano and playing pétanque are all cultural activities. All science is culture, of course, but not all culture is science. The same can be said of art, technology, industry, finance and medicine. Culture at times comes to the rescue of nature. When our eyes can no longer focus correctly, culture provides us with glasses to make up for this failure in our nature. When a diabetic loses their ability to naturally regulate blood sugar levels, culture helps them by diagnosing and treating this condition with insulin, to compensate for what they are lacking naturally. When shivering isn't enough to warm us up, we put on a coat.

Although the popular meaning of culture has positive connotations, the scientific meaning is neutral. That which is cultural isn't necessarily good or desirable in any sense. Sometimes they are, but in other cases they are not. By culture we wear hair-shirts, smoke, drink, shoot up, pollute the air we breathe, fill our heads with prejudices, superstitions and pseudo problems; we swindle, torture, wage war, die for our country and kill for our nation or religion. Culture is so powerful that, overcoming our natural instinct for survival, it can turn an indoctrinated person into a suicidal martyr willing to blow themselves up in order to cause a massacre.

SOCIAL LEARNING

Learning is the process through which information that is not inherited is acquired by an animal and stored in its brain, in its long-term memory, in such a way so as to be recoverable at a later date. Learning is a process of individual adaptation of the body's behavior to its environment. The specific things that an individual learns depends on their own individual experience. However the type of things they can learn and the neurosensory mechanisms they use to do so depends on the nature of their species, as expressed by their genome. Each animal species has a hereditary predisposition to learn a specific set of abilities, which determines the things each individual in that species is able to learn. Birds learn how to fly easily but we do not. And we learn how to speak easily but birds do not. Even on an individual human level there are differences in our congenital learning abilities because our individual genomes are not identical. Take musical ability as an example. Some people can effortlessly reproduce any melody they hear and others would be unable to do so even if they spent their whole life studying music.

Learning can be social or individual. Through individual learning one acquires information through trial and error, imprinting (learning certain guidelines during a specific stage of life), classic conditioning, or other methods. Learning by trial and error, in a new situation, an animal explores and tries out various alternative behaviors presented and, in the future, repeats those that in previous trials were rewarded (had pleasurable consequences) and avoids those that were punished (produced pain). This type of learning is normally adaptive (it increases the individual's reproductive success), as animals are generally pre-programmed to get pleasure from things that are advantageous and pain from those that are not.

In social learning, one assimilates information transmitted by others, which is acquired through imitation, communication or teaching. Although learning by trial and error is a good method to deal with new situations, it undoubtedly has its risks, as some of the alternatives to be explored may be lethal. In any case, it requires a significant expenditure of time and energy. Thus it is no surprise that the genome has invented a more economic method to solve the problem: imitating another animal (from the same species, so it has similar requirements) that previously acquired the knowledge through trial and error. This is the root of social learning, the foundation of culture. Moreover, not all individuals are equally inventive. Social learning allows the rest of the group to benefit from the special talent of the inventors.

In the process of social learning through imitation, one learns by observing behavioral guidelines exhibited by another animal of the same species. This is the way culture is normally transmitted by those non-human animals that possess it. Imitation is also the method through which fashions, styles and obsessions are normally spread. Artisanal techniques, domestic skills, and most

trades have also been spread through imitation, at least before the recent creation of professional training schools for some of these activities.

Social learning through teaching is learning through observation, where the appropriate behaviors receive positive reinforcement in the form of rewards and those that are inappropriate receive negative reinforcement in the form of punishment. With mere imitation, the model that is imitated is passive; faithful reproduction of the imitated behavior is neither controlled nor corrected. In teaching, the imitated model is active and rewards or punishes the imitator according to their correct or incorrect imitation. Although active teaching processes have been observed in chimpanzees[1], in humans they have reached their highest level of development, as proven by our numerous public and private teaching institutions. Humans also use telecommunications for social learning. This is the assimilation (through reading, listening, seeing) of information transmitted from a certain spatial or temporal distance from one author or issuer to numerous receptors through conferences, phone calls, radio, television, Internet, newspapers, books, CDs, and other artificial media.

Human culture has become impressively rich and dynamic in our time, but this has not always been the case. For example, Acheulean culture, the main culture of human lineage for seven hundred thousand years (or even more than a million years in some locations), was much more modest and less dynamic. During this extremely long period of time, there were few changes in their typical lithic tools, such as cutting stones and chipping and biface artifacts.

CULTURE IN NON-HUMAN PRIMATES

Culture, defined as information transmitted through social learning, isn't an exclusively human phenomenon; it also occurs in other animal species. As is to be expected, particular attention has been paid to chimpanzee culture. Cultural primatology has established three chimpanzee cultural areas. In Western Africa, these animals have developed a rock culture, studied by Christophe and Hedwige Boesch at the Tai national park (Ivory Coast) since 1979. The most characteristic element of this culture is their use of rocks as tools. They use rocks weighing between one and nine kilos as hammers to crack nuts, placing them on top of larger rocks (up to 20 kilos) that act as an anvil. Females make the most use of these stone tools. Mothers teach their female young to use the rocks in a long, slow learning and teaching process that even includes demonstrations and exercises[2]. The same type of nuts and rocks exist in other parts of Africa, like Equatorial Guinea, but the chimpanzees there do not use the rocks to crack nuts because the corresponding culture hasn't been transmitted.

[1] See Christophe Boesch, "Teaching among wild chimpanzees", *Animal Behavior* 41: 530-532 (1991).
[2] Idem.

In the area of Cameroon and Equatorial Guinea, chimpanzees have developed a stick culture, researched by Jordi Sabater Pi and Yukimaru Sugiyama. Animals in this area make standardized sticks that are straight and hard, measuring approximately one meter in length, which they use to dig up termites. Moreover, these chimpanzees introduced an innovation to their traditional culture by using one tool to make another: they use stones to fray one end of the stick, transforming it into a broom they then use to sweep termites out of the depths of their mounds. In eastern Africa, chimpanzees exhibit a rich culture, as studied by Jane Goodall[3] (in Gombe) and Toshisada Nishida (in Mahale). These chimpanzees stick vines or twigs, suitably stripped of their leaves and smoothed down, into termite mounds in order to "fish" for termites and eat them. They even use the same twigs as olfactory detectors, to see if a termite mound has been abandoned or is currently occupied. They make and use spatulas to extract termites that are hiding behind tree bark. The chimpanzees of Gombe also make a type of artificial sponge out of chewed leaves, which they use to absorb water and humidity from inside the trees in times of drought.

The use of rocks to crack nuts, or sticks as a lever to open a box, or stripped twigs to "fish" for termites, are cultural traits. Chimpanzees are highly cultural animals. They learn to distinguish hundreds of plants and substances, and they know their nutritive and astringent properties. This way, they can feed themselves and counteract the effects of parasites. There is no common "chimpanzee culture" that covers the whole species. Each group has its own traditions of socialization, hunting, food, sex and tools. For example, only the chimpanzees of Tai National Park hunt colobus as a group and they do so with a refined strategy which includes positioning hunters ahead of time in blinds and having the rest of the group drive the prey in their direction. This hunting method is probably similar to that used by our ancestors. The chimpanzees of Gombe also hunt at times, but not as a group.

Culture is so important for chimpanzees that all attempts to reintroduce those raised in captivity back into the wild have failed. These chimpanzees do not survive. They do not have the right culture. They do not know what to eat, how to act, or how to behave with their wild counterparts who attack and kill them. They do not even know how to make their nest-bed in the branches of a tree at night in order to sleep safely. Over the five years a young chimpanzee spends with its mother, it has some two thousand chances to observe how the nest-bed is made[4]. Female chimps that are separated from their group and bottle-fed in a zoo do not know how to take care of their own young, although they can learn this by watching movies or videos of other chimpanzees breast-feeding.

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[3] Jane Goodall, *In the Shadow of Man*, Collins, London, 1971; *The Chimpanzees of Gombe. Patterns of Behavior*, Harvard University Press, 1986; *Through a Window. 30 years with the chimpanzees of Gombe*, Weidenfeld & Nicolson, London, 1990.

[4] Jordi Sabater Pi, *Etología de la vivienda humana. De los nidos de gorilas y chimpancés a la vivienda humana*, Labor, Barcelona, 1985.

However, let it not be thought that humans and chimpanzees are the only primates with culture. Some of the most spectacular and thoroughly documented examples of invention and transmission of cultural guidelines have been found in Japanese macaques (*Macaca fuscata*). For example, the macaques of Jigokudani discovered hot springs. Some of them tried bathing in these pools of hot water and acquired and transmitted a taste for thermal baths, thereby establishing the social custom of collective bathing. Japanese etiologists[5] have spent many years carefully studying the behavior of several generations of macaques on a number of small islands in southeastern Japan.

On the island of Koshima, there was a group of macaques that included a female called *Imo*, who at the time was two years old. Researchers threw yams on the beach, where they were quickly covered in sand, making them practically inedible. Shrewd *Imo* came up with the idea of taking the yams to a fresh-water stream washing them off and then eating them. Little by little, the other macaques started to imitate her and learned to wash the yams before eating them. *Imo*, the gourmet, then tried washing them off in salt water and found they were tastier that way. Her fellow macaques also slowly followed her lead in this. Two years later, the etiologists started throwing wheat onto the beach. Some macaques tried to pick it up kernel by kernel, but the process was too slow and laborious. Again, *Imo* (who by then was four years old) had a great idea: pick up handfuls of sand mixed with wheat, take the mixture to the sea and drop it in. The sand would sink and the wheat would float, making it easy to collect the kernels and eat them. *Imo*'s innovation was again imitated by the others soon after.

All of these are pure examples of culture, invention and transmission, not through genetic but through mimetic means (by imitation), of information that is not innate, of memes. The diffusion scheme was always the same: a young individual (the female *Imo* in the aforementioned cases), with a playful nature and prone to exploration, made a clearly valuable discovery or invention, given the circumstances. First, some of the young macaques imitated her and little by little the practice extended to all the members of her generation. The young macaques passed the behaviors on to their mothers, with whom they had frequent contact, and the mothers taught them to their babies. Finally, the whole population adopted the new discovery, except for the adult males, who were reticent to change and had little contact with the younger population.

CULTURAL EVOLUTION

Despite the contributions of Mary Williams, David Hull and Elliot Sober, we are still lacking a satisfactory axiomatization of Darwin's theory of evolution.

[5] Toshisada Nishida, "Local Traditions and Cultural Transmission", in B. Smuts et al (ed.) *Primate Societies*, The University of Chicago Press, 1986.

However, there have been no lack of attempts to generalize the notion of evolution, although with little formal precision. The abstract principles of the theory of evolution through natural selection have been applied with different outcomes in a variety of other fields, such as immunology, prebiotic evolution of macromolecules, cultural evolution, epistemology and even business theory. Donald Campbell (1916-1996), Popper and David Hull have proposed considering the development of scientific knowledge as a specific implementation of the abstract notion of evolution. At the same time, geneticists like Martin Feldman, Cavalli-Sforza, Robert Boyd and Peter Richerson have applied the mathematical formulism of population genetics to cultural change, creating a statistical theory of cultural evolution in which memes or cultural traits play a parallel role to that of genes.

The word "meme", which recalls memory, was coined in 1976 by Richard Dawkins[6] through analogy with *genes*, the unit of genetic information. *Memes* are the basic units or pieces of cultural information, cultural traits; the conventional units we use to analyze the cultural content of a given context. The notion of memes has been adopted and developed by a number of biologists, psychologists, philosophers and cultural anthropologists including John Bonner, Susan Blackstone, Dennet and William Durham. Just as biological evolution is fundamentally the evolution of genes, cultural evolution is the evolution of memes.

Genetic information is only transmitted vertically (from parents to offspring), while cultural information is also transmitted in other ways: horizontally (between siblings or friends) or obliquely (to members of the next generation who are not direct offspring). The unit of genetic information is the gene; the unit of cultural information is the meme. The culture of individual *x* at time *t* is the set of memes stored in the brain of *x* at time *t*. Memes are transmitted or passed from one brain to another and make up a network. This cultural network is a phenotypic effect of the organisms that weave it, just as a spider web is a phenotypic effect of an individual spider and a coral reef is a collective phenotypic effect of a group of polyps.

A speaker's linguistic competence is the tacit or interiorized knowledge of their language's underlying system of rules, and in particular those of their idiolect. *Performance* consists of utterances (or inscriptions) that are effectively produced or uttered by the speaker. This terminology, which is common in generative linguistics, is parallel to the distinction between *langue* and *parole* previously made by Ferdinand de Saussure. The difference between competence and performance is equivalent to that between culture and cultural product, that is between culture as information (in this case, the linguistic system with its grammar and lexicon) and the phenotypic effects of culture (in this case, the

[6] On page 206 of his book *The Selfish Gene*, Oxford University Press, 1976.

specific utterances). It is also parallel to the biological distinction between the genotype as information and its phenotypic effects on the body and on behavior.

Just as physical dynamics uses forces like gravity and electromagnetism to explain the changes in position of moving objects, and biological dynamics (the theory of evolution) uses forces like mutations or natural selection to explain changes in a species over time, cultural dynamics uses forces [7] like communication, isolation, free choice, acculturation and coercion to attempt to explain changes in a culture over time.

The evolution of biological species is often compared to that of group cultures or cultural groups. It is true that there is a great similarity between allopatric speciation and cultural fragmentation. Allopatric speciation, due to geographic isolation, leads to reproductive isolation and the evolution of genetic divergences (new mutations in one sub-population are no longer spread in the other and these divergences accumulate until two different species are created). Cultural fragmentation, also through social or geographic isolation, leads to isolation of communications and a differentiated cultural evolution (new ideas in one sub-group are no longer spread in the other and these divergences accumulate until two different cultural groups are created). Thus, the isolation of populations of the same species can lead to the creation of new species, while, for example, the isolation of speakers of the same language can lead to the creation of new languages, as occurred with the fragmentation of Latin into Romance languages after the fall of the Roman empire.

Despite the parallels between biological and cultural evolution, we mustn't forget that there are also differences. Dawkins proposed memes as the cultural equivalent of genes. To what extent are they comparable? Here are some important differences. While we know the underlying mechanisms of genetic information (the double-helix structure of DNA and genetic code), we know nothing of the brain mechanism that underlies memes. Gene replication is direct and does not involve phenotypic effects. Each gene, as a DNA sequence, produces two identical genes through duplication. Memes, on the other hand, can only be replicated through their phenotypic effects (linguistic utterances, written texts, gestures, observed behavior, etc.), which eventually may lead to the emergence of a similar meme in the listener, observer or receptor. In the biological world, changes that are merely phenotypic aren't transmitted genetically and are generally lost. However, cultural contents (that from a biological standpoint are part of the extended phenotype) are transmitted, although this happens through social learning and not genetically. Genetic changes are random, they occur by chance in the absence of any purpose. However, cultural changes are often (but not always) the result of intentional design on the part of the individual that invents or introduces them. Gene and

[7] Here we use the word force in the generic sense of an explicatory factor. All physical forces are forces, in this sense, but the opposite is not true.

meme carriers can change their memes but not their genes. A species only becomes extinct when all its members are deceased. However, a group culture, just like a fashion, can disappear without its members dying.

Biological species are like tubes in space-time in which genes travel. The tubes are completely sealed and impermeable (except for the marginal phenomena of hybridization). On the other hand, the cultures of social groups are not isolated; they are permeable. The phenomenon of cultural convergence, through which different social groups share more and more memes, has no parallel in biological evolution. Different cultural groups can share memes, but different species can't exchange genes (if they could, they wouldn't be different species). The universal cultural convergence currently underway, also known as "globalization", has absolutely no counterpart in biological evolution.

In any case, cultural evolution, like biological evolution, is a historical phenomenon that depends on thousands of unpredictable contingencies. We can't predict it with any degree of precision or certainty.

LANGUAGE AND CULTURE

Cultural information is generated in the brain through a more or less random or intentioned invention or discovery and transmitted from one brain to another through social learning. Whether a certain behavioral trait of an organism is natural or cultural doesn't depend on the type of trait in question but on the way it is transmitted. The presence of a communication system (and even of different dialects of the same system) in an animal species neither implies nor excludes culture.

Some communication systems are innate and others are cultural. In some bird species, offspring acquire the ability to sing by learning from and imitating their parents, while in others the same result is obtained through genetic inheritance. So birdsong can be cultural or natural, depending on the species in question. An extreme case is that of the cuckoo (*Cuculus canorus*). It is well known that the cuckoo is very crafty and, instead of caring for its own young, merely lays its eggs in the nest of another bird from a different species, which then takes on the task of raising the young. Given that it is raised by an individual from another species, the cuckoo chick could never learn its characteristic birdcall just by listening to its adoptive parents. The cuckoo's birdcall is innate; it is pre-programmed in its genes. Cuckoos that are bred in strict isolation, deafened or exposed to the song of many other types of birds will, nevertheless, spontaneously sing in the same manner as all other individuals of their species. The bullfinch (*Pyrrhula pyrrhula*) is a good example of the other extreme, as its song is transmitted entirely through learning. When researchers raised a bullfinch in a cage with a canary, they found that, come spring and the time to

reproduce, the bullfinch sang just like a canary. In spite of this, the bullfinch was able to mate and when its own young reached maturity, they too sang the canary birdsong they had learned from their father (although they were also exposed to the song of their own species). It was even observed that one of these offspring transmitted the meme of the canary birdsong to its own young, the cultural tradition surviving over at least three generations[8].

Although we humans have some purely natural communication systems and others that are purely cultural, the most important of all, language, combines both aspects. Linguistic skills or the faculty of language is part of human nature; it is programmed in our genome and incorporated into the structure of our brains. The specific language that we speak, with its phonological, lexical and grammatical particularities, is a cultural code transmitted culturally through a process of social learning dependent on imprinting. This imprinting consists of grasping certain keys or parameters in the statements produced in one's surroundings at a critical age (between one and three years old), which allows the infant's brain to reconstruct the entire phonology, morphology and syntax of the language in question. The language, in its reconstructed form in the adult brain, with its particular lexicon and phonological and grammatical idiosyncrasies, constitutes that individual's idiolect. Linguistic reality stems from idiolects, which exist in the brains of its speakers. More abstract linguistic varieties, like languages and dialects, are merely a statistical result of these idiolects.

Human nature allows us to learn and use not only one language, our first language or mother tongue, but also a second or even many others, which we can acquire later. The main difference is in the learning process, easy and spontaneous in the first case, slower and more laborious in the second. These second languages are inscribed in a different part of the brain from the first, so certain brain hemorrhages or accidents can cause a person to lose one but not the other. In fact, multilingualism has been fairly common throughout history and continues to be in our time.

Not all culture is linguistic. A large part of culture is independent of language and transmitted through imitation and not words. We have already referred to the cultures of various primates without language abilities, like chimpanzees and macaques and also we have mentioned the transmission of trades and the spreading of fashions among humans.

[8] J. Nicolai, "Familientradition in der Gesangentwicklung des Gimpels (*Pyrrhula pyrrhula L.*)" *Journal of Ornithology* 100: 950-956 (1959).

PONDERABLE AND IMPONDERABLE CULTURAL TRAITS

It is impossible to move forward with this analysis of cultural issues without making the crucial distinction between ponderable and imponderable cultural traits. Many cultural traits (the imponderable ones) merely reflect social conventions of the group and the individual's acquired taste, so they can't be compared with external realities and there is no way to measure or compare them in any objective way. Different ethnic and social groups have different ways of greeting each other, with sounds and words, smiles and facial expressions, by patting, rubbing, kissing and hugging, curtsying, kneeling and bowing, as well as head, arm, hand and chest movements, not to mention hand and even hat gestures. It can be said that social convention transforms these gestures, these body movements, into greetings. All greetings are equally good and none of them can be compared with extra-cultural reality (and none of them have meaning beyond their cultural sphere). The same can be said for different types of parties, songs, worship, courtship, family structure, communal authority and etiquette. Some eat with their hands; others, "westerners", eat with a knife and fork, while the Chinese, Japanese and Koreans eat with chopsticks. I use all three methods and can't see any objective advantage in any of them, comfortably adopting the customs of those around me at all times. All of these traits are imponderable.

Other cultural traits, however, are mere tools to carry out a well-defined function and how well or badly they meet this goal can be measured objectively, independently of group conventions. These are ponderable traits. For example, a knife is for cutting and that cut has a direct effect on external reality. A steel knife cuts much better than one made of stone or wood. This is something humans from all cultures detect immediately. Therefore, when an indigenous group with stone or wood knives comes in contact with steel knives brought by missionaries, traders or journalists, these indigenous groups immediately and voluntarily abandon their traditional tools and adopt the steel knife. This has happened in tribes around the world, even the most remote and primitive, and there are no known exceptions. The most basic test shows that the steel knife cuts everything a stone or wood knife can, and does so faster and with less effort and, in addition, the steel knife cuts many things that stone and wood knives can't. This has nothing to do with conventions or traditions, but is solely based on the physical structure of reality. Universal human cognitive skills (determined by 99.9% of our shared genetic makeup) are more than enough to make this fact clear.

Until the 19th century, medicine was a group of imponderable traditions that differed from one place to another and only shared a common inefficacy. European physicians were no better than African witch doctors. Their favorite therapy consisted in cutting and bleeding patients, which, far from helping them, actually made them worse. In Europe and China doctors no longer spoke

of demons and the evil eye, but they did believe in equally phantasmagoric things like the Hippocratic humors and acupunctural meridians. These humors and meridians were the focus of numerous texts and treatises, however they only existed in these documents and in the minds of doctors, not in reality. Their existence was conventional, not real. Therefore, outside of their respective spheres of cultural influence, nobody accepted them. However, since the 16th century, we have been heading towards a view of scientific anatomy, which speaks of things that really exist, such as bones, arteries and nerves. Anatomy is a ponderable cultural trait. Human cognitive skills can be used to find and describe bones, but not to detect meridians. Because it is objectively superior, acceptance of an anatomy based on bones has thus spread peacefully throughout the world, while the same can't be said of theories of humors and meridians. As we mentioned previously, the fact that meridians do not exist doesn't mean that acupuncture may not be useful as a form of anesthesia or therapy in some cases; it only implies that the traditional explanation of its possible success is unsatisfactory. The relevant difference between the anatomy of bones and arteries and that of meridians isn't found in any texts or discourses. It stems from reality and can be seen when we open our eyes, dissect cadavers, and use ever more efficient methods of observation (x-rays, sonograms, CAT or PET scans, etc.). Bones, tendons, arteries and nerves can be seen, touched, detected. An anatomical theory that recognizes them can be exported, globalized, and accepted by all, independent of their local traditions. On the contrary, anatomical theory based on humors, meridians or chakras is only accepted by those who have been indoctrinated in a specific cultural tradition.

SCIENCE

In the past, different human societies were isolated from one another by distance and geographic barriers that were difficult to cross. This gave rise to distinct cultural groups, among which there was little exchange of memes (or cultural traits). Nowadays, progress in the fields of communication and transport has made the planet a global village where news spreads in real time. For this reason, all local cultures are blending into a universal culture, at least in terms of the more ponderable dimensions of culture like science, technology, transport, industry and medicine. Current science is no longer Western or Christian, but universal. Scientific communities are global. This universal science plays a growing role not only as the foundation of technology, but also as the source of our worldview: our ideas about the world we live in, who we are, where we come from and where we are heading. In this sense, science is clearly replacing traditional religions, despite the survival of irritated and occasionally virulent traditionalist groups.

To the extent that traditional ideological worldviews wane, we each have to wake up and learn to think on our own, creating our own map of the world to follow. Science provides us with the fiber with which to weave this basket. What we need is for these fibers to be culturally available so that each person can incorporate them into their own beliefs, if they so choose. Traditional cultures transmitted curious legends, like children being delivered by a stork; they were children's stories. For many adults, this is not enough. We do not want to sleepwalk through life, acting like children. We aspire to the truth and want to live with our eyes wide open.

For the vast majority of human ethnic groups, science did not exist, although all have had some type of knowledge (just as before the Internet there were other forms of communication and before planes, other modes of transport). There are partial occurrences of scientific activity in ancient Mesopotamia, China, India, among the Mayans and, of course, in Greece and the Hellenic world. However it is really in 17th-century Europe, at the time of Galileo, that scientific enterprise in its widest sense began its irreversible march. In the 17th century, science only existed in a few parts of Europe and scientific rationality was peculiar to only a few Europeans. At that time one could have said that scientific rationality was particularly European. However that moment didn't last long. Scientific rationality wasn't just any cultural trait; it was (to use epidemiological terms, which are quite suited to describing the phenomena through which culture spreads) extraordinarily virulent and contagious. Over the following three centuries, it not only decimated the traditions of Christian Europe but also spread to all continents and devastated local worldviews everywhere.

Current scientific thought is universal. The same science is taught and practiced in universities and research centers throughout the world. This is an unprecedented cultural fact in the history of prior human culture. The universality of scientific rationality is the opposite of the parochialism of traditional or ethnic cultures. In particular, we mustn't confuse western Christian tradition, as tribal and closed as any other, with current science, which is neither Christian nor western. We sometimes contrast eastern and western cultures, and we understand the East to encompass, above all, India, China, Korea and Japan. However it is precisely in these countries where some of the most important contributions to global scientific and technological progress are being made. Nowadays, scientific rationality doesn't vary according to ethnic, geographical or cultural areas, with the exception of some pockets of religious fanaticism and others of extreme poverty and isolation.

Science is part of culture, of course, but each part of culture has its own peculiarities. Robert Merton (1910-2003), the founder of the sociology of science, observed that science, as a sector of culture, is a sector that is different from the rest as it has particular characteristics that are hardly ever seen in the others, like the search for internal consistency, truth and empirical proof; the

precedence of experimental data over any type of authority; and a reward system that promotes these values.

Many social activities can be conceptualized as games. Politics, for example, is an interpersonal game, which doesn't involve nature. It makes no sense to ask nature who should lead our group or how much we should pay in taxes. These things can only be decided in a conventional or political way. However, in the game of science, nature, reality, is invited to play and even given the final word. Although in the 1920s the consensus of cosmologists favored a static Universe, Hubble analysis of the light spectrum that reaches us from far-off galaxies made them change their minds and accept an expanding universe. Equally, although in the 1990s scientists thought this expansion was slowing down, measurements of type Ia supernovas by Saul Perlmutter and Brian Schmidt have again disrupted the established consensus and forced others to admit that this expansion is actually accelerating. This makes science an exceptional cultural game.

By not distinguishing between ponderable and imponderable cultural traits, between things that can be measured and compared objectively and others that only exist subjectively or through social conventions, denying the peculiarity of the game of science in general culture, we would condemn ourselves to not knowing anything. It's no surprise that most scientists do not recognize themselves in the analyses of their activities done by certain postmodern ideologues, that appear to them to be comparable to a group of deaf people trying to understand the movements of an orchestra based on the power relationships between the musicians, without any reference to the music they are playing.