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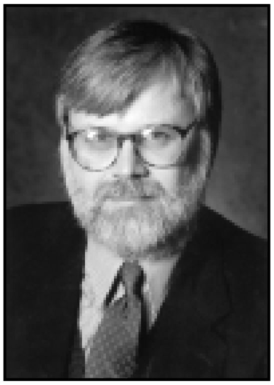
A Brief History of Human Society: The Origin and Role of Emotion in Social Life



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Human society emerged over 6 million years of hominid evolution. During this time group size steadily increased, and to maintain group cohesion human beings gradually evolved a well-developed social intelligence based on the differentiation and refinement of emotions. The neurological structures for emotional expression are part of the primitive brain and developed long before the cognitive equipment for rational intelligence evolved. Indeed, full rationality came rather late in human evolution, and it has only been within the last 100 years that the social conditions emerged for a mass culture based on rationality. A review of the evolution of human society and human cognition illustrates the creation and workings of the human emotional brain and show how it operates independently of and strongly influences the rational brain. If sociology is to advance, research and theory must grapple with both rational and emotional intelligence and focus particularly on the interplay between them.

"*As you know, sir, in the heat of action men are likely to forget where their best interests lie and let their emotions carry them away.*"

Sydney Greenstreet in "The Maltese Falcon"
Written and directed by John Huston

Early in the twenty-first century, two momentous events will occur. Somewhere around 2007 humanity will cross a demographic Rubicon: For the first time, more than half of all human beings will live in cities. From that point on, the bulk of population growth will occur in urban areas, guaranteeing that humanity's future will unfold there. Shortly thereafter, surely during the second decade of the century, the last hunter-gathers will cease to exist, ending 6 million years of dedication to what Diamond (1992:191) called "the most successful and long-persistent lifestyle in the career of our species." Sociology *should* be well-poised to understand the nature and meaning of these incredible transitions; but I believe it is not, owing to three interrelated conceits.

The first is our elevation of the social over the biological. Somehow we have allowed the fact that we are social beings to obscure the biological foundations upon which our behavior ultimately rests. Most sociologists are woefully ignorant of even the most elementary precepts of biological science. If we think about biology at all, it is usually in terms of discredited eugenic arguments and crude evolutionary theorizing long since discarded in the natural sciences.

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The second conceit is our focus on the "modern" rather than the "traditional." Sociology came of age in the late nineteenth century as an attempt to comprehend new social forms arising out of urban industrialism, leaving the study of so-called "primitive societies" to our colleagues in anthropology. But a science of human society is a *science of human society*, and as such it should span all communities, from small bands of hunter-gatherers to large urban agglomerations. I can think of no more obvious relic of nineteenth-century colonialist thinking than the continuing division between anthropology and sociology.

Finally, sociologists have unwisely elevated the rational over the emotional in attempting to understand and explain human behavior. It's not that human beings are not rational—we are. The point is that we are not *only* rational. What makes us human is the *addition* of a rational mind to a preexisting emotional base. Sociology's focus should be on the *interplay* between rationality and emotionality, not on theorizing the former while ignoring the latter or posing one as the opposite of the other. Attempting to understand human behavior as the outcome of rational cognition alone is not only incorrect—it leads to fundamental misunderstandings of the human condition.

In this address I seek to explicate and amplify these three critiques by undertaking a brief review of human society from its origins to the present. I date the origins of humanity from the point at which we began to walk upright, which freed our hands for the manufacture of tools and our brains for abstract thought. In tracing our origins from the remote past to the present, I seek to illuminate what sort of beings we really are, and to project how we might be expected to function in the dense, urban environments of the future.

THE PATH TO THE PRESENT

We are the survivors of a host of bipedal primates, known as hominids, who once walked the earth. The path of descent from the first biped to ourselves resembles not so much a tree as a shrub, with many branches drifting off to extinction and others extending toward the present. Considering this shrub from its origins to the present and paying attention to the fundamentals of population, community, technology, subsistence, and culture, I identify seven basic eras of societal development.

PREHABILINE SOCIETY

Recent archaeological finds have pushed the origins of the hominid line back to 6 million years ago, when *Ardepithecus ramidus* and later *Australopithecus africanus* descended from the trees to spend their days walking upright on the ground, which enabled them to exploit an emerging ecology of mixed forest and grassland (Wrangham 2001). Our earliest ancestors were small, averaging 1.5 meters in height and maybe 70 kilograms in weight, but they exhibited a pronounced sexual dimorphism that left males 60 percent larger than females. Among primates, such dimorphism is associated with a pattern of female out-marriage into a group composed of a dominant male plus subordinates, consorting females, offspring, parents, and siblings (Goodall 1986, 1990). As such, daily life was probably similar to that of modern-day chimpanzees, which is organized around foraging, scavenging, and the occasional hunting of small prey (de Waal 1998; Dunbar 1988; Goodall 1986, 1999).

There is no evidence that the early Australopithecines manufactured permanent tools—hence their society is labeled *prehabiline*. Like modern chimps, they probably modified perishable materials to use as tools (such as sticks to fish termites or leaves to soak up water), and they may have wielded unworked stones for a variety of purposes. The teeth of the Australopithecines were large, their jaws were adapted for crushing, and their guts were capacious, suggesting a diet centered on vegetable matter. Some have argued that the Australopithecines descended from the trees precisely to exploit new, ground-based food sources (protein-rich roots and tubers) that were becoming available on the expanding savannahs (Wrangham 2001).

Groups of early hominids, like modern chimps, were probably loosely structured socially (Maryanski and Turner 1992; Turner 2000). Chimpanzee communities are held together by emotional bonds between indi-

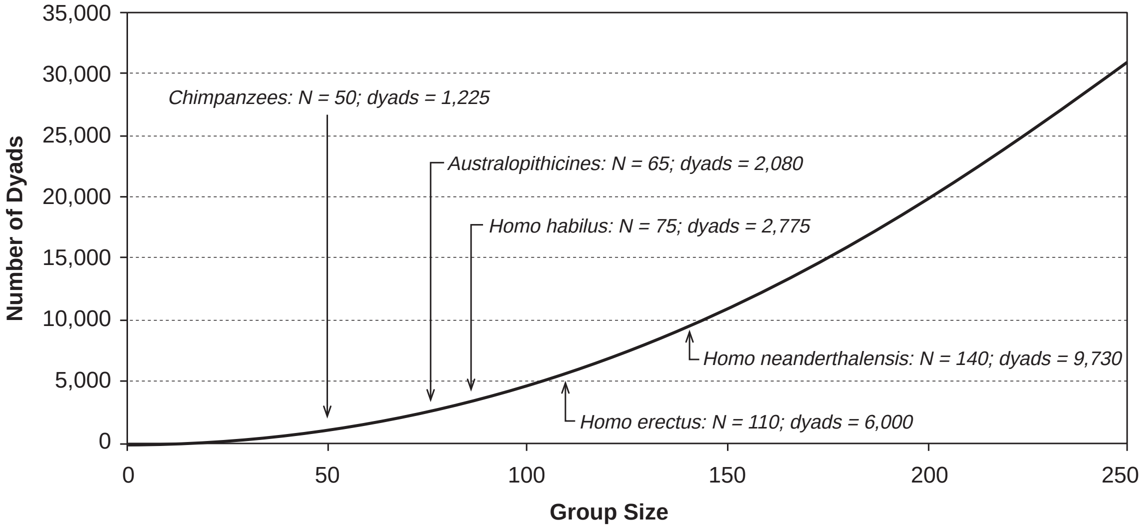

Figure 1. Number of Dyadic Relationships Graphed by Group Size

Note: The number of dyads is a function of group size. It is determined by the formula $(N^2 - N)/2$.

viduals differentiated by sex, age, and rank in a dominance hierarchy. Within groups rather strong ties exist between mothers and children, and these ties may persist even after the children are grown, especially for male offspring. Weaker ties exist between adult males, and ties between other community members are generally weak or absent. Females transfer out to join other groups at puberty, preventing the formation of strong structures based on intergenerational matrilines of related females and male dominance hierarchies. Among apes—and among our last common ancestors—social structure is fluid, "leaving individuals at the micro level to seek out their own supportive 'friendships' that reflect personal likes and dislikes," which creates an overall sense of community at the macro level (Turner 2000:9).

Emotional bonds of kinship and friendship are maintained by mutual grooming, while rank is established by threat displays occasionally backed up by force. Social relations are complex, requiring each individual to recognize and form alliances with others. Chimps must cultivate webs of influence and mutual obligation, form coalitions to defeat common adversaries, remember the personal attributes and past behaviors of others, and know of relationships between others (Byrne 1995, 2001; de Waal 1998, 2001; Goodall 1999). Studies and field observations show that chimpanzees are self-aware and able to infer the intentions of others and fully capable of social deception and manipulation (de Waal 1998, 2001; Gallup 1970, 1982; Goodall 1986, 1999; Yerkes [1943] 1988). It is quite likely that Australopithecines possessed similar capacities (Maryanski 1987, 1992,1993).

Compared with modern-day chimps, however, early hominids lived in larger groups. Whereas Chimps normally exist in groups of about 50, calculations by Dunbar (1996) suggest that Australopithecines lived in bands of 60 to 70 individuals. Like chimpanzees, therefore, the earliest hominid species must have possessed a well developed social intelligence. The number of possible dyads among any N individuals is given by the formula $(N^2 - N)/2$, which is graphed as a function of group size in Figure 1. Whereas chimps (at N = 50) must keep track of 1,225 dyadic relationships, Australopithicines (at N = 65) had to manage 2,080, which requires greater cognitive ability (Dunbar 2001). As a result, the average cranial capacity of Australopithecines, about 450 cc, was larger than that of chimps, which averages about 400 cc (Napier and Napier 1985).

The increase in cranial capacity reflects an expansion of the neocortex, the outermost layer of the brain, yielding a higher degree of encephalization (Jerison 1973; Passingham and Ettlinger 1974). Despite their keen social intelligence, however, there is no evidence Australopithecines possessed much in the way of what we would call rationality. The frontal, temporal, and parietal lobes of the brain—the loci of abstract reasoning and language—remained relatively undeveloped, and there is little evidence of any asymmetry between the right and left hemispheres, a definitive characteristic of hominids who manufacture tools. Expansion of the neocortex occurred mainly in those portions that dealt with sensory processing and probably involved a "rewiring" to enable greater cortical control of emotional expression (Turner 1997, 2000).

Like modern chimps, the early Australopithecines could probably solve simple practical problems and learn through observation and imitation, but communication was restricted to simple vocalizations and gestures. Although modern chimps can be taught 150 to 200 symbols in the laboratory and can learn to string them together in sets of two or three (Snowdon 2001), they display no awareness of word order (syntax), and over millions of years they have never used symbols on their own (Lenneberg 1980). Chimps do not even engage in spontaneous pointing, a behavior displayed by the youngest human children (Bruner 1986).

Prehabiline cognition is associated with what Donald (1991) calls episodic culture, in which perceptions and behaviors flow largely in the present moment. Individuals have memories of concrete past episodes, they can recall prior experiences, and they can perceive ongoing social situations; but they lack semantic memory and abstract reasoning. Prehabiline society and its episodic culture dominated human life for 3.5 million years. During all this time—some 175,000 generations—no stone tools were produced. Hominid life was confined to Africa and yielded a population that numbered only in the thousands or tens of thousands of beings dispersed into small roaming groups (Coale 1974). The essential features of prehabiline society are summarized in Table 1 and are compared with succeeding societies.

Oldawan Society

The first revolution in human history occurred with the appearance of stone tools about 2.5 million years ago and was associated with the appearance of a new genus of hominids. *Homo habilis* made crude stone artifacts that most of us would not even recognize as tools. Named for the East African gorge where they were first discovered, Oldawan tools are pieces of rock that have been sharpened on one side by flaking to create crude choppers and scrapers. These simple tools are associated with the first evidence of patterned human living in the form of centralized butchering sites and indicate a growing reliance on hunting over gathering.

Although the height of *Homo habilis* did not differ dramatically from *Australopithecus africanus*, body weight was larger as their skeletons were more robust, and cranial capacity averaged about 550 cc (Stringer 1992)—a 20 percent increase associated with an expansion of group size to 70 or 80 individuals (Dunbar 2001). The increase in group size was accompanied by a greater cognitive capacity to monitor the increased number of interpersonal dyads (2,775 at N = 75); it also necessitated a concomitant increase in the amount of time spent grooming. Primates cultivate and maintain dyadic bonds through mutual grooming, which causes the release of natural opiates in the brain, which in turn promote feelings of well-being and attraction and lead to social cohesion (Keverne, Martensz, and Tuite 1989). For maximum group cohesion to be achieved, every group member must groom or be groomed by everyone else.

As a result, group size is naturally limited by the amount of time individuals can afford to spend grooming each other rather than engaging in other essential behaviors such as sleeping, feeding, courting, and mating (Dunbar 2001). Across primates 20 percent seems to represent an upper threshold for time spent grooming. The group size characteristic of *Homo habilis* for the first time pushed grooming time above this threshold, suggesting that other social mechanisms must have come into play to maintain relationships (Aielo and Dunbar 1993). Turner (2000) suggests these mechanisms involved a more complex communication of emotion.

Beyond increased group size, the existence of stone tools, and a larger brain, little else changed cognitively, culturally, or socially for hominids during the Oldawan period, which lasted around 1 million years, or 50,000 generations. The total human popu-

Table 1. Eras in the Evolution of Human Society

	Kind of Society						
Variable/Characteristic	Pre-Habiline	Oldawan	Paleolithic	Neolithic	Agrarian	Industrial	Post-Industrial
Beginning date	6 million B.P.	2.5 million B.P.	1.5 million B.P.	50,000 B.P.	10,000 B.P.	200 B.P.	20 B.P.
Duration (in years)	3.5 million	1 million	1.5 million	40,000	10,000	180	20+
Generations	175,000	50,000	75,000	2,000	500	9	1+
Inhabitants	*A. africanus*	*H. habilis*	*H. erectus*	*H. sapiens*	*H. sapiens*	*H. sapiens*	*H. sapiens*
Cranial capacity	450 cc	550 cc	1,100–1,400cc	1,450 cc	1,450 cc	1,450 cc	1,450 cc
Sustenance	Foraging	Hunter-gatherer	Hunter-gatherer	Hunter-gatherer	Farming	Manufacturing	Knowledge
Tools	Perishable	Crude stone	Refined stone	Flint and bronze	Bronze and iron	Steel alloys	Silicon, plastic
Kind of culture	Episodic	Episodic	Mimetic	Mythic	Mythic	Theoretic	Theoretic
Settlement type	Mobile camp	Butchering site	Base camp	Camp/village	City	Metropolis	Megalopolis
Community size	65	75	145	155	1 million	20 million	30 million
Human population	<50,000	<100,000	<1,000,000	6 million	970 billion	6 billion	9 billion

lation at the time still numbered only in the tens of thousands, all lived in Africa, and there is no evidence of any use of language or symbolic culture (see Table 1). Hominid culture remained episodic, albeit with an increase in social complexity and a concomitant expansion of cranial capacity to handle greater demands for social intelligence.

Paleolithic Society

About 1.5 million years ago the appearance of another species and a new technology signaled the emergence of a new kind of society. The species was *Homo erectus* and the technology was the Acheulean tool culture (named for French village, Saint Acheul, where the tools were first found). The progression from habilis to erectus marked an abrupt and very important shift in human evolution (Donald 1991). Although the upper heights of the two species differed relatively little, the size of *Homo erectus* became considerably more uniform (1.3 to 1.5 meters)—sexual dimorphism was reduced dramatically from a 60-percent male/female differential to one on the order of 15 percent, about the average for modern humans. Anatomically, full shoulder rotation disappeared (which is why modern humans cannot brachiate well), indicating a final break from arboreal life. Both teeth and guts grew smaller, suggesting the increased nutritional importance of meat. And with the emergence of *Homo erectus* we find evidence of the controlled use of fire (Brain 1983) and the creation of seasonal base camps (Donald 1991), suggesting the emergence of a nomadic life.

The sharp decrease in sexual dimorphism stemmed not from a reduction in the size of males, but from an increase in the size of females, thus raising the *average* height of hominids. The increase in the size of females was necessary to accommodate the birth of these new creatures with large heads and fat brains, as the progression from *Homo habilis* to *Homo erectus* was accompanied by a doubling of cranial capacity—from about 550 cc to 1,000 cc to 1,100 cc. The dome of the cranium rose, and the face flattened to accommodate expansion of the frontal, temporal, and parietal lobes of the brain. *Homo erectus* also provides the first evidence of brain laterality—a differentiation in size between right and left brain hemispheres—which is associated with handedness and communicative abilities (Donald 1991). Rather than the crude stone choppers of the Oldawan culture, the Acheulean tool kit evinced considerable manual dexterity (which goes along with handedness). Tools now consist of symmetrically shaped, carefully worked hand axes, cleavers, and knives with sharper and more effective cutting surfaces.

The decline in sexual dimorphism and the need to care for large-brained children who were helpless in infancy, vulnerable in childhood, and dependent through adolescence produced a radical change in human social structure and mating patterns (Ellison 2001). It was probably during this era that the human practice of pair bonding appeared, accompanied by a decline in intermale conflict, the disappearance of rigid dominance hierarchies, and a growing investment by fathers of their time and resources for the benefit of their mates and children (Lovejoy 1980). Male commitment to pair bonding was reinforced (though not guaranteed) by an entirely new reproductive biology, in which females were continuously sexually receptive, breasts were enlarged and displayed, and the timing of estrous was hidden. The distinctively human and unprimatelike practice of copulating in private probably also emerged at this time.

Homo erectus's increased brain size enabled another expansion in group size, to 90 to 120 individuals, yielding somewhere in the neighborhood of 6,000 dyadic relationships (N = 110). Despite greater encephalization, however, evidence suggests that the intelligence of *Homo erectus* was still prelinguistic. It was, however, different from the episodic intelligence that preceded it. The basic cognitive function for *Homo erectus* was *mimesis*—imitation or mimicry—in which vocalizations, facial expressions, eye movements, body postures, and manual signs were used to communicate and to transmit skills from person to person.

The emergence of gestural communication reflected a significant increase in the range and complexity of emotional expression, as the cognitive bases for primary emotions such as fear, anger, disgust, happiness, and sadness were rewired and interconnected via the cortex to produce new sets of emotions conducive to social cohesion and solidarity, such as shame, guilt, anticipation, and hope (Turner 2000).

Learned physical skills among *Homo erectus* were an essential adaptive resource and were passed from generation to generation by demonstration and imitation (Donald 1991). Although mimetic culture remained concrete, visual, and episode-bound, it nevertheless brought about an increase in the sharing and accumulation of knowledge, yielding a more stable social structure based on ritual and custom, which served to heighten the emotional content of social relationships and promote bonding (Turner 2000). It was probably during this phase of human social evolution that facial expressions attained their current importance as a means of signaling emotion. Patterns of nonverbal facial expression recur across cultures and are interpreted similarly by humans in all societies, suggesting a "hard wired" ability to read emotions that are displayed on the human face (Eibl-Eibesfeldt 1989; Ekman and Rosenberg 1997; Goleman 1995). The resulting mimetic culture provided humans with a powerful adaptive tool that enabled them to leave their ancestral homeland for the first time and survive in a wider variety of habitats. Around 1 million years ago, *Homo erectus* moved out of Africa and occupied the southern portions of Asia and Europe, a move which brought about the first significant growth of the human population (Coale 1974).

Late in the paleolithic period, around 300,000 years ago, several new species of hominid arrived on the scene to compete with *Homo erectus*, who eventually disappeared. The new species were *Homo heidelbergensis* and the better-known *Homo neanderthalensis*, also known as the Neanderthals (Tattersall 1995). The latter approximated modern humans in height, but were much heavier and more powerfully built, with thicker bones and a more robust musculature. The size of the Neanderthal cranium also expanded to reach volumes characteristic of our own species, although the physical organization of the brain remained distinct, with small and constricted frontal lobes. Nonetheless, the increase in average cranial capacity to around 1400 cc enabled group size to expand further, reaching 120 to 160 individuals and implying a need to manage some 9,730 separate dyadic relationships (N = 140; see Figure 1)

With groups this large, the maintenance of cohesion could not possibly have relied on mutual grooming, as servicing so many relationships would have required around 40 percent of the group's entire time to be spent grooming, a percentage that is far too large to be feasible (Dunbar 2001). Culture, therefore, must by then have been the central mechanism maintaining social cohesion. Nonetheless, both the fossil and archaeological evidence suggest that Neanderthals were mimetic and nonverbal (Diamond 1992; Donald 1991; Tattersall 1995): Their constricted frontal lobes and a skull flexure incapable of accommodating a modern vocal apparatus suggest that Neanderthals could not speak (Lieberman 1975, 1984).

The Neanderthals nonetheless evinced a more advanced material culture than their hominid predecessors, as indicated by the emergence of a new tool kit, the Mousterian (again named for a French village), which consisted of flint or stone blades hafted onto wood or bone handles. These are the first composite tools—those composed of at least three materials. The new tool kit yielded 10 times more cutting edge per kilo of raw material than the former Acheulean technology. With the Neanderthals we also begin to observe stone hearths and postholes, indicating the construction of permanent shelters. We also observe migration and settlement in the colder regions of northern Europe, and numerous bone middens indicate a heavy reliance on hunting for food. With the emergence of semipermanent settlements of 120 to 160 persons, social structure probably began to move beyond small bands differentiated by age and sex to form larger collectives such as kin-based clans (Tattersall 1995).

Neolithic Society

Fully modern human beings emerged in Africa somewhere around 150,000 years ago and rapidly migrated outward to occupy all corners of the globe. *Homo sapiens* reached Europe and Asia around 50,000 years before present (B.P.), Australia by 40,000 B.P., the Arctic by 20,000 B.P., the Americas by 10,000 B.P., and most of the islands of

Polynesia by 2,000 B.P. (Balter 2001; Diamond 1997; Gibbons 2001a, 2001b). Whereas the Australopithecines and habilines had remained in Africa for 5 million years without moving, and *Homo erectus* and the Neanderthals had not expanded beyond southern Europe and Asia over 1 million years, within the space of just 50,000 years *Homo sapiens* fully populated the entire earth. Clearly they must have gained access to some remarkable new survival tools. Given that the maximum density achieved by hunters and gatherers in the richest habitats is a little under .5 persons per square kilometer (Hassan 1981), demographers estimate that the prehistoric human population reached roughly 6 million persons (Coale 1974; Landers 1992; Livi-Bacci 1992;).

In *Homo sapiens*, the brain reached its present size and structure with a full expansion of the frontal lobes that created the potential for a new and revolutionary kind of culture (Knight, Dunbar, and Power 1999; Watts 1999). The importance of the human brain as an adaptive organ is indicated by the fact that it constitutes 2 percent of body weight but uses 20 percent of the body's total energy (Donald 1991). Nonetheless, the appearance of anatomically modern human beings was not initially accompanied by dramatic cultural changes.

The crucial period of cultural change seems to been around 50,000 years ago, in an era that has variously been called "the great leap forward" (Diamond 1992), "the creative revolution" (Tattersall 1998) and "the symbolic revolution" (Chase 1999). From this point onward, human technology undergoes rapid change that is disconnected from further changes in brain size or anatomy. Whereas earlier technologies prevailed for hundreds of thousands or even millions of years and only changed with the arrival of a new species, after 50,000 B.P. material culture evolves rapidly and differentiates without any corresponding physical changes. Human cognitive capacity had apparently reached a state of dynamism and flexibility where it could innovate adaptations ad infinitum.

In addition to the hafted stone and wood tools characteristic of Mousterian culture, *Homo sapiens* now began to fashion a host of new and more delicate tools from bone and antler, creating hooks, needles, awls, and harpoons. They wove fibers into ropes and clothing; tanned hides for clothing and coverings; created jewelry and other forms of personal adornment; and built permanent shelters that not only included hearths, but lamps and kilns as well. They invented spear throwers, bows, and arrows to allow effective hunting from a distance, thus minimizing risks to personal safety. Late in the neolithic era, bronze began to replace flint in tools and weapons, ushering in a "bronze age."

Perhaps not immediately, but sometime after the appearance of *Homo sapiens*, speech developed and gave human beings a capacious verbal memory and new capacities for cognition and analysis (Gregory 1981). The development of language was enabled by important changes in the size, structure, and function of the brain compared with the Neanderthals. Expansion of an area located toward the bottom of the frontal lobes (Broca's area) permitted *phonology*, the making and controlling of sounds. The development the temporal lobes (Wernicke's area) allowed *audition*, the ability to hear and differentiate sounds; and expansion of the parietal and frontal lobes permitted *conceptualization*, the ability to use and manipulate arbitrary sound symbols in meaningful ways—to *think of* words before uttering them and to organize them into large units of meaning. All of these expanded brain functions were connected into a larger articulatory loop that functioned in a newly coordinated fashion (Carter 1998; Panksepp 1998).

Language emerged not to give humans a capacity for rational or abstract analysis per se—rational thought was more of a by-product—but to enhance their *social intelligence* to enable them to get along in large groups (Dunbar 1996; Maryanski 1996). Language is the ultimate social arbiter, allowing people to maintain interpersonal relationships through conversation, to monitor the social interactions of others through gossip, and to reach collective decisions through discussion. In Dunbar's (2001) words, "humans have bigger, more complexly organized groups than other species simply because we have a larger onboard computer (the neocortex) to allow us to do the calculations necessary to keep track of and manipulate the ever-changing world of social relationships in which we live" (p. 181).

Language is far more efficient than grooming as a means of maintaining social contact and monitoring interpersonal relationships, for the simple reason that we can talk to more than one person at a time. The maximum group size predicted for human beings from their cranial capacity is around 155 persons, which corresponds closely to the maximum size observed among hunter-gatherer societies (Dunbar 1996). Comparing the group size of chimps to that of humans (55 to 155) suggests that the mechanism that replaced grooming as a means of achieving group cohesion was three times more efficient. Unobtrusive studies of conversations conducted across a variety of cultural and social settings reveal that human conversational groups naturally gravitate toward a configuration of one speaker and three listeners. Moreover, whereas chimps spend about 20 percent of their time grooming, humans spend around 20 percent of their time in social interaction, mostly in conversation (Dunbar 2001:190–91). Thus language replaced grooming and built upon gesture as a means of ensuring social cohesion within large groups.

All human societies possess a spoken language and all human beings are capable of learning any linguistic system. Indeed, as Chomsky (1975) and Pinker (1993) suggest, human beings possess a "language instinct." Given appropriate exposure in childhood, any person anywhere can learn any language with a minimum of effort and without formal instruction. In contrast, as stated earlier even after intensive training throughout childhood, Chimpanzees cannot learn to speak any language. And even though they can learn to recognize 150 to 200 symbols, they cannot use them in grammatical fashion (Diamond 1992; Donald 1991).

Despite its evolution as an instrument of "social intelligence," however, language also offered humans new possibilities for rational analysis. Through vocabulary, syntax, and grammar, languages inevitably created categories of perception for time, objects, and events in the real world. Languages thus allow humans to create a conceptual model of the universe and how it works, permitting the invention of what Gregory (1981) calls "mind tools": categories of thought that facilitate other mental operations. The emergence of language is thus associated with the emergence of a new kind of "mythic culture" in which humans developed symbolic metaphors to explain the operation of the universe.

The appearance of musical instruments, rhythmic devices, lunar calendars, and various other symbols in the millennia from 50,000 B.P. to 10,000 B.P. testifies to the growing importance of myth in society. Interment of the dead with utensils, food products, and jewelry indicates a belief in the afterlife (Donald 1991). The first symbolic art appears in the form of sculptures and cave paintings, and given the remote location of most cave art deep in the interior of inaccessible caverns, it obviously served some symbolic, ceremonial purpose (Tattersall 1998).

Mythic culture, for the first time in history, allowed humans to synthesize discrete, time-bound events and circumstances and to connect them into a single, coherent narrative to explain the world. Mythic culture did not supplant episodic and mimetic cultures; it was wrapped around them and extended a preexisting emotional infrastructure. Every hunter-gatherer society thus has an elaborate mythic system that permeates daily life, and through the use of verbal and nonverbal symbols, that system gives meaning to everyday objects, circumstances, and events (Donald 1991). Myth constitutes a "symbolic web" that explains how people are supposed to behave, why cultural rules must be obeyed, and how they are to be enforced (Chase 2001). God myths, in particular, reflect a society's idea of causality: where life comes from, what happens to people after death, and what controls events in the world.

When considered comparatively across time and space, hunter-gather societies are found to share a variety of traits (Barnard 2001). They occupy large territories at low densities and are characterized by geographic flexibility and a lack of attachment to fixed settlements. They are unstratified, with few social distinctions except for those based on age and sex. Males and females are distinguished from one another by undertaking different productive activities and ritual behaviors, and adults take care of children and the elderly. Most groups possess social mechanisms to distribute food and prevent the accumulation of surplus. They employ a universal classification of people according to kinship and have a symbolic structure based on bipolar opposites (good/bad, male/female, hot/cold, etc.). Their metaphoric narratives associate animal identities with those of humans, and much of human action is infused with ritual (Collins 1987).

Although possessing a capacity for rational thought, elements of rational cognition and culture are not very well developed in mythic cultures. Rather, the new cognitive apparatus created by words was more strongly connected to emotional centers of the brain through conditioning and learning that were deliberately reinforced by ritual, ceremony, and spirituality (Collins 1987; Turner 2000). The emergence of cultural forms more strongly connected to rationality required something that hunter-gathers never achieved—a food surplus—and that only became possible with the domestication of plants and animals.

Agrarian Society

The signature characteristic of hunter-gatherer societies is that, except for the very young and the very old, everyone produces food: Each day all people must work to ensure the group's caloric intake. Until quite recently, human societies had no specialists, and certainly none devoted to full-time cognition. This only became possible between 12,000 and 10,000 years ago with the emergence of the first settled villages, which, in turn, were rendered feasible by the cultivation of crops and the herding of animals. For the first time humans had created a food surplus. The accumulation of food in excess of one-day's needs enabled a dramatic acceleration of human population growth, higher population densities, and the existence of a new class of people—albeit a small class—who did not have to produce food for their own survival (Coale 1974; Livi-Bacci 1992; Sjoberg 1960).

Agriculture, herding, and cities emerged at different times in different places depending on access to plants and animals that were potentially domesticable (Diamond 1997); but they first materialized in a geographic arc extending from the eastern Mediterranean upward through Anatolia and down into the valley of the Tigris and Euphrates rivers. Known as the "Fertile Crescent," it was here that the ancient ancestors of several modern cereal crops and herd animals were found in foothills adjacent to a flat alluvial plain whose soil was annually replenished and watered by seasonal flooding—the perfect environment for the emergence of intensive agriculture. Wheat, barley, and peas were domesticated in Mesopotamia by 10,000 B.P., along with sheep and goats; by 6,000 B.P. several fruit-bearing trees and bushes had also been tamed (notably those yielding olives and grapes). Agriculture was independently invented in China, Mesoamerica, and perhaps India, and spread to Europe and other locations in Asia and the Americas through diffusion (Diamond 1997; Sjoberg 1960).

The domestication of plants and animals set the stage for a new kind of human society based in cities. The first cities emerged in Mesopotamia around 8,000 years ago, with populations in the 5,000 to 25,000 range (Sjoberg 1960). Under a preindustrial technology, the amount of food that could be produced per hectare was limited and the total size of the food surplus was necessarily meager. While intensive agriculture may have permitted cities to exist, they couldn't be numerous and only a few people could live in them. Prior to the industrial revolution, no more than 5 percent of any society lived in cities and the total population of a single city never exceeded 1 million (Chandler and Fox 1974; United Nations 1980).

With yields per hectare fixed by technological limits, the only means for a city to become larger was to gain control of more land and thereby to commandeer a larger surplus. Mesopotamian cities were limited in size by internecine rivalries and political fragmentation. It was not until the Pharaohs consolidated their control over the Nile River Valley around 5,000 years ago that cities really began to expand. The first settlement to exceed 100,000 inhabitants was Thebes, in Egypt, around 3,400 years ago. It was succeeded a thousand years later by Babylon, which surpassed 200,000, and finally by Rome, which during the reign of Caesar Augustus was the first city to surpass 500,000. The 100,000-person threshold was crossed in China 2,600 years ago and in Mesoamerica about 2,000 B.P. (Chandler and Fox 1974).

Wherever it occurred, agrarianism displaced hunting and gathering as a way of life—through direct conquest, demographic absorption, or ecological marginalization. This victory occurred not because agrarianism provided people with less work, better nutrition, and longer lives. On the contrary, the residents of early agrarian societies worked longer hours, consumed fewer calories, lived in poorer health, and within cities they died in larger numbers (Diamond 1997; McNeill 1976). What gave agrarian societies their decided advantage in confrontations with hunter-gatherers was their demographic weight, which allowed them to possess an advanced technology, specialized fighters, and deadlier germs.

With the advent of agriculture, the stone age gave way to the bronze and iron ages—metals replaced flint to create more effective tools and more lethal weapons. Urban dwellers and the agrarian empires they maintained evinced new instrumental needs, specialists thought up new tools to satisfy them, traders obtained the necessary raw materials, artisans made them, a political elite controlled their distribution, and a religious elite justified their deployment. As a result, in any encounter urban-led agrarian societies were able to wield weapons and technologies far superior to anything that hunter-gatherers could muster. Agrarian societies also could spare more people from the necessity of food production to wield these weapons, which led to the emergence of professional soldiers and the first standing armies. In any competition over land and resources, populations enumerated in the tens or hundreds of thousands held a clear advantage over small bands numbering in the dozens or hundreds, especially if the former fielded an army of well-equipped, well-fed, and well-trained professional fighters.

Finally, the density of preindustrial cities, the lack of sewage facilities, the contamination of drinking water, and the close association of humans with animals gave one final advantage to agrarian-urbanism: germs (Diamond 1997). Until the nineteenth century, in fact, health conditions in cities were such that infectious diseases were endemic, and life expectancies were short, much shorter than among peasants in the countryside (McNeill 1976; Preston and Haines 1991). In fact, were it not for continuous rural in-migration, preindustrial cities would not have been able to sustain themselves demographically. Nevertheless, although death rates were high and life expectancies short, those urban dwellers who survived either inherited or acquired an immunity to bacteria, viruses, and other parasites that hunter-gatherers could never attain, given their low densities. As a result, throughout history initial contacts between hunter-gathers and agrarianism-urbanism have invariably led to the former's decimation through a sudden exposure to diseases for which they had no natural immunity (Diamond 1997; McNeill 1976; Tierney 2000).

From the rise of the first city-states around 10,000 years ago up to the year 1800, agrarianism was the dominant form of human society, occupying ever larger portions of the world's geography with ever larger populations, both rural and urban. The rough trajectory of world population growth is shown in Figure 2, which graphs the estimated size of the human population from 600 B.C. to 1800 A.D. At the end of the paleolithic era, the world's population stood at around 8 million; but over the next 8,000 years it grew to reach about 252 million in the year zero. Under the *Pax Romana,* population growth reached a plateau and with the collapse of the Roman Empire it declined to around 200 million before rebounding slowly after the year 600. Beginning in the year 1000, a variety of technological and social innovations came together to unleash a demographic boom in Europe, which proceeded apace until the Black Death struck in the middle 1300s (Levine 2001). As the foundations for a global economic order based on mass production, trade, and investment were established after 1600 (Braudel 1982; Wallerstein 1974), the human population entered an era of sustained exponential growth that accelerated until the dawn of the nineteenth century, when the world's population stood at around 954 million (Livi-Bacci 1992).

In the 500 generations preceding 1800, the proportion of people living in urban areas never exceeded 5 percent (United Nations 1980), and before that year only 65 cities in

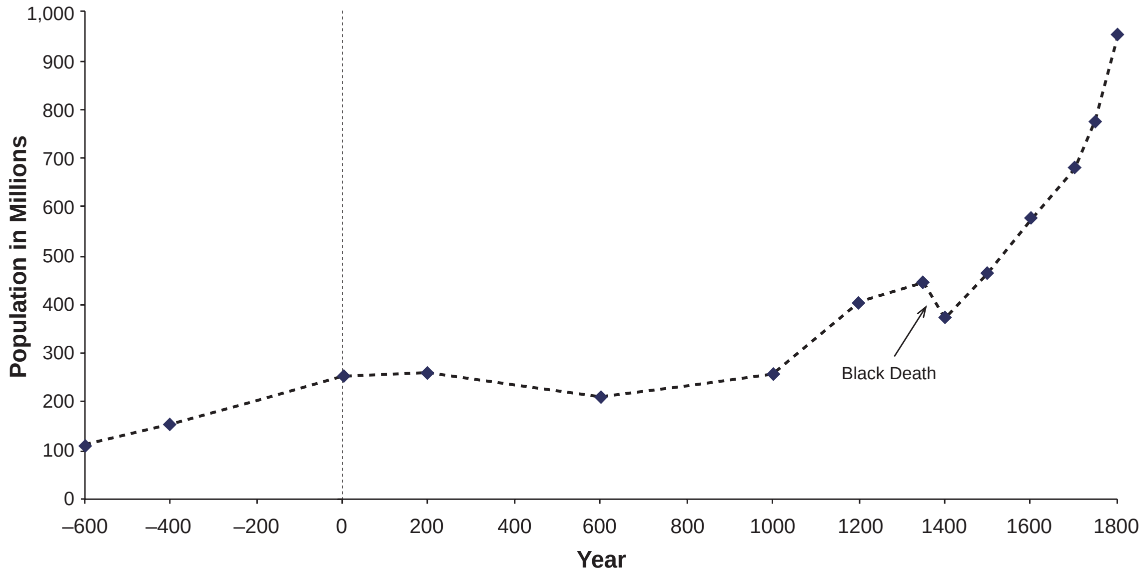

Figure 2. World Population, 600 B.C. to 1800 A.D.

Sources: Coale (1974); Landers (1992); Livi-Bacci (1992).

the entire history of the world had ever achieved populations greater than 100,000 (Chandler and Fox 1974). The vast majority of people in the "civilized" agrarian societies of the past were illiterate peasants who lived in small villages and isolated hamlets not much bigger than the hunting and gathering communities of the paleolithic era. Work was governed by the rhythms of the seasons, and most people lived and died within a few kilometers of where they were born, spending all their lives within a community of friends and relatives they knew personally. In such a society, culture remained substantially mythic. The only real difference compared with the mythic cultures of hunter-gathers was the patina of formal structure imposed from above by a priestly class.

Through the innovation of written language, however, agrarianism created the foundation for a new kind of culture. The origins of writing lay in the desire of Sumerian merchants for an accounting system to keep track of their sales and shipments. Some 10,000 years ago, urban traders began using a stylus to mark clay tokens of different shapes, thus indicating the quantity and nature of goods being shipped or stored (Harris 1986; Lawler 2001). Over the millennia, these clay tokens expanded into tablets, and the markings were elaborated until about 5,000 years ago, when they became a syllabic script for the Sumerian language. Then, about 4,000 years ago the Phoenicians evolved the first phonetic alphabet, which later was borrowed and modified by the Greeks and eventually the Romans, whose system we use today (Diamond 1997). Writing emerged independently in China and Mesoamerica at later dates.

The advent of writing created the first external memory devices—tablets, scrolls, and stone monuments—which dramatically reduced the demand on biological memory and freed up human cognition for other tasks. Whereas biological memory is inherently limited by a fixed number of neurons (not all of which we use), writing created a storage system of unlimited size. Moreover, through both written and oral connections between individual brains within dense urban environments, cities dramatically increased the size of the human cognitive apparatus (Wright 2000). In many ways, they functioned as macro-social "brains," and the use of symbols externalized thought and dramatically increased information processing (Diamond 1997).

Writing thus created the potential for a new *theoretic culture*—a logical system of thought grounded in experience and rationality and capable of making accurate predictions about events in the natural and social worlds (Donald 1991). Almost by definition, access to such a culture was limited to the small minority of people who were literate

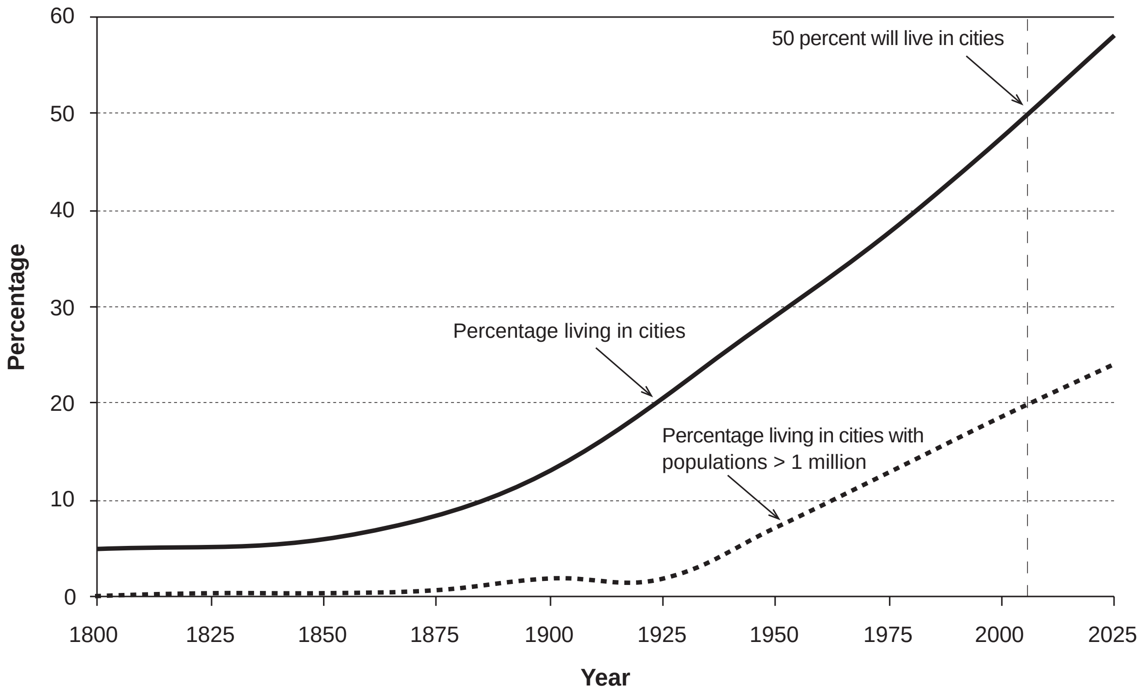

Figure 3. Trends in World Urbanization, 1800 to 2000

Sources: United Nations (1980, 1999).

and freed from the burdens of food production, and even among those who could read and write there were two competing modes of thought (Bruner 1986; Snow 1959). *Narrative thought* is basically a written extension of oral culture expressed as literature: plays, poems, stores, novels, operas, and so on. *Analytic thought*, while dependent on words, is a rational construction grounded in formal systems of argument, taxonomy, and conceptualization. Analytic thought follows logical rules based on induction and deduction and makes frequent use of formal quantitative measurement. Although theoretic culture gained adherents and influence in human affairs during the agrarian era, it necessarily remained a minor part of the total human experience, given the small number of people who were literate.

Industrial Society

Agrarian food surpluses allowed a small number of people to devote their time to thinking and innovating, and even though the *percentage* of such people remained tiny, the steady increase in population from Roman times to 1800 meant that the *absolute number* of such people steadily grew. Whereas no more than 5 percent of the world lived in cities during the eras of both Caesar Augustus and Queen Victoria, for Roman times this implied a population of 13 million urbanites, while for the Victorian era there were 48 million city-dwellers. The growing quantity of people with the time and freedom to think new thoughts promoted more and faster innovation, which caused more population growth, which increased innovation, and so on.

Beginning around 1800, human society entered a remarkable new period of demographic growth the likes of which the world had never seen. Whereas hunting and gathering had been the dominant mode of society for 6 million years and agrarianism for 10,000 years, industrialism flowered and matured in less than 200 years. From a base of 954 million people in 1800, the human population grew to 1.6 billion in 1900, 2.5 billion in 1950 and 6.1 billion in 2000. In the past 200 years, more people have been born than in all previous human generations combined. Even more remarkable has been the shift of the human population from rural to urban areas.

As can be seen in Figure 3, in 1800 the percentage urban was still roughly at the up-

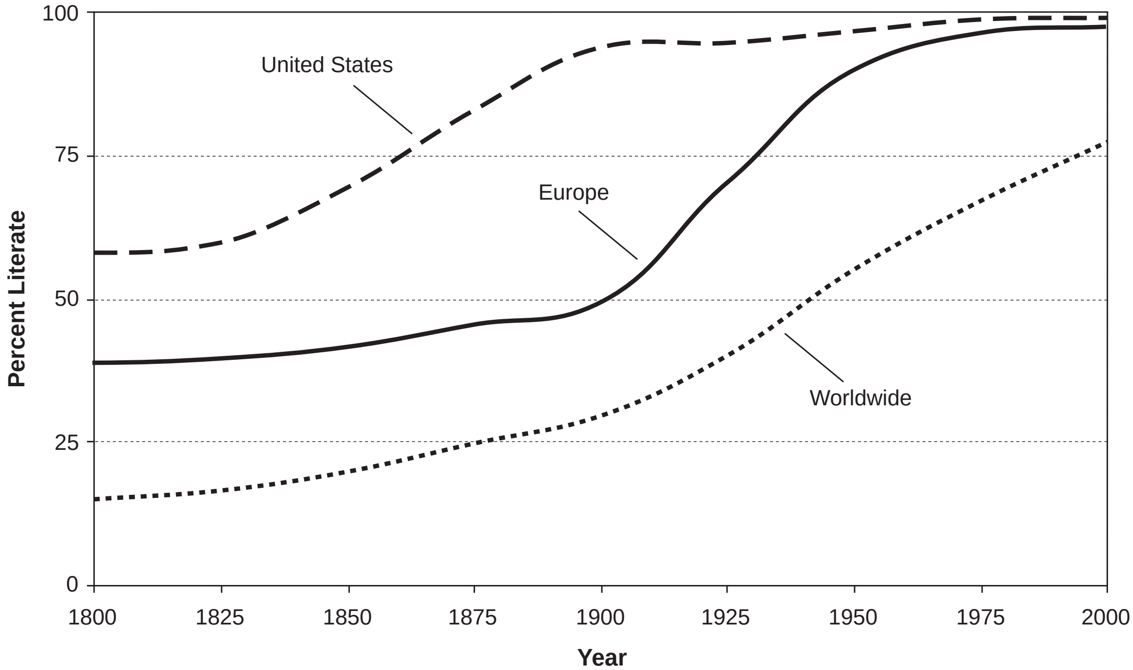

Figure 4. Trends in Literacy, 1800 to 2000

Sources: Cipolla (1969); Graff (1987); Lestage (1982); and Wagner (1993).

per limit for an agrarian society—about 5 percent of total population. Slowly at first, and then accelerating in the late nineteenth and early twentieth centuries, there was a massive geographic shift. In the industrializing societies of Europe and North America the transition to urbanism was rapid and complete by the mid-twentieth century (Brockerhoff 2000; Preston 1979). Although developing countries lagged behind, they are now also rapidly urbanizing, and by 2025 the proportion of city-dwellers worldwide is projected to reach nearly 60 percent.

In this century, not only will a majority of human beings be living in cities, but a growing fraction will reside in extremely large places. Beginning in the mid 1920s, the percentage of human beings living in cities of 1 million or more rose sharply. As world urbanization passes the 50 percent mark toward the end of this decade, the number living in large metropolises will surpass 20 percent; and by the year 2025, one-quarter of all humanity will live in cities of 1 million or more. Increasingly, most of these large urban agglomerations will be in the Third World. Whereas the five largest cities in 1900 were London, New York, Paris, Berlin, and Chicago, in 2015 they will be Tokyo, Bombay, Lagos, Dhaka, and Sao Paolo, followed by Karachi, Mexico City, New York, Jakarta, and Calcutta (United Nations 1999).

The urbanization of society has been accompanied by a remarkable acceleration of technical, economic, social, and cultural change. Technologically, inanimate sources of power replaced animate sources, as horses and oxen gave way to wind and water, then to coal and steam, and finally to petroleum, hydroelectricity, nuclear energy, solar, and geothermal power. Economically, the productive base of society shifted in rapid succession from agriculture to manufacturing to services, with each transition accompanied by a startling increase in the productivity of land, capital, and labor. The creation of mass markets yielded economies of scale that were accompanied by an unprecedented increase in social differentiation and stratification. As the distance between the top and the bottom of society grew, the intervening space was filled with a complex array of increasingly variegated social strata. Culturally, gender roles changed, childhood was extended, fertility levels fell, and survival rates increased to create a demographic structure in which the old outnumbered the young.

Although the foundations for theoretic culture were laid in the agrarian era, the technical constraints of preindustrial farming naturally limited the size of the food surplus and hence the percentage of people who could live in cities, thus placing an upper limit on literacy. As long as literacy remained the prerogative of a small minority of people who were liberated from the land, the prevailing cultural mix would be weighted toward the mythic rather than the theoretical. The full flowering of rational culture, in other words, awaited the advent of mass literacy.

Figure 4 shows trends in the literacy of adults from 1800 to 2000 in Europe, the United States, and worldwide; data are from Cipolla (1969), Lestage (1982), Graff (1987), and Wagner (1993). In 1800, the vast majority of human beings would not have had much access to the fruits of theoretic culture, as 85 percent of the world's population was preliterate. Even in Europe, only about 40 percent could read and write in 1800, owing mainly to mass illiteracy in the Russian Empire. The United States fared better, with literacy rates approaching 60 percent.

In Europe and the world, the degree of literacy changed slowly during the nineteenth century. As late as 1900 half of all Europeans and two-thirds of the world's population still could not read or write. After 1900, however, the extension of public schooling in Europe rapidly increased literacy there to levels above 90 percent. Among nations of the Third World, meanwhile, national development programs began to extend universal schooling, and in the late 1940s world literacy broke the 50 percent barrier. By the year 2000, three-quarters of the world's population had been given instruction in at least the fundamentals of reading and writing. Nonetheless, nearly one-quarter of all humanity remained disenfranchised from the basic requirement for a rational, theoretic culture.

The Emerging Post-Industrial Order

Despite the incredibly rapid change since 1900, there is evidence of an even greater acceleration beginning around 1980 with the mass production of the silicon chip and the consequent introduction of computers into virtually all aspects of social and economic life. In the new economic order, wealth rests on the creation of knowledge rather than the manufacture of goods, and status derives from the control and manipulation of information. Although markets are increasingly global in scale, they are also increasingly fragmented, being divided into segmented niches rather than mass populations of consumers. Within the global economy, capital, labor, goods, commodities, and information are increasingly mobile and transnational, yielding a new internationalization of both production and culture (Harvey 1990).

Compared with the roughly 300,000 generations that humans spent as hunter-gatherers and the 500 generations they spent as agrarians, the 9 generations passed in the industrial era and the 1 generation so far spent in the emerging post-industrial era are a drop in the bucket of time. As organisms, we cannot possibly have adapted to the environment in which we now find ourselves. Future adaptations will come from institutional, technological, and cultural changes, not from physiological adaptation. The nature and success of our adaptation will depend heavily on what sort of organisms we are—how we think and how we function socially.

PAST IS PRESENT

In his play, *Requiem for a Nun*, William Faulkner noted,"The past is never dead. It's not even past" (act 1, scene 3). Our brains have evolved over millions of years as a changing mixture of emotionality and rationality, and each evolutionary step has built upon what came before. Emotionality clearly preceded rationality in evolutionary sequence, and as rationality developed it did not replace emotionality as a basis for human interaction. Rather, rational abilities were gradually *added to* preexisting and simultaneously developing emotional capacities. Indeed, the neural anatomy essential for full rationality—the prefrontal cortex—is a very recent evolutionary innovation, emerging only in the last 150,000 years of a 6-million-year existence, representing only about 2.5 percent of humanity's total time on earth. To the extent we possess rational cognition, it necessarily rests on a preexisting emotional foundation.

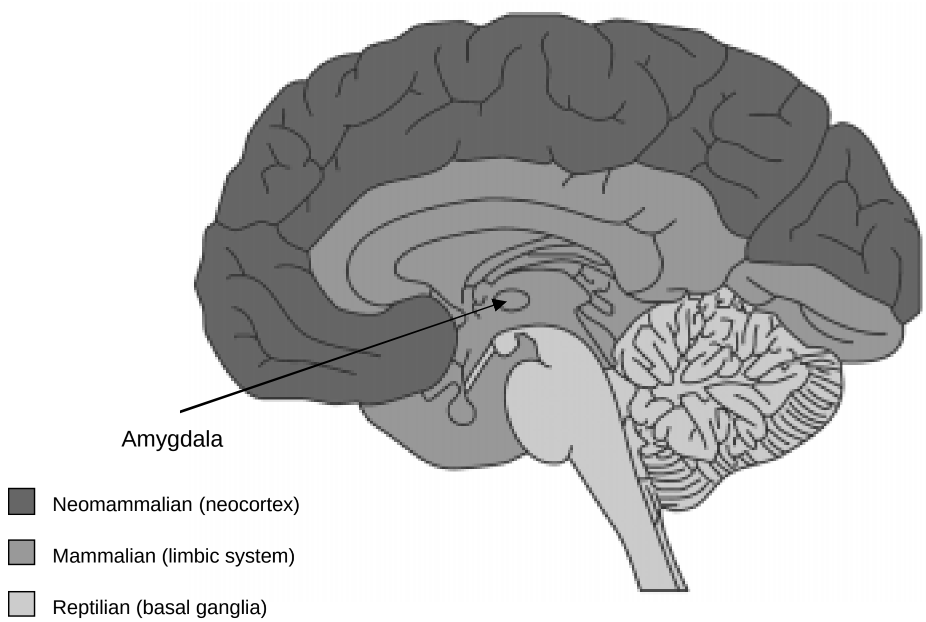

Figure 5. The Triune Structure of the Human Brain

This evolutionary history is reflected in the basic structure of our brains, which is summarized in Figure 5. Natural selection is conservative: It doesn't build new capacities from scratch, but acts upon structures and functions that already exist. As a result, human beings have come to possess what MacLean (1973, 1990) has labeled a "triune brain": three different layers of neural anatomy laid down on top of one another during different phases of evolution. The oldest and deepest layer consists of the brain stem and the cerebellum (basal ganglia); these structures control autonomic functions, such as heartbeat and breathing, as well as instinctual behaviors, such as the sucking reflex. It is known as the reptilian brain because it closely resembles the structure and organization of the neural anatomy found in reptiles today, and presumably in the past.

The next layer is called the mammalian brain (Panksepp 1998). It surrounds the reptilian brain and consists of a set of neural structures collectively known as the limbic system. The most important organ in this system is the amygdala, which is crucial in registering incoming emotional stimuli and storing emotional memories. Other limbic system organs include the thalamus, which receives stimuli and relays them to other parts of the brain; the hypothalamus, which works with the pituitary gland to keep the body chemically regulated and attuned to its environment; the hippocampus, which is responsible for laying down memory; and a surrounding layer of tissue known as the cingulate cortex. Together these cerebral organs work together unconsciously to coordinate inputs from the senses and to generate subjective feelings and emotional states that influence subsequent cognition and behavior (for a detailed account of the neurology of emotion, see Turner 1999, 2000).

The outermost layer of the brain is the neocortex, also known as the neomammalian brain (Panksepp 1998). This consists of an outer layer of gray matter mostly given over to the conscious processing of sensory stimuli. The neocortex has four basic sectors replicated symmetrically across two hemispheres of the brain. At the back, the occipital lobes do visual processing. Along the top and sides, the parietal lobes focus on movement, orientation, and calculation. Behind the ears, the temporal lobes deal with sound and speech; and the lower part of the frontal lobes are devoted to taste and smell. The top part of the frontal lobes is known as the prefrontal cortex.

The foregoing organization is common to all mammals, although different lobes may be more or less developed in different species. Dogs, for example, have a better sense of smell than humans, and consequently their smell portion of the neocortex is more highly developed. The feature of brain anatomy that most distinguishes humans from other mammals is the relative size of the prefrontal cortex. This portion of the brain mushroomed spectacularly over the course of hominid evolution to the point where the prefrontal region now constitutes 28 percent of the entire cerebral cortex, 40 percent more than in our first hominid ancestors (Carter 1998).

The prefrontal region is the only portion of the neocortex that is free from the demands of sensory processing, and as such it is the locus for abstract thinking, conceptualizing, and planning. It is this section of the brain that is most clearly associated with self-will and human consciousness—the place where we process and analyze information about the world and make plans for the future that are transmitted downward to the limbic system and basal ganglia along well-developed neural pathways. If the prefrontal lobes are damaged, human beings are unable to plan, to motivate themselves, or to recognize and act upon emotions (Goleman 1995; LeDoux 1996).

Leaving aside the reptilian brain and its largely autonomic functions, evolution has bequeathed us two dynamic, interactive brains—one emotional brain located in the various subsystems of the limbic system, and one rational brain centered in the prefrontal cerebral cortex. The two brains are connected to one another, but operate in parallel to yield two different systems of perception and memory. While neural pathways between the emotional and the rational brain carry information in both directions, *the number of neural connections running from the limbic system to the cortex is far greater than the number connecting the cortex to the limbic system* (Carter 1998; LeDoux 1996; Panksepp 1998). As a result, not only do unconscious emotional feelings exist independently of rational appraisals of them, but given the asymmetry in neural connections between the limbic system and the neocortex, it is much more likely that emotional impulses will overwhelm rational cognition than vice versa (Goleman 1995). To a great and unappreciated extent, therefore, our rational judgments about people and events reflect the influence of emotional states that are transmitted unconsciously from our emotional brain to our rational brain.

Rational and Emotional Perceptions

The emotional brain not only precedes the rational brain in evolutionary time—it precedes it in the order of perception. Research in neuroscience shows that stimuli from the external world are perceived, evaluated, and acted upon by the emotional brain *before* the rational brain has received the pertinent information (LeDoux 1996). By the time the rational brain receives incoming sensory stimuli about an event or object in the real world, the emotional brain has already swung into action and showered the neocortex with emotional messages that condition its perception.

Figure 6 presents a simplified schematic diagram showing how incoming stimuli are processed by the human brain. Sensory perceptions enter the brain and go to the thalamus, where the signal is dispatched to both the rational and emotional brains, which are, of course, connected to one another. But the timing of the neural signal's arrival in the emotional and rational brains is different, so that the former is activated first. The functioning of the two brains can be illustrated with a vignette.

Say you are walking in a crosswalk and suddenly a car runs a red light and bears down upon you. The stimuli enter your eyes and ears. The perceptions travel along the optic and auditory nerves to the thalamus, which sends the signal in two directions. One is the "high road" to the neocortex: first to the appropriate sensory processing area and then to the prefrontal cortex for rational consideration. There your rational brain will undoubtedly tell you that if you don't move quickly you will be run over by the car, resulting in serious injury or death. Your frontal cortex issues instructions to motor areas in the parietal lobes to jump out of the way, and the message is relayed down the brain stem to the outlying nerves, which cause your muscles to contract in such a way that you jump out of the way.

The foregoing account is consistent with a model of rational choice. Your brain made a

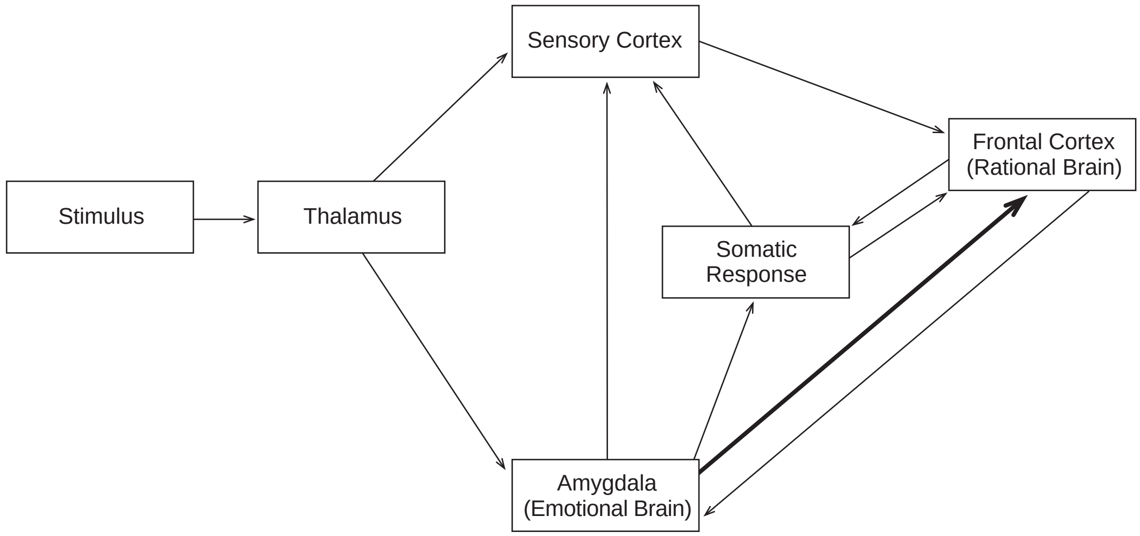

Figure 6. Schematic Representation of the Cognitive Processing of Emotion

quick cost-benefit calculation and decided it was worth the expenditure of energy to jump out of the way to avoid being run over by the car. Given what we now know about how the brain works, however, this account of human action is completely incorrect (Goleman 1995; LeDoux 1996; Panksepp 1998). By the time the rational brain has received the information about the oncoming threat, the emotional brain has already spurred your body into action and you will have begun to jump out of the way. Your heart will be pounding, and your breathing will have accelerated. If you later try to explain your behavior, you may say it all happened so fast that you acted "without thinking."

But the action *was* a result of thinking; it was *unconscious* thinking undertaken in the limbic system. At the same time that the thalamus sent the visual and auditory information to the cortex for high-order processing, it also dispatched it along a "low road" to the amygdala, for what LeDoux (1996) calls "quick and dirty" processing. In contrast to the "high road" through the neocortex, this lower route is shorter and faster. The amygdala immediately recognizes the threat to survival posed by the oncoming car and sends a message to the hypothalamus to spur the body into immediate action. Adrenaline is released, your heart rate rises, your muscles contract, and in a split second you jump out of the way.

Laboratory studies indicate that information reaches the amygdala about a quarter of a second before it reaches the prefrontal cortex. Thus, the emotional brain perceives the danger and acts *before* the rational brain "knows" what is happening. In this case, human behavior actually derived from the workings of the older mammalian brain rather than the newer, more rational, but much slower neomammalian brain: If your frontal cortex were severed from the rest of your brain, thus disabling your rational faculties, you would still jump out of the way of the car.

In explaining human behavior it is thus important to distinguish between rationality and rationalization. In the foregoing episode, a rational-theoretical account that explains the act of jumping out of the way as the result of a rational cost-benefit decision is incorrect. This explanation is a *rationalization* of behavior whose trajectory had already been determined in the emotional brain. The limbic system was the locus of action, not the prefrontal cortex. An innate feature of the rational brain, however, is to rationalize events and behaviors. Thus, even though the behavior, jumping away from the car, stemmed from prerational cognition, we feel compelled to tell ourselves a logical story about what happened.

The power of rationalization has been demonstrated in a famous experiment in which women were presented with a series of nylon stockings and asked to select the pair they liked best (Gazzaniga 1992). When asked why they had made their selection, all subjects provided a lucid account referring to differences in quality, texture, color, size, workmanship, or style—even though the stockings were, in fact, identical. According to one neuroanatomist, “we like to think of . . . action as the result of a rational decision, but it is really just the fulfillment of an impulse” (Carter 1998:41).

Rational and Emotional Memory

Not only does the emotional brain offer human beings a second, parallel system of perception, it also provides a second memory system in which emotional states and feelings are recorded independently from information is consciously stored in the neocortex (Carter 1998; LeDoux 1996). That emotional memory exists is illustrated by the case of a woman who, as a result of brain damage, had lost all ability to create new memories. Every time her doctor saw her he had to reintroduce himself. One day, however, he held a pin in his hand before he introduced himself. When the woman shook his hand, she recoiled in pain as the pin punctured her skin. The doctor then left the room and after a while came back. Once more he offered his hand in introduction. Although the woman did not recognize him, she refused to shake his hand. She could not say why; she just wouldn’t do it:

> [The doctor] was no longer just a man . . . but had become a stimulus with a specific emotional meaning. Although the patient did not have a conscious memory of the situation, subconsciously she learned that shaking [the doctor’s] hand could cause her harm, and her brain used the stored information, this memory, to prevent the unpleasantness from occurring again. (LeDoux 1996:181)

As mentioned before, the brain is highly lateralized, and in most people the left side is devoted to analytic, logical, verbal thinking, and the right side to emotional processing. That is, the left neocortex is used for rational thought whereas the right amygdala is employed for emotional processing (there are right- and left-side amygdalas, like all brain organs except the putamen). Each eye receives and transmits information to both sides of the brain at once: The right side of both eyes sends information to the right side of the brain and the left side of both eyes sends information to the left side. Brain researchers have developed special contact lenses that refract incoming light to one side of the retina or the other, so that quite literally, the left half of the brain does not know that the right side sees and vice versa. In one experiment, LeDoux, Wilson, and Gazzaniga (1977) showed disturbing images of people being thrown into flames to subjects wearing right-refracted lenses, which channeled the information to the emotional brain but not to the rational brain. Afterward the subjects had no declarative memory of what they had seen—they could only describe a vague awareness of light and flashing—yet they felt quite upset and disturbed. Although they could not say why, they no longer liked the experimenter or felt comfortable in his presence.

Such unconscious learning reflects a basic but powerful psychological process identified long ago by the Russian physiologist Ivan Pavlov (1927). In his experiments on *classical conditioning*, an unconditioned stimulus (in the above example, a pin prick) is paired with a conditioned stimulus (the doctor’s hand) to generate an unconditioned response (pulling away from the pin prick). As a result of the pairing, the conditioned stimulus (the doctor’s hand) becomes associated with the unconditioned stimulus (the pin prick) in the subject’s memory. Because the memory is stored in the amygdala, however, it is not conscious, representing what LeDoux (1996) calls an “implicit memory.”

Implicit memories exist independently of and apart from explicit verbal memories and contribute an underlying emotional valence to the information that the neocortex stores. It is thus a basic feature of human cognition that all perceptions and memories have both an implicit and an explicit content. Explicit content is laid down in conscious memory by the hippocampus and stored in the cerebral cortex, whereas implicit content is filtered by the thalamus and stored unconsciously in the amygdala. Indeed, it is only because objective perceptions carry different emotional valences that we are even able to use rationality to choose between them (Turner 2000).

Implicit memories are created through the pairing of stimuli with hard-wired emotional or motivational states. Once an implicit memory has been created and stored, it is remarkably durable and difficult to eliminate.

For our purposes, unconditioned stimuli may be divided into appetites and emotions. The former are internal conditions within the body that send messages to the brain to instigate particular survival-related behaviors. Classical conditioning was first studied using an appetite (hunger) in which Pavlov's dogs were conditioned to salivate in response to a bell, which sounded just before food was presented. In the past few years, scientists have identified specific neural structures, pathways, and transmitters associated with basic appetites such as hunger, thirst, tiredness, lust, playfulness, and curiosity (Carter 1998; LeDoux 1996; Panksepp 1998).

There also appear to be specific neural assemblies associated with the fundamental human emotions such as fear, anger, disgust, nurturing, and liking (Panksepp 1998). Although some of the neurological mechanisms (such as fear) are better worked out than others (such as disgust), all appear to be mediated through specific neural structures within the limbic system, thus creating the possibility for classical conditioning by systematically pairing external stimuli with emotional reactions to generate implicit memories that are stored in the amygdala. I believe that such unconscious memories created by intentional or inadvertent conditioning lie behind much human social behavior.

THE LIMITS OF RATIONALITY

My review of human evolution and cognition yields six basic facts which, I believe, bring to question our overreliance on rationality in explaining human behavior. (1) Emotionality preceded rationality in human evolution. Our ancestors lived in structured social communities grounded in emotion *long before* they developed rational faculties. (2) The ability to evaluate potential costs and benefits of hypothetical actions and to use these evaluations in planning for the future—the essence of what most theoretical models mean by rationality—emerged very late in human evolution. We have only possessed the neurological equipment for such mental operations for less than 3 percent of our time on earth. (3) Once we acquired the physiological capacity for rational thought, it took additional time to develop the mental devices necessary for rational cognition and analysis. Although anatomically modern human beings appeared 150,000 years ago, symbolic thought evolved a full 100,000 years later than that. (4) It took another 45,000 years for spoken languages to be systematized in writing, creating the possibility for the external storage of information and the emergence of an incipient rational culture. (5) Even after these artifacts had been invented, it took another 5,000 years for them to be inculcated within a majority of human beings, offering for the first time the possibility of a mass society based on rationality. (6) And finally, despite the recent flowering of rationality, evolution has bequeathed us a cognitive structure with *two* mentalities—one emotional and one rational. While these two processors are interconnected, emotional cognition precedes rational cognition in evolutionary time and in real time, and feedback between the two is such that emotional traffic into the rational brain dominates that going in the reverse direction.

These six facts lead me to the inescapable conclusion that human decisions, behaviors, and social structures cannot be modeled solely as a function of rationality. My reading of human evolution and cognition suggests that rationality, rather than being a dominant and deep-rooted force in human affairs, is quite recently arrived and rather fragile. To the extent that rationality manifests itself in social life, it is only because of cultural practices and cognitive habits that have been painstakingly acquired over millennia and deliberately passed on to succeeding generations. Emotionality remains a strong and independent force in human affairs, influencing perceptions, coloring memories, binding people together through attraction, keeping them apart through hatred, and regulating their behavior through guilt, shame, and pride. By failing to theorize emotion and by ignoring interactions between rational and emotional cognition, sociologists derive an incomplete and misleading view of human social behavior. As I suggest in the following examples, a serious consideration of the nature and working of the emotional brain has much to offer sociology.

The Origin of Norms and Values

Sociology used to explain behavior as stemming from norms and values. While these concepts have not disappeared from the discipline, the thrust of recent theorizing has been to explicate their rational foundations and see them as fundamentally logical processes (see Becker 1996; Coleman 1990). Work on subjective social meanings has increasingly been left to our friends in anthropology, who unfortunately have taken a dive off a postmodernist cliff. From my point of view, however, the study of norms and values should really be about interactions between social structure and the emotional brain, and particularly about how families and communities act to create implicit memories that link behaviors, places, objects, experiences, and thoughts to subjective emotional states, thus shaping future rational behavior.

The way that parents teach values to children, for example, implicitly recognizes the cognitive structure pictured in Figure 6 (see page 18), where emotional cognition precedes rational discrimination and where, owing to the asymmetry of neural connections (indicated by the heavier line going from the amygdala to the prefrontal cortex), the emotional brain is in a better position to influence the rational brain than vice versa. Consider, for example, thoughts about sex. Although thinking about sex naturally leads to the release of endorphins in the human brain to create pleasurable feelings, parents who wish their children to avoid early sexual contact endeavor to pair sexual stimuli and symbols with negative emotions such as shame, guilt, and even pain to create a conditioned response that will cause the child, in adolescence, to remain chaste. If the conditioning is successful, the emotional brain will send out negative, inhibiting messages to the cortex when confronted with sexual stimuli. Of course, such conditioning carries the risk that it maybe all too successful, leading to sexual dysfunction in adulthood.

Consumer Markets

Neoclassical economics assumes that tastes and preferences are given and that people enter markets to satisfy them through the rational process of utility maximization (for a recent attempt to move beyond this simplification, see Becker and Murphy 2000). Although professors of economics may accept these assumptions and use them to derive complicated behavioral models, their colleagues in business schools do not. On the contrary, professors of marketing for years have sought to teach students specifically *how to influence* preferences, tastes, and motivations through advertising and public relations efforts. It has been years since the overlords of Madison Avenue have tried to appeal to our rational brains in marketing consumer products.

For example, what is the rational connection between an entity labeled “the Swedish bikini team” and a popular brand of beer? Objectively there is none, of course—the image is not intended to appeal to the rational brain. By systematically and repeatedly pairing the beer with attractive blond women in bikinis, the TV ad seeks to create a conditioned response among young men—the prime demographic category of beer consumers. If the conditioning is successful—and in the course of any sporting event the pairings will surely be relentless—the sight of the relevant six-pack (the conditioned stimulus) will trigger an implicit memory of the endorphins released by the sight of voluptuous Swedish women to generate a feeling of attraction toward the product that will lead to its purchase.

Influencing Political Behavior

One frequently hears the disparaging epithet “social engineering” applied to liberals who advocate using government power to redistribute resources in society. In truth the real social engineers are today’s political consultants. These individuals, mostly conservative, apply the methods of social science to manipulate the emotional brain and thus shape perceptions of political actors and ideas. They pair their candidate or position with positive emotional stimuli while linking opposing figures and ideas with negative stimuli (Jamieson 1996). Given the inherent survival value of emotional reactions such as fear and rage—which prepare an organism to flee or fight—negative emotions tend to be more powerful as conditioning stimuli than positive emotions, which yields a greater prevalence of negative ads in political campaigns. Attack ads would probably also predominate in commercial advertising were it not for libel laws.

A persistent question is why do candidates continue to rely so heavily on negative advertising when surveys repeatedly show that voters disapprove of and dislike the tactic? The simple reason is that the attack ads work. Although voters express a rational disapproval of negative campaigning, their emotional brains nonetheless pay attention to negative material, and the pairing of the negative emotions they arouse with candidates and political positions shifts votes in the expected direction by creating implicit memories lodged in the amydgala that later shape rational cognition.

Increasingly political consultants use the methods of social science—surveys and focus groups—not to hone rational arguments but to identify emotional triggers that can be paired with people and platforms to create implicit memories within the emotional brain. The 1994 Republican Contract with America, for example, was less a coherent political program than a list of 8 vague "principles" and 10 contradictory legislative proposals that surveys and focus groups had revealed would appeal to different segments of the electorate. Their votes were thus "stitched together" to eke out a majority in the house of representatives. What modern political consultants have done is simply to routinize and refine the tactics of pandering that astute politicians have naturally employed for generations (see Berezin 1997; Emirbayer and Goldberg 2001).

Fear, Prejudice, and Stereotyping

Increasingly, we have become a fearful society, harboring a variety of apprehensions and suspicions about people and events that are completely out of proportion with the actual risks in society (Davis 1998; Glassner 1999). These fears reflect rampant fear conditioning achieved inadvertently by the media and, sadly, often intentionally by political actors in our image-driven postmodern world. As a species, we are programmed to pay close attention to violent and threatening events. In the natural world, violence is rare—but when it occurs our brains instantly tune in. Fear-inducing stimuli proceed directly to the amygdala and unleash a variety of somatic and emotional reactions that focus our attention and put us on high alert before our rational brain has had a chance to act (Carter 1998; LeDoux 1996; Panksepp 1998). Even though our rational brain may quickly discern that there is no particular threat, the chemicals released into the blood stream (e.g. adrenaline) persist for some time and yield extended feelings of excitation and arousal (Goleman 1995; LeDoux 1996).

Television programmers and movie producers have long understood the inherent attraction of violent images, and over the years they have steadily ratcheted up the incidence and severity of violence in a variety of media, from movies to the internet. Possibly the most important escalation of violence has been on television news. Whereas serious crime dropped by 3 percent through the 1980s and early 1990s, and while the murder rate fell by 9 percent and overall criminal victimization dropped by 21 percent, news coverage of crime by the three major networks *doubled* and the reporting of murders *tripled* (Freeman 1994; Zucchino 1994). In a typical news night in 1995, 29 percent of news time was devoted to violence and well over half to crime, war, or disaster (Klite, Bardwell, and Setzman 1995). As Orfield (1997) put it, "Stations are pushed toward crime coverage because it represents attention-grabbing material while requiring little or no labor costs spent on background research and because crime's sensationalism garners high Nielsen ratings in a competitive market" (p. 23).

Thus, despite constant or declining crime rates in the United States, Americans are exposed, albeit vicariously, to more crime and violence than ever before, and consequently in a safer world they feel more vulnerable and threatened. What is important sociologically, however, is the potential for conditioning inherent in the repeated association of the emotional responses of fear and rage with people, events, and actions that regularly appear on the screen. As Glassner (1999) documents in his study of the "culture of fear," Americans have come to harbor a host of irrational fears, not just of crime, but of dangerous drugs, monster moms, killer kids, mutant microbes, plane crashes, and road rage.

Probably the most important fear conditioning that is accomplished by TV programmers, however, is the implicit association between violence and minorities, especially African Americans. The repeated pairing of minorities with fearful circumstances on television cannot help but create highly negative and largely unconscious memories associated with groups such as blacks and Hispanics, and the existence of these implicit memories can only serve to strengthen racial and ethnic stereotyping and perpetuate racism (Glassner 1999). The existence of such manufactured fears and racist feelings also provide politicians with powerful emotional levers they can use to mobilize the white electorate (Edsall and Edsall 1991).

The most notorious example, but certainly not the only one, is the famous Willie Horton commercial during the 1988 presidential campaign, in which the natural human abhorrence to violence was systematically paired with Governor Michael Dukakis via a clearly racialized image. The commercial was powerful and effective not only because it tapped deep into the fear system hardwired in the brain but also because it drew upon racialized images established through past fear conditioning. The frequent deliberate use of racist imaging for short-term political gain is certainly one of the most disgraceful practices to emerge in modern politics, whether in the United States, in the Balkans, or in Rawanda.

The Effects of Urbanism

For my last example of how emotion influences human affairs, I return to the fact that we are on the verge of becoming, for the first time, a fully urbanized society. Increasingly human beings will not only live in cities but those cities will be very large, and the largest among them will be in poor countries of the Third World. As a result, among both developed and developing societies, poverty will increasingly be urbanized and geographically concentrated. Within nations, the bulk of the poor will be housed in large urban agglomerations, and within these areas the poor will increasingly concentrate in poor neighborhoods, thus driving the spatial concentration of poverty to new heights (Massey 1996).

Sociologists have long been fascinated with the influence of urbanism on social life. A classic statement was offered by Wirth (1938), who argued that the size, density, and heterogeneity of industrial cities would undermine social cohesion to promote individual alienation and social malaise. Although subsequent research has failed to confirm his hypothesis, (Fischer 1975, 1982, 1995), that didn't stop a second round of theorizing about the pathological effects of population density based on animal models (Calhoun 1962; Christian 1963). Once again, however, the expected relationship failed to materialize (Carnahan, Gove, and Galle 1974; Gove and Huges 1983; Winsborough 1970).

More recent work, however, has confirmed a clear relationship not between population density and social maladies but between the concentration of poverty and deleterious outcomes (Brooks-Gunn, Duncan, and Aber 1997; Sampson, Morenoff, and Earls 1999). Here, understanding function and operation of the emotional brain is of potentially great importance in illuminating the link between concentrated deprivation and behavior.

Among other things, areas of concentrated poverty are characterized by high rates of crime, violence, and social disorder (Massey 2001). Inhabitants of poor neighborhoods are likely to experience high rates of exposure to danger, causing the amygdala frequently to send out signals that cause the release of stress-induced hormones into the blood (Kotulak 1997; LeDoux 1996; Panksepp 1998). When threats of violence are infrequent, such a response is highly adaptive; but when violence becomes endemic, serious physiological side effects may occur as a result of overloading the stress system, leading to the impairment of learning (Diamond and Rose 1993, 1994), the degeneration of memory (McEwan 1992), a greater propensity toward violence (Goleman 1995; James et al. 1987; Kotulak 1997), and a greater risk of coronary heart

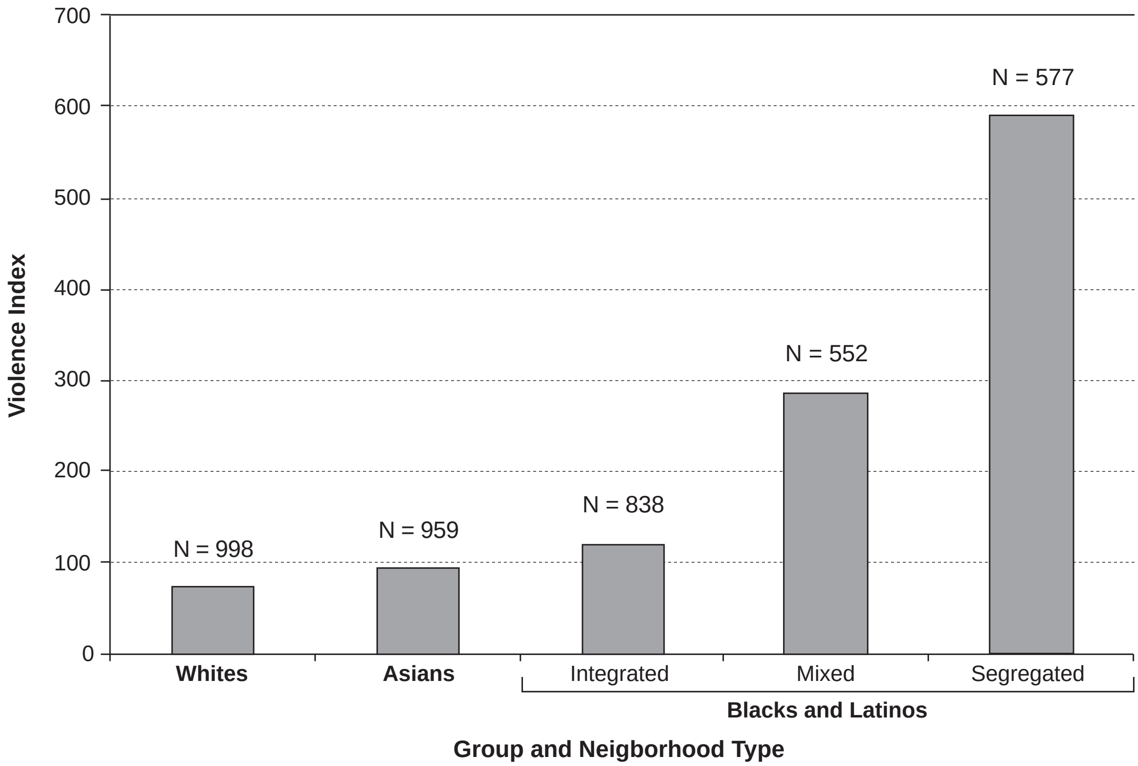

Figure 7. Average Exposure in Childhood to Neighborhood Violence by Neighborhood Type: Freshmen from Elite U.S. Universities

Source: Massey, Durand, and Malone (2002).

Note: Integrated neighborhoods are less than 30 percent minority; mixed neighborhoods are 30 to 60 percent minority; segregated neighborhoods are greater than 70 percent minority. The Violence Index is the number of violent acts to which a respondent was exposed while growing up, weighted by the severity of the violence as measured by the Sellin-Wolfgang Scale (Sellin and Wolfgang 1964).

disease and other health problems (McEwan 1999; Peyrot, McMurry, and Kruger 1999; Taylor, Repetti, and Seeman 1999).

Exposure to violence has the potential of affecting social conditions many times removed from the neighborhoods in which the violence originally occurred. This was recently brought home to me with some force. With colleagues I am presently conducting a study of students at elite colleges and universities around the country. In the fall of 1999 we interviewed cohorts of white, Asian, black, and Latino freshmen entering the nation's most selective colleges and universities (see Massey, Charles, Lundy, and Fischer 2002). Among other things, we were interested in the sorts of neighborhoods in which the respondents had grown up. As they had already been selected by virtue of their admission to highly exclusive colleges and universities, we expected a certain homogenizing of experience, and this was certainly the case for whites and Asians. Blacks and Latinos, however, evinced much higher rates of exposure to neighborhood violence, which was highly conditioned by the degree of residential segregation they had experienced while growing up.

We designed an index of exposure to violence that was weighted to capture not only the incidence of violence but its severity as well, as measured by well-known the Sellin-Wolfgang scale (Sellin and Wolfgang 1964). Figure 7 shows this index for whites and Asians compared with blacks and Latinos classified by the type of neighborhood in which they grew up: integrated, mixed, or segregated. As can be seen, black and Latino students who grew up in integrated neighborhoods had roughly the same exposure to crime and violence as whites and Asians. In contrast, those growing up in segregated neighborhoods experienced a degree of exposure to violence that was six times that of whites or Asians. Given what we know about the effect of stress hormones on cognition, it is quite possible that such high levels of exposure to violence have long-term effects on memory, learning, and temperament, a hypothesis that we will certainly consider in our future work.

FINAL THOUGHTS

I have presented just a few of the ways in which an appreciation for the role of emotionality in human affairs can enhance the sociological understanding of the human condition. Given the parallel operation of the emotional and the rational brain within every human being, it is inevitable that all judgments, perceptions, and decisions will have both emotional and rational components. Moreover, because of our evolutionary history and cognitive structure, it is generally the case that unconscious emotional thoughts will precede and strongly influence our rational decisions. Thus our much-valued rationality is really more tenuous than we humans would like to believe, and it probably plays a smaller role in human affairs than prevailing theories of rational choice would have it.

Our colleagues engaged in the practical application of social science—marketing, advertising, and political campaigning—have known this for some time. They have not simply recognized the duality between the emotional and the rational brain, but have sought to cultivate and exploit it. The social engineering they practice has advanced considerably and become extremely effective in shaping behavior, even as academic theorists have relegated emotionality to the back burner and devoted more attention to a fully rational account of human society. Assuming rationality makes the world neater and cleaner, of course, for it allows the use of higher mathematics in modeling social structures and behavior. But the evidence is incontrovertible that human behavior has both rational and emotional components and that the latter cannot be reduced to the former. On the contrary, if anything, emotionality supersedes rationality in both timing and influence.

If my arguments are correct, therefore, sociologists must work to understand more fully our evolutionary history; we should reacquaint ourselves with the anthropological literature on hunter-gatherer societies; we must look to studies of primatologists for a window on the prerational origins of social behavior; we must ground ourselves more firmly in the emerging literature in cognitive neuroscience; and finally, we must end our hostility to the biological sciences and work to incorporate the increasingly well-understood biological foundations of human behavior into our theoretical models.

I am not saying that emotion is totally absent from social theory and research, of course. Indeed, it has been addressed by social theorists from classical times to the present (see Barbalet 1998; Collins 1975, 1993; Elster 1999; Turner 2000) and has attracted considerable attention from empirical sociologists (Hochschild 1983; Katz 2000). To date, however, most sociologists have approached emotion in more philosophical than scientific terms, building edifices on assumptions and speculations about the nature of emotion rather than on proven facts. With the great advances already made in cognitive neuroscience and with those on the horizon, we no longer must rely on assumptions. Rather, echoing Turner (2000), I believe that we can and should ground our theories and models in established knowledge about how people think and interact using both their emotional and rational brains.

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