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## 2.1 Introduction

One question that is, surprisingly, hardly ever asked is this: Why do humans have the capacity to experience, express, and read in others such a wide variety of emotional valences? It is just assumed that humans are emotional, but the question of “why” is left unanswered. One can find somewhat vague pronouncements that emotions are socially constructed, and with big brains came language and culture that allow for an expanded palate of emotions. But is this really the answer? I think not, because emotions are generated in the subcortical regions of the brain, not in the neocortex. True, culture gives us the capacity to label emotions, and this comes from the neocortex, but the emotions themselves are of deeper origins, not only in the actual structure of brain but also in its evolution over the last 8 million years. If we are to understand emotions, then, we need an explanation of why and how the capacity for emotionality on a human scale first evolved; and an answer to this question, I believe, enables us to understand how they operate today. In this chapter, I will use a methodology developed by Alexandra Maryanski and me to offer a long-term evolutionary explanation for why and how humans became so emotional.

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## 2.2 Humans are Primates

Humans are a species of primates, whose closest living relatives are the great apes: chimpanzees (two subspecies), gorillas (two subspecies), and orangutans. Humans share 98.5 % of their genetic material with the common chimpanzee, which means that chimps should probably be grouped with humans in the family *Hominidae* and genus *Homo* rather than in *Ponidae* where they are now placed along with the genus *Pongo* (orangutans) and genus *Gorilla*. Because chimpanzees are genetically closer to humans than the other two great apes, only the vanity of humans keeps them out of *Homo*. I emphasize this point because, in chimpanzees and in the other great apes, we have an unusual vantage point: we can see what our distant ancestors are like because the habitats in which the great apes evolved have not changed dramatically for millions of year, whereas our last common ancestor with these great apes and humans had to adapt to an entirely new habitat, the African savanna. Apes evolved in the arboreal habitat, and all of the great apes still live in the forests, whereas our ancestors, called *hominins*, had to adapt to the dangerous, predator-ridden savanna. To view matter simplistically, but nonetheless usefully, hominin evolution involved taking a body plan much like that of the common chimpanzee and reworking it so that hominins could live on the savanna, which except for hominins, became the graveyard of all other species of apes. Apes are, in reality, a great evolutionary failure because most species are now extinct, ex-

cept for humans (and the verdict is still out on us) and the handful of apes that are on life-support in their shrinking forest niches. Even humans, with their capacities for culture and language, have almost gone extinct twice over the last 200,000 years. Indeed, humans are much less genetically diverse than any other primate for a simple reason: you and I are all descendants of a very small population—perhaps only a few hundred and at most only a few thousand members—that was on the verge of extinction.

The explanation for why humans became so emotional resides in this forced occupation of open-country savanna over the last 10 million years. Emotions became the key to hominin survival, not culture as is so often hypothesized. For language and culture are very late arrivals in the hominin line and were not the fundamental change that allowed hominins to do what no other ape can now do: live on the savanna.

To be sure, a bigger neocortex that could allow for culture increased fitness among late hominins over the last 2-million years, but this larger neocortex was not what allowed hominins to survive in the first place. It is the other part of the brain—the subcortical areas of the brain inherited from reptiles and early mammals—that first changed in some rather fundamental ways—long before the neocortex began to grow significantly about 2 million years ago. The subcortical areas of the brain were rewired by natural selection to make humans dramatically more emotional than other primates and, in all likelihood, all other animals on earth, and it is in this subcortex that we can see the footprint of natural selection as it enhanced hominins' and eventually humans emotionality.

But, this conclusion only begs the question that I articulated earlier: Why was it necessary for hominins to become so emotional? What were the selection pressures on savanna-dwelling apes that, through random and blind natural selection, allowed our ancestors to survive and avoid the mass extinction of every other savanna-dwelling ape? To answer this question, we need to adopt a methodology for doing cross-species comparisons, which Alexandra Maryanski and I call *evolutionary sociology*, which we view as a more viable alternative to evolutionary psychology.

## 2.3 Evolutionary Sociology

Evolutionary sociology consists of a series of methodologies: (1) *cross-species comparisons* among primates on their respective patterns of social relations as these produce network structures among conspecifics; (2) *cladistic analysis* by which these patterns of relations among extant apes are used to reconstruct the social structures of the last common ancestor of humans and the great apes; (3) *ecological analysis* of the changes in habitat and niches in these habitats that led natural selection to push for particular behavioral and structural patterns among primates; (4) *comparative neuroanatomy* whereby the brains of extant apes are compared to those of humans to give us a sense of what natural selection did to the brain of hominins and humans over the last 8 million years; and (5) *analysis of hard-wired behavioral propensities* of all great apes, primates, and more generally, mammals to see what existing behaviors could be selected upon during hominin evolution in various habitats and niches in these habitats.

These five methods allow us to look back millions of years into humans' evolutionary history, much like the Hubble telescope can do for the universe. We cannot see with perfect clarity but we can see enough back in time to understand where our ancestors started in terms of their physical phenotype (i.e., neuroanatomy and anatomy), their behavioral phenotype (i.e., dominant behaviors), and their social phenotype (i.e., social structures). Then, we can follow their evolution and see how these various phenotypes were all transformed during the course of hominin evolution under the power of natural selection to alter anatomy, neuroanatomy, behavioral propensities, and patterns of social structure.

### 2.3.1 Structures of Relations Among Primates

The great apes reveal a very unusual pattern of relations among conspecifics: they evidence very few strong social ties and no firm basis for inter-generational continuity of social relations (Maryanski 1986, 1987, 1992, 1993, 1995). Moreover,

their basic unit of social organization is not the local group but, instead, the much larger regional community of 10 square miles in which individuals move about freely, forming temporary gatherings that then break up, only to form again but never for long periods of time (Maryanski and Turner 1992). The group, then, is *not* the natural unit of social organization for a great ape, which in all likelihood means that it was not the unit of organization for our common ancestor with great apes, as we will see shortly in cladistic analysis. Alexandra Maryanski (1986) employed a network model of tie strength among all species of apes to see what kinds of social structures had been observed by researchers (who have a behavioral bias and, in fact, have a hard time understanding what social structures is). She compared these findings with a similar analysis of representative species of monkeys which, as I will note shortly, is important in cladistic analysis. The finding on great apes are rather startling: the only consistently strong tie among all species of great apes is between a mother and her pre-adolescent offspring, and this tie is broken when *all* females leave their natal community at puberty, never to return, and in so doing break the possibility of intergenerational ties and groups. For gorillas and orangutans, males also leave their natal community at puberty, never to return. Only chimpanzee males remain in their natal community and form moderate-to-strong ties with their mothers as well as male friends and relatives. None of these ties, however, leads to permanent groups; rather, individuals hook up for a short period, and then disband. Since females of a community have all left at puberty, they must be replaced by immigrating females from other communities, which assures a resupply of females (and genetic diversity), but these females will be strangers to each other and, hence, do not form strong ties even as they sit in proximity and let their offspring play. Thus, what emerges in a network analysis of the great apes is a predominance of weak ties and a rather startling absence of strong ties that could lead to group formation. This network system is also supported by the fact that apes are promiscuous, with paternity of offspring never to be known. For chimpanzees, enthusiastic sexual promiscu-

ity makes it impossible to know who the father of an infant is; and for orangutans, who are virtually solitary, males hook up with females for a short time and then wander off to be alone, with the female raising her offspring alone as well. Only gorillas form somewhat more stable groups built around a lead silverback male and females with children, and various hangers on; this unit works in favor of the female who uses the lead silverback as a babysitter for her sexual liaisons with males lurking out of the sight of the lead male. Yet, even this somewhat structured group breaks part when the females' children enter adolescence, if not before.

This weak tie pattern is rather unusual among mammals because there is no system of kinship beyond the females caring for their offspring before the latter leave the community forever. In contrast, monkeys reveal the opposite pattern of apes: females *never* leave their natal group and, instead, form matrilineal lines of generational and collateral female kin. All males leave their natal group at puberty for other groups, being replaced by males from other troops. These males then enter into a competition for dominance, forming a hierarchy of dominance, which will change every few years, if not sooner. Thus, monkeys are entirely oriented to the local group rather than the larger community population, as is the case for apes; these groups are highly structured by female matrilineal lines and male dominance hierarchies (some monkey troops also reveal female dominance hierarchies as well). Dominant males seek to monopolize sexual access to females in a kind of harem pattern, with varying degrees of success in keeping all females in line.

I will not go into details here (see Maryanski and Turner 1992; Turner and Maryanski 2005; Turner and Maryanski 2008). The importance of these data can be seen when performing cladistic analysis.

### 2.3.2 Cladistic Analysis of the Last Common Ancestor

Cladistic analysis is the term used in biology to denote the reconstruction of the traits and charac-

teristics of a set extant species that are presumed to be biologically related. The logic of cladistic analysis is similar to historical reconstruction of languages where the common features of a set of related languages are used to discover the features of the root language from which they all evolved. In cladistic analysis, the common behavioral and structural traits of a set of extant species are used to determine the likely traits of their common ancestor. Maryanski (1986) performed this analysis—the details of the methodology are less important for my purposes here—and came to the conclusion that the last common ancestor of humans and the great apes was virtually solitary, probably much like contemporary orangutans where individuals live alone, except for females and their pre-adolescent offspring. There are no strong ties among adults, and the only strong ties are those evident in all mammals between mothers and their young offspring. But, even these ties are broken when male and females emigrate from their natal community, never to return. Thus, the last common ancestor of humans and great apes was not very social, did not form strong ties among adults, was promiscuous, and was not prone to form groups of any sort, beyond mother-offspring groups that disbanded with offspring reached puberty.

In cladistic analysis, a comparison out-group of more distantly related species is often used to assess the plausibility of the reconstruction for what are presumed to be more closely related species. Monkeys were used by Maryanski to make this comparison. Monkeys are primates, and at one time, there were few differences between monkeys and apes physically, but over a 10 to 15 million year period of time, they diverged because they began to live in different niches in the arboreal habitat (see ecological analysis below). The reason for the comparison group is to make sure that the set of species under investigation is really distinctive, as a set, in terms of key characteristics and that these characteristics did not evolve independently but, in fact, have been features of all members of this set for a long time and, in fact, distinguish them from other sets of species revealing a different pattern of characteristics. The fact that monkeys evidence almost

*the exact opposite pattern* of organization to apes suggests that, although they are both primates and share a very distant common ancestors, they are separated by several key features in their behavior and social organization, including: group organization for monkeys compared to community organization for apes; permanent matrilineal of related females who never leave their natal group compared to universal transfer of females away from the natal community or regional population; harem patterns of male-female among monkeys compared to sexual promiscuity between male and female apes that do not lead to strong bonds or groupings; and strong ties among related females for monkeys versus weak ties among females in ape communities.

Thus, contrary to many assumptions in philosophy and sociology, humans are not as social at their ape core as is often assumed. Family and kinship were not natural to the last common ancestor; groups in general were not permanent among all great apes; promiscuity was rampant with pair-bonding between adult males and females never occurring; and there was no inter-generational continuity for either males or females (except for species of gibbon and siamangs, which are not great apes and very far off the great apes line). The last common ancestor was virtually solitary, moving about alone within a regional community and only forming groups long enough to reproduce or, at times, to defend the community from encroachment by males from other communities. There were no strong and enduring ties among adults, and only temporary ones between sexual partners and even between females and their offspring. Obviously, humans today are more social than this profile would suggest, but the important point is that, for reasons to be outlined below, our ape nature is the exact opposite to what is often posited as “natural” to humans; and the evolution of hominins began with no bioprogrammers in the neurology of the last common ancestor for strong social ties (beyond those of all mammals in female-offspring nurturing) or for group formation. And, these facts are critical to understanding virtually everything about humans. The story of hominin evolution, then, is one where natural selection worked to increase sociality and

the capacity for group formation, but how? My answer (Turner 2000) is through the dramatic rewiring of the hominin brain toward enhanced emotionality.

### 2.3.3 The Ecology of Ape and Hominin Behavioral and Social Structural Patterns

Why did were great apes become so asocial? The answer resides in what transpired in the arboreal habitat. Many of the features of all primates—visual dominance, generalized bodies with four limbs, five fingers, and strong arms, wrists, and fingers, and greater intelligence—are all an outcome of building a body that can move about efficiently and safely in a three dimensional environment off the ground. The differences between the bodies of apes and monkeys, and more importantly, between their behavioral and organizational patters, are a consequence of the *different* niches in the arboreal habitat where apes and monkeys lived. Without offering any details (see for details: Maryanski and Turner 1992; Turner and Maryanski 2005, 2008), monkeys gained the advantage over apes in the arboreal habitat, perhaps because they acquired the capacity to eat unripe fruit, which, to this day, the few remaining great apes cannot do. The result is that monkeys could occupy the verdant portions of the trees where there is more food and room and, hence, where larger groupings of conspecifics could survive. In contrast, despite the fact that they are larger than monkeys, apes had to migrate to the terminal feeding areas of trees where branches are thinner, where space is limited, and most critically, where food is in much shorter supply. In these niches, whatever grouping patterns apes may have once had were selected out because, to survive in these sparse niches, larger groups could not be supported; and moreover, in this habitat, individuals had to be free of strong ties of any sort so that they would be willing to move to new feeding areas. The behavioral and structural properties of apes and their societies thus reflect intense selection pressures to limit the number of individuals in any one place and

to assure that they would leave kin and move to wherever food is available. And, it appears, apes were able to prosper, even though they are larger than monkeys (requiring more food) and had to live where branches are weaker and food is in short supply. And so, the weak-tie social relations and structures of apes represent a successful adaptation to a difficult set of niches in the arboreal habitat. Moreover, some of the physical differences between apes and monkeys can be seen as an outcome of selection on the phenotypes (and underlying genotypes) of apes adapting to these niches: great apes are much more intelligent than monkeys; great apes have stronger finger, hands, wrists, arms and shoulder joints than monkeys; and the great apes can briachiate (rotate their arm 360 degrees) whereas monkeys cannot. All of these body changes represent adaptations to the “high-wire act” of the tree-tops and undersides of branches high in the air.

About 10 million years ago, African began to cool down and the dense tropical forests began to recede, and the vast savannas of African began to grow. Many species of primates were forced to the ground as the amount of space in the arboreal habitat kept declining, and here is where the mass extinction of apes began. Without the bioprogrammers for social bonding and for groups that would lead to cooperative food foraging and for collective defense in the predator-ridden, open country savanna, most species of apes went extinct. In contrast, monkeys forced to the terrestrial habitat could survive because they are well organized by male dominance hierarchies and by female matriline. Indeed, monkeys march across the savanna in almost military precision, with lead male at the front and his lieutenants on flanks and bringing up the rear of a phalanx of larger males encircling smaller females and children. Few predators, whether big cats or packs of hyenas and related species, would dare attack such a well-defended group. Here, the grouping propensities of monkeys allowed them to survive where the lack of such bioprogrammers in apes doomed them to extinction. Today, monkeys are by far the more fit set of species compared to apes. Indeed, apes including humans as an evolved ape represent less than 5 % of all species



Table 2.1 Relative size of brain components of apes and humans, compared to *Tenrecinae*. (Source: Data from Stephan 1983; Stephan and Andy 1969, 1977; Stephan et. al. 1981, 1986; Eccles 1989)

Brain component	Apes ( <i>Pongids</i> )	Humans ( <i>Homo</i> )
Neocortex	61.88	196.41
Diencephalon	8.57	14.76
Thalamus		
Hypothalamus		
Amygdala	1.85	4.48
Centromedial	1.06	2.52
Basolateral	2.45	6.02
Septum	2.16	5.48
Hippocampus	2.99	4.87
Transition cortices	2.38	4.43

Numbers represent how many times larger than *Tenrecinae* each area of the brain is, with *Tenrecinae* representing a base of 1

of primates. Apes are thus one of the great evolutionary failures in evolutionary history, a fact that is obscured by the large number of humans on earth. So, in a very real sense, we can ask: how did our hominin ancestors beat the odds and do what no other apes can do today: survive in the open, country African savanna. The answer can be seen in human neurology where natural selection rewired the hominin and, eventually, human brain to make us the most emotional animal on earth.

2.3.4 Comparative Neuroanatomy and Human Emotionality

Some time ago, precise measurements were taken on the brains of primates and compared to humans. In Table 2.1, I have arrayed the data for the great apes and humans on the size of various components of the brain, controlling for body size which is roughly correlated with brain size. As part of the control for body size, the numbers in the table represent how many times greater than “1” a brain system is. The “1” is designed to represent the size of a small rodent-like insectivore, *Tenrecinae* that is probably very much like the original insectivore that climbed into the arboreal habitat of Africa some 63 million years ago to initiate the primate order. This norming of measure-

ments to a common base allows for comparisons. For example, the neocortex of humans is 196.41 times larger than *Tenrecinae*, while the neocortex of apes is 61.88 larger—thus making the human neocortex a bit over three times the size of great ape brains. The numbers below this first row (comparing the size of the ape and human neocortex) are for subcortical areas of the brain, which evolved much earlier and which, in basic structure, were inherited from reptiles. These structures do not all correspond to emotional centers which are subcortical, below the neocortex which is wrapped over them, but they are all implicated in the production of emotions. Since these data were not collected to assess emotion centers, we will have to use them as a proxy for some of these centers. The diencephalon containing the thalamus and hypothalamus are relevant to emotions because all sensory inputs are routed through the thalamus and then sent to the relevant cortices in the neocortex and also to key subcortical emotion modules, such as the amygdala, which is the ancient reptilian center for *fear* and *anger*. The septum is the structure that gives pleasure to sex and hence is responsible for sexual drives. The hippocampus is involved in memory formation stores memories and, I would hypothesize, is the place where repressed emotions are stored outside the purview of the prefrontal cortex in the neocortex; and the transition cortices are responsible for working memory and inputs into the hippocampus where memories and the emotions associated with them are stored and later shipped up to the neocortex for longer term memory (if the memories and the emotions attached to them are activated in the hippocampus in their first two years of storage). What is evident is that these subcortical areas, and I suspect other emotion centers, are about twice as big as those among the great apes, controlling for body size. Interestingly, the big increase in the size of the amygdala in humans is in the baso-lateral component and, surprisingly, is mostly devoted to pleasure (Eccles 1989)—interesting because why would pleasure in humans be attached to the ancient centers for fear and anger? The septum is over twice as large in humans than apes, and why should this be so since apes take great pleasure in sex and

are highly promiscuous? In addition to being larger, the wiring connecting subcortical centers to each other and to the neocortex, particularly the prefrontal cortex where decision making occurs, is much denser in humans than in apes.

Thus, it is very clear that natural selection was grabbing onto subcortical areas of the brain to enhance emotionality during hominin evolution. And, it was doing so long *before* the neocortex began to grow significantly with *Homo erectus* some 2 million years ago. Indeed, developmental sequences in animals sometimes reflect evolutionary sequences in the history of a species; and in the case of human newborn, the infant can imitate all of the facial gestures of a caretaker signaling primary emotions within weeks of birth, whereas it takes years of babbling for an infant to begin to reproduce human speech phonemes and syntax. And so, I think it very likely that this developmental sequence mirrors the evolutionary sequence in the growth of the hominin brain. Long before the neocortex expanded to produce the capacity for symbolic culture and speech, the brain was wired for dramatically enhanced emotionality. Why would this be so?

An animal having no bioprogrammers for group formation but under intense selection pressure to organize into higher-solidarity and more-permanent groups in a predator-ridden savanna environment had to get better organized, or die. Most apes trying to adapt to the savanna died off, but natural selection stumbled upon a solution by selecting on emotion centers to increase the variety and valences of emotions that could be used to forge strong bonds and, eventually, group solidarities. Indeed, this is how people form and sustain bonds today; they generate positive emotional flows that increase commitments to others and groups through interaction rituals (Collins 2004) and other interpersonal processes of attunement (Turner 2002). Natural selection hit upon a solution to the problem faced by all apes over the last 10 millions years: get organized into more stable and cohesive groups, or go extinct. What is more, apes on the savanna have some major liabilities, beyond the lack of bioprogrammers for strong social ties and group formation.

One problem of apes adapting to the savanna is that they could not easily smell prey or predators, as most mammals do; in the transition to becoming visually dominant as an adaptation to the three-dimensional arboreal environment, the olfactory bulb, which is subcortical, was reduced in size and function because a big snout in front of eyes sockets that have been moved forward for 3-D vision would be maladaptive. But something else was created with this rewiring of the brain around the inferior parietal lobe and related modules: the brain became prewired for language. Thus, all of the great apes have the capacity for language-use and comprehension to about the level of a three year old human child. They do not use this area for human-like language, unless trained to do so, but this linguistic capacity existed very early on in ape evolution. The greater intelligence apes compared to monkeys makes this capacity accessible to selection, and hence, it was there in the common ancestor to apes and humans some 8 million years ago. The capacity for language, therefore, is not a recent invention; it existed for a long time in the ape line. This capacity had nothing to do with vision; it was a simple byproduct for rewiring the neocortex to make primates visually dominant, but it represented a pre-adaptation that could be selected upon if language was fitness enhancing. The language would not be auditory because apes lack the physical equipment for precise articulated speech, but language can be visual and be constructed from emotional phonemes strung together in a syntax carrying emotional meanings, *if* such an emotional language would be fitness enhancing.

Another liability of apes on the savanna is that they are slow; they must knuckle walk and, unlike fully quadrupedal animals under predation, they can easily be picked off and eaten by much faster predators. Still another liability is that apes are emotional and start making noise and running about randomly when aroused by, say, fear of a predator. And, a loud primate on the savanna is soon a dead one. Thus, unlike monkeys with powerful bioprogrammers for group organization, apes were very vulnerable on the savanna because they had so many other liabilities in addition to the lack of programmers to form groups.

**Table 2.2** Variants of primary emotions. (Source: Data from Turner 1996a, 1996b, 1996c)

Primary emotions:	Low intensity	Moderate intensity	High intensity
Satisfaction-happiness	Content	Cheerful	Joy
	Sanguine	Buoyant	Bliss
	Serenity	Friendly	Rapture
	Gratified	Amiable	Jubilant
		Enjoyment	Gaiety
			Elation
			Delight
			Thrilled
			Exhilarated
Aversion-fear	Concern	Misgivings	Terror
	Hesitant	Trepidation	Horror
	Reluctance	Anxiety	High anxiety
	Shyness	Scared	
		Alarmed	
		Unnerved	
Assertion-anger		Panic	
	Annoyed	Displeased	Dislike
	Agitated	Frustrated	Loathing
	Irritated	Belligerent	Disgust
	Vexed	Contentious	Hate
	Perturbed	Hostility	Despise
	Nettled	Ire	Detest
	Rankled	Animosity	Hatred
	Piqued	Offended	Seething
		Consternation	Wrath
Disappointment-sadness			Furious
			Inflamed
			Incensed
			Outrage
	Discouraged	Dismayed	Sorrow
	Downcast	Disheartened	Heartsick
	Dispirited	Glum	Despondent
		Resigned	Anguished
		Gloomy	Crestfallen
		Woeful	
		Pained	
		Dejected	

If emotions were to be used to increase sociability, bonding, and group formation, there was yet another obstacle. Apes do not have neocortical control of their emotions, thereby making emotions a liability. Moreover, and perhaps even more fundamentally, three of the four primary emotions that all scholars would agree are hard wired in the brain—*anger*, *fear*, *sadness*, and *happiness*—are negative; and negative emotions do not promote bonding or solidarity. And so, if natural selection were to take the route to enhancing emotionality, how would it get around the problem of the high proportion of negative

valences in the basic palate of emotions among mammals. Add to this the problem of controlling emotional outbursts, and it would seem that this route to making hominins more social and group oriented would be an evolutionary dead end. How did natural selection, then, get around the liabilities inherent in emotions, *per se*?

The increased connectivity in the human brain gives part of the answer. I think that selection first worked on controlling noisy emotional outbursts by expanding and thickening neuro-nets between the prefrontal cortex and subcortical emotion centers. This is one of the big differences between ape and human brains, and it probably began to evolve early among hominins on the savanna. With this increased control, the neurology to expand the variations in negative emotions would be in place; and as a result, variants of different levels of intensity of primary emotions could be produced. Table 2.2 illustrates some of the variants of primary emotions that humans possess, and what becomes evident is that by simply damping the intensity and increasing variants, the intensity of negative valences declines as a proportion of all primary emotions, while more nuanced and subtle emotions can be produced. Then, I think that natural selection continued on this path by combining primary emotions, as is illustrated in Table 2.3. In Table 2.3, a greater amount of one primary emotion is combined (in some unknown way) with a lesser amount of another primary emotions, generating not only a much larger palate of emotions but also dampening further much of the negativity inhering in primary emotions. Even some of the negative emotions could be used to promote solidarity if used in a nuanced way as subtle sanctions. And when emotions are combined, some new emotions appear that can be considered more likely to promote solidarity and bonding. For example, *satisfaction-happiness* combined with a lesser amount of *aversion-fear* produces such emotions as *wonder*, *hope*, *gratitude*, *pride*, and *relief*; or *satisfaction-happiness* combined with *assertion-anger* produces emotions like *calm*, *relish*, *triumph*, and *bemusement*. All of these emotions are potentially available for bonding, and they are less negative. However, some deadly combinations can be produced



**Table 2.3** First-order elaborations of primary emotions

Primary emotions		First-order elaborations
<i>Satisfaction-happiness</i>		
Satisfaction-happiness + <i>aversion-fear</i>	<i>generate</i>	Wonder, hopeful, relief, gratitude, pride, reverence
Satisfaction-happiness + <i>assertion-anger</i>	<i>generate</i>	Vengeance, appeased, calmed, soothed, relish, triumphant, bemused
Satisfaction-happiness + <i>disappointment-sadness</i>	<i>generate</i>	Nostalgia, yearning, hope
<i>Aversion-fear</i>		
Aversion-fear + <i>satisfaction-happiness</i>	<i>generate</i>	Awe, reverence, veneration
Aversion-fear + <i>assertion-anger</i>	<i>generate</i>	Revulsed, repulsed, antagonism, dislike, envy
Aversion-fear + <i>disappointment-sadness</i>	<i>generate</i>	Dread, wariness
<i>Assertion-anger</i>		
Assertion-anger + <i>satisfaction-happiness</i>	<i>generate</i>	Condescension, mollified, rudeness, placated, righteousness
Assertion-anger + <i>aversion-fear</i>	<i>generate</i>	Abhorrence, jealousy, suspiciousness
Assertion-anger + <i>disappointment-sadness</i>	<i>generate</i>	Bitterness, depression, betrayed
<i>Disappointment-sadness</i>		
Disappointment-sadness + <i>satisfaction-happiness</i>	<i>generate</i>	Acceptance, moroseness, solace, melancholy
Disappointment-sadness + <i>aversion-fear</i>	<i>generate</i>	Regret, forlornness, remorseful, misery
Disappointment-sadness + <i>assertion-anger</i>	<i>generate</i>	Aggrieved, discontent, dissatisfied, unfulfilled, boredom, grief, envy, sullenness

**Table 2.4** The structure of second-order emotions: Shame, guilt, and alienation

Emotion	Rank-ordering of constituent primary emotions		
	1	2	3
<i>Shame</i>	Disappointment-sadness (At self)	Assertion-anger (At self)	Aversion-fear (At consequences for self)
<i>Guilt</i>	Disappointment-sadness (At self)	Aversion-fear (At consequences for self)	Assertion-anger (At self)

as is the case for *vengeance*, which is *happiness* combined with *anger*. Still, in looking over the complete palate of the emotions in Table 2.3, this combining or what I term *first-order combinations* of emotions produces many more potentially useful emotions for nuanced forms of social bonding, mild sanctioning, and social control (Turner 1997, 1998, 1999, 2000, 2002, 2008, 2010a). The overall amount of negativity in the palate is reduced from three-fourths, as is the case with primary emotions alone, to something much less.

If these first-order elaborations of emotions enhanced fitness by increasing the emotion hooks for bonding, then *second-order elaborations* would be even more fitness enhancing because these would be combinations of the three negative emotions that produce entirely new kinds of negative emotions that could increase social

control. I believe that the origins of the uniquely human emotions of *shame* and *guilt* are an outcome of natural selection pushing combination strategies for negative emotions. *Shame* and *guilt*, I believe, are combinations of *anger*, *fear*, and *sadness* in somewhat different proportions. Table 2.4 outlines my view of how these emotion evolved; and they probably evolved rather late in hominin evolution, at best with *Homo erectus*, because they involve having a neocortex that can conceptualized normative expectations and moral rules. *Shame* is the emotion of having not met the expectations of others. At is low-intensity end, shame is *embarrassment*, whereas at its high-intensity end, emotions like *humiliation* are felt, and emotions at this intense end are devastating to self. *Guilt* is the feeling that one has violated moral codes and, like shame, it is highly painful to self. Notice that I am using the worlds self in

these definitions; so, more than just an awareness of expectations and moral codes is necessary; to feel shame and guilt, there must be a sense of *self as an object of evaluation*—yet another cognitive capacity only possible with higher intelligence (see discussion below on self).

Shame and guilt are mostly *disappointment-sadness* at self, but it is the order of magnitude of the fear and anger components that makes all of the difference in which of these two emotions is felt. If *anger at self* is the second more powerful emotion behind sadness, and *fear about the consequences to self* is the third-ranked emotion, then *shame* is experienced. If, however, the relative magnitude of *anger* and *fear* is reversed, then *guilt* is experienced. Thus, it is the *relative rank-ordering* of sadness, anger, and fear that determines which of these two emotions a person will feel, as is outlined in Table 2.4. These conclusions are, of course, highly speculative but the neurology of the brain suggests that this is the way that natural selection would have gone. Separate modules for each first- or second-order emotions would be difficult because mutations would be required, and mutations are almost always harmful, and especially so in such a complex area as the brain. Instead, directional selection on tail ends of Bell curves describing the distribution of traits for existing brain systems and the neurons connecting them would be the easier route, and comparing the human and ape brains reveals not only larger size in subcortical components, but also significantly increased connectivity. And somewhere in this enhanced connectivity, the capacity for shame and guilt was generated; and with it came increased capacity for social control in groups as self-control, thereby making hominins or humans that much more fit.

Great apes do not experience *shame* and *guilt*, and so it is possible that these are uniquely human emotion (Boehm 2012). Shame and guilt are emotions of social control because they cause individuals to monitor and sanction themselves over their success or failure in meeting normative expectations and abiding by the dictates of moral codes. They reduce the need of others to negatively sanction a person, and thereby, the negative emotional flow that can arise when individuals

imposed negative sanctions on each other. People are motivated to avoid shame and guilt, and if they feel that they have violated moral codes or not met expectations of others, they become motivated to change their behaviors and make apologies to others, which can only work to increase solidarity and the power of groups regulated by expectations and moral codes. Thus, with *shame* and *guilt*, social bonding and group formation become that much more viable because they are driven by powerful emotions of social control, and so, these emotions would dramatically enhance fitness on the African savanna. Moreover, they would eventually make viable even larger and more complex sociocultural formations organizing humans.

Because shame and guilt are so painful, another dynamic often comes into play: repression of either or both emotions. The very connectivity that makes these emotions possible also enables humans to push them out of conscious awareness, probably into the hippocampus which has memory-formation functions and, in this case, memory-hiding functions. Once repressed, however, negative emotions in general and certainly *shame* and *guilt* often transmute into one of their constituent emotions. I have hypothesized that in the case of shame and guilt, it is the second emotion in the hierarchy outlined in Table 2.4 that is most likely to emerge in a person's behaviors. That is, *shame* transmutes into *diffuse anger*, while *guilt* transmutes into *diffuse anxiety*. These emerging emotions can be painful, particularly on social relations and group solidarity, but they do protect self from some of the intense pain of shame or guilt. Shame in particular is a dangerous emotion because once repressed, it increases in intensity and then escapes the cortical censors as *diffuse anger* that disrupts social bonds and, if experienced collectively, can lead people to attack groups and larger social structures. Thus, these emotions of social control can become out of control in their transmuted form and pose dangers to individuals and sociocultural formations.

In Table 2.5, I visualize repression as the master emotion of repression, with other defense mechanism channeling the emotional valences in various directions. Thus, the emotions listed

**Table 2.5** Repression, defense, transmutation, and targeting of emotions. (Source: Turner 2007)

Repressed emotions	Defense mechanism	Transmutation to:	Target of:
Anger, sadness, fear, shame, guilt, and alienation	Displacement	Anger	Others, corporate units <sup>a</sup> and categoric units <sup>b</sup>
Anger, sadness, fear, shame, guilt, and alienation	Projection	Little, but some anger	Imputation of anger, sadness, fear, shame or guilt to dispositional states of others
Anger, sadness, fear, shame, guilt, and alienation	Reaction formation	Positive emotions	Others, corporate units, categoric units
Anger, sadness, fear, shame, guilt, and alienation	Sublimation	Positive emotions	Tasks in corporate units
Anger, sadness, fear, shame, guilt, and alienation	<i>Attribution</i>	<i>Anger</i>	Others, corporate units, or categoric units

<sup>a</sup> Corporate units are structures revealing a division of labor geared toward achieving goals

<sup>b</sup> Categoric units are social categories which are differentially evaluated and to which differential responses are given. Members of categoric units often hold a social identity

on the left column are repressed, transmuted by specific defense mechanisms listed in the middle of the table, and then target and lock onto certain basic social objects—self, others, categories of person, or social structures—arrayed in the right column of the table. At the bottom of Table 2.5, I have listed *attribution* as a defense mechanisms, which is a bit out of the ordinary because this is usually a cognitive process but it is also the most important defense mechanisms from a sociological point of view. People make causal attributions for their experiences and, thereby, see self, others, situation, categories of others, or social structures as responsible for their emotions—whether positive or negative. When people experience a negative emotion like *diffuse anger*, they make a causal attribution; and people generally make *external attributions* for negative emotions, particularly negative emotions fueled by such powerful emotions as *shame*. Thus, negative emotions evidence a *distal bias* (Lawler 2001; Lawler et al. 2009). In contrast, positive emotions reveal a *proximal bias* and circulate locally between self and others, thereby ratcheting up the positive emotional energy in interaction rituals (Collins 2004; Lawler 2001; Lawler et al. 2009). Thus, to the extent that positive emotions are generated, attribution dynamics charge up solidarity, group symbols, and commitments to these symbols; and so, attribution dynamics may have evolved early during the time that emotions were increasingly used by hominins to forge social bonds and groups. But, once in place, attribution dynamics could convert negative emotions into acts that

break social relations and social structures down. So, attribution can be a double-edge sword.

In sum, then, analysis of the brain, especially comparative analysis of the human and ape brain, gives a real sense for what transpired in the 8 million years of evolution once hominins split off from the ancestors of present-day apes. The ecology of apes changed much less than the ecology to which hominins were forced to adapt; and so, while the evolution of apes was not static over the last 8 million years, apes still represent our best picture of what the neuroanatomy of our last common ancestor was like. And so, differences in the wiring of the ape and human brain represent the handiwork of natural selection as it worked to make hominins more social and group oriented because, without the capacity to form stable groups, the ancestors of humans would have gone to the graveyard like virtually all species of apes. What kept our ancestors alive was not culture but emotions, probably organized into a quasi language that used an ever-larger palate of emotions to forge social bonds and build up loyalties to groups. Only very late in hominin evolution did culture and spoken language evolve, but culture and language would have no teeth or power to control without the *prior* wiring of our brains for emotions. And, little has really changed, because social solidarity, groups bonds, attachments, legitimation of social structures, and social control depend far more on emotions than culture or language, although second-order elaborations of emotions like *shame* and *guilt* required some elements of proto-culture, such as

expectations for particular actions, to increase the control capacity of emotions.

As I explore below as the last element of Maryanski and my methodology for evolutionary sociology, there were many other hard-wired behavioral propensities in all apes that could have been used to forge social bonds among hominins. Yet, apparently they were not enough to make savanna-dwelling apes sufficiently fit to survive open-country savanna conditions. If they had been adequate, none of the re-wiring of the brain for enhanced emotions would have been necessary. Still, with increased emotionality, these other behavioral propensities would *all be enhanced* and, together with the super-charging effects of emotions, they explain not only human emotionality but also the basic mechanisms by which humans interact and develop more enduring social bonds.

### 2.3.5 Additional Behavioral Capacities and Propensities

In addressing the issue of “human nature” we are, essence, asking what behavioral propensities are hard wired into human neuroanatomy. All mammals have these propensities, and they vary depending upon the selection pressures generated in the ecology in which a species has evolved. Evolution is a conservative process and does not generally eliminate older behavioral propensities, but instead, adds new ones that may come to dominate over older ones. Given enough time, however, a behavioral propensity, if it is harming fitness, will be eliminated as all those members of a species who possessed this trait would simply die out, while those without it would survive and multiply. As I have emphasized thus far, natural selection worked on apes to eliminate behavioral propensity to form groups or even strong social ties, even in kin groups, because of ecological constraints imposed by the terminal feeding niches in the arboreal habitat. But, once the forests receded and pushed apes to the African savanna floor, they had to survive in an entirely new habitat where the grouping propensities lost to natural selection would now be highly adaptive. Yet, even after wiping out propensities

to form local groups and strong ties, a number of behavioral propensities that could be selected upon for more sociality remained, as I explore below. Moreover, there also existed pre-adaptations that evolved as a byproduct of changes in ape anatomy that could later be selected upon when apes were forced to the savanna floor. Probably the most important and distinctive trait of primates in general and all apes is their visual dominance, as I mentioned earlier, but let me start here and elaborate this and other traits in apes as they descended from the trees to the dangerous life in open-country savanna (Turner and Maryanski 2012).

1. *Visual dominance over haptic and auditory sense modalities, thereby subordinating other sense modalities to vision* (Maryanski and Turner 1992; Jarvis and Ettlinger 1977; and Passingham 1973, 1975, 1982, pp. 51–55). As mentioned earlier, some 63 million years ago, a small insectivore crawled or clawed its way into the arboreal habitat to initiate the primate line. This animal was, like most mammals, olfactory dominant; that is, smell was its dominant sense modality and the principle means by which it acquired information from its environment. All other sense modalities—vision, haptic (touch), and auditory (hearing)—were subordinated to smell so as to avoid sensory conflict. Smelling one’s way around a three dimensional environment is very limiting, whereas seeing one’s way would be fitness enhancing, and so over time, natural selection moved the eye sockets forward to produce overlapping and, hence, three-D vision for depth and distance, and eventually color vision as well. All primates are visually dominant, and as a result, humans are visually dominant. As soon as we smell, hear, or touch something of interests, we look at what we are sensing, with visual cues subordinating other sense modalities.

This shift to visual makes primate rather unique among mammals; a few other mammals like bats are auditory dominant and bounce sound waves off objects to maneuver in their environments. What made the movement to vision so important is that it would

be the dominant way in which all primates and eventually humans interact. We are highly attuned to visual cues from face and body language; and this visual language evolved before spoken language. We tend to see non-verbal languages as subordinate to auditory or spoken language, but in reality the opposite is the case. Body language evolved before spoken language, and more significantly, it is still dominant, especially when reading emotions. In fact, language capacities in general, including speech, are only possible because of the pre-adaptation that rewiring the primate brain for visual dominance created. A preadaptation is a trait installed by natural selection that is an outcome of selection for other traits; it is simply a byproduct of selection for these other traits, but it potentially can be selected upon if its enhancement would increase fitness. And, eventually such was the case for humans and perhaps late hominins like *Homo erectus* because, as is evident in humans, the temporal lobe leading to the association cortices around the inferior parietal lobe is devoted to spoken language production and comprehension, especially around Broca's area for speech production and Werneicke's area for speech comprehension and uploading into the meta-language by which the brain organizes through and thinking.

2. *The ability among the great apes to learn and use language at the level of a three-year-old human child* (Geschwind 1965a, 1965b, 1965c, 1985; Geschwind and Damasio 1984; Rumbaugh and Savage-Rumbaugh 1990; Savage-Rumbaugh and Lewin 1994; Savage-Rumbaugh et al. 1988, 1993; Bickerton 2003). Again, as noted above, the *rewiring* of the brain to convert primates to visual dominance also created the potential for language production and comprehension. This neurological capacity for language is not evident in primates without, it seems, a corresponding increase in overall intelligence. Among primates, only the great apes have the requisite threshold level of intelligence to learn language. Apes became smarter than monkeys because they lived in the more dangerous niches of the arboreal

habitat—high in the trees where branches are thinner and a mistake in calculating their strength leads to death by gravity.

I have argued (Turner 2000) that this capacity for language did not just “sit there” for millions of years but instead it was selected upon early in hominin evolution to create a visually based language that could communicate emotions among our hominin ancestors. This language is thus more primal and, in important ways, *more* primary than speech. Emotions are read by looking a face and bodies more than by listening to what people actually say or their voice inflections; and so, social bonding and attachment is as much, if not more, of a visual more than auditory process. For example, when someone says that “I love you,” we look to their face and body to really be sure that this is being said sincerely.

Older data on infants supports this view that a body language built around emotions preceded spoken language ((Emde 1962); Ekman 1984; Sherwood et al. 2004, 2005, 2007, 2008). As I noted earlier, newborn babies can read all of the primary emotions in their caretakers within weeks and birth, and they can imitate these emotions in their *facial expression* whereas it takes two years of babbling before an infant can even begin to form sentences; and since evolutionary sequences often mirror evolutionary sequences, I have more confidence that the body language of emotions evolved long before spoken language (because the changes that would have to occur to primate vocal tracks, lips, and facial muscles are extensive, and these could not occur rapidly). More recent support to this conclusions comes from chance discoveries of the genes regulating the muscles and tissues necessary for fine-grained speech production; the data indicate that these have been under intense selection for only about 200,000 years, which is just about when humans first emerged (Enard et al. 2002a, 2002b). Thus, complex and highly refined enunciation may be unique to humans, with hominins having cruder vocal responses and relying primarily on the language of emotions signaled through face and body.



3. *The behavioral propensity to follow the gaze and eye movements of others* (Hare, et al. 2001, 2006; Povinelli 1999; Povinelli and Eddy 1997; Itakura 1996; Baizer et al. 2007; Tomasello et al. 2001; Tomasello and Call 1997; Okomoto et al. 2002). This propensity argues that apes and, hence, all hominins and humans are wired to look at eyes, to follow gazes, and to interpret their meanings—thus making interaction in groups a process of watching face and, particularly, eye movements. This conclusion is supported by the propensity for face-monitoring for signs of action of conspecifics particularly for emotional content (Leslie et al. 2004, Gazzaniga and Symlie 1990). Apes can communicate in very subtle ways with their face—so subtle that researchers have yet to figure out how this facial communication occurs (Menzel 1971; Stanford 1999; Mitani and Watts 2001; Turner and Maryanski 2008). By visual cues that humans often cannot decipher, chimpanzees can coordinate instrumental actions. For example, several chimpanzees intending to eat a baboon wandering through their patch of forest will communicate visually instrumental actions without emitting any auditory sounds. They, in essence, say with their eyes “you go there flush the prey out, and I will catch the prey as it runs, and then we will eat it together.” So, already built into the ape line is the capacity to communicate, even instrumental actions where coordination of roles occurs, through eyes and face alone; it should not be surprising that humans have this capacity, and moreover, that it would be selected upon during hominin evolution.
4. *The propensity to use imitation to learn appropriate facial and body signals and behaviors* (Tomonaga 1999; Subiaul 2007; Horowitz 2003; Gergely and Csibra 2006). Apes appear to be programmed to imitate gestures of conspecifics, and especially those that carry meanings and communicate intentions and dispositions. This capacity could be dramatically expanded upon by natural selection if such signals had fitness-enhancing value among hominins; and since emotions are best

read through body language, selection could “kill two birds with one stone” because by enhancing the range and subtlety of gestural communication, it would also be increasing the capacity for more nuanced emotional communication, if more nuanced emotions would also have fitness-enhancing consequences.

5. *The larger decision-making prefrontal cortex among humans compared to apes* (Semendeferi et al. 2002). The enlarged prefrontal cortex of humans compared to that of apes indicates that selection favored not only control of emotions but also use of emotions to provide the markers of utility or reward-value in making decisions (Damasio 1994); and if this capacity enhanced fitness, it could also be used for additional control of emotions and for their use for more instrumental purposes in an emotion-based language system.

It is evident, then, that natural selection had a great many neurological capacities on which to select for language, but a visually-based language probably built from emotions that reveal phonemes, morphemes, and syntax strung out in a series of gestural displays that “speak” to people (Turner 2000).

Yet, social bonding and solidarity did not have to depend solely on neurological capacities for a visually based language. Primates today and, hence, our common ancestor with primates, reveal other hard-wired behavioral propensities that increase sociality. Just like emotion-generating systems and the pre-adaptation for language facility, these too could be selected upon to increase sociality of hominins. Let me list the most important of these (Turner and Maryanski 2012):

1. *The capacity among great apes to experience empathy with conspecifics* (deWaal 2009). It is clear that the great apes, particularly chimpanzees—humans’ closest primate relative—can empathize with conspecifics. They do so by reading gestures, especially those revealing emotional states but also instrumental states as well. Remarkably complex emotional states such as sympathy are apparently experienced, calling on a chimp to engage in

efforts to help those fellow chimpanzees experiencing distress and other negative emotions. Thus, apes clearly have the capacity to engage in what George Herbert Mead (1934) termed role-taking and, indeed, in-depth role-taking of emotional states, or what I have come to term emotion-taking (Turner 2010a, b). This is a hard-wired capacity that was part of the hominin neuroanatomy and, thus, could be selected upon and enhanced, if empathy had fitness-enhancing consequences. And so, in contrast to Mead's skepticism about non-human animals having the capacity to role take, it is clear that interaction with gestures carrying common meanings and understandings of emotional states takes place among apes and, no doubt, among our distant common ancestors with apes. No new mutations would be necessary for this capacity to evolve; it was already in place and could be enhanced by selection on tail ends of the Bell curve describing its distribution in the hominin genome.

2. *The rhythmic synchronization of bodies, especially of emotions, via mirror neurons* (Rizzolatti et al. 2002). Although mirror neurons were first discovered in monkeys, they are also part of ape and human neurology. The same neurons of persons who are role taking with others will tend to be activated when observing the responses of others. Mirror neurons are thus one of the mechanisms of empathy and role taking, and this mechanism is ancient and hard-wired into higher-primates. Thus, if role-taking and empathy would have fitness-enhancing value by creating bonds of solidarity, mirror neurons were available for further selection—although perhaps such selection was not needed. The capacity to fall into rhythmic synchronization, as emphasized by Collins (2004), is a neurological as much as a cultural process. It has been part of the higher-primate genome for millions of years and, thus, was part of the hominin and human genome.
3. *The capacity of chimpanzees to engage in a practice described by researchers as “carnival” in references to collective emotional dis-*

*plays by human in various carnival-like festivals seen around the world* (e.g., New Orleans, Rio). Emile Durkheim (1912) described emotional “effervescence” among periodic gatherings of Arunta aboriginals around Alice Springs, Australia. Similarly, chimpanzees and, perhaps, humans' last common ancestor who was probably even more weakly tied than chimpanzees, probably possessed this capacity for solidarity-generating emotions to be aroused in periodic gatherings of conspecifics. Chimpanzees are known to engage in carnival when gathered together, and the descriptions of carnival are very much like those of Baldwin Spencer's and Francis Gillen's description of aboriginals and Durkheim's secondary description from Spencer and Gillen's (1899) famous work on the tribes of central Australia. Carnival among apes and later hominins was probably only periodic because most apes move about their home ranges, but as hominins began to form more permanent groupings, the neurology behind carnival may have become a critical mechanisms in creating and sustaining group solidarity, just as Goffman (1967) and Collins (2004) have emphasized in their respective extensions of Durkheim's basic insight. Humans create a more mild form of effervescence during virtually all interpersonal encounters and interaction rituals. Thus, the propensity for carnival, if selected on, could be extended to almost all interaction rituals on a dramatically less intense scale to generate the same solidarity-generating consequences as interaction rituals do today among humans, if building up solidarities was critical to survival of hominin on the savanna.

Moreover, carnival and effervescence make happiness a more powerful emotion, and indeed an emotion that can mitigate against the power of the three negative emotions. And so, anything that would increase the salience of positive emotions would be fitness enhancing for hominins desperate for more group organization and solidarity. Episodes of carnival gave natural selection something to work on to produce lower-key interaction rituals generating positive emotions and eventually commitments

to group symbols as late hominins began to acquire the capacity to use symbols.

At first, solidarity was purely emotional and did not invoke culture, beliefs, or norms. For, solidarity can exist and, indeed does occur in more intense forms among chimpanzees, *without* cultural props. Indeed, like language more generally, the cultural embellishment and perhaps normative regulation of carnival and its lower-key variants in interaction rituals are simply add-ons to an already extant neurological capacity that humans share with common chimpanzees and, of course, their hominin ancestors

4. *The propensity for reciprocity in the give and take of resources.* Reciprocity is evident in apes and, indeed, in many higher mammals. It is particularly developed in apes and humans and is the central dynamic of exchange theoretic descriptions of *interaction* and group processes (Cosmides 1989; deWaal 1989, 1991, 1996; deWaal and Bronson, 2006). With expanded emotional repertoires, coupled with the capacities listed above, it is not difficult to see how natural selection enhanced this sense of reciprocity, creating a need for reciprocity and arousing negative emotions and negative sanctions when reciprocity is not honored. Thus, a hard-wire propensity for reciprocity was already wired into the higher mammals, and all higher primates, and was therefore available for selection to work on.
5. *The behavioral propensity to compare shares of resources with others in making judgments of fairness in their respective distributions.* Monkeys and apes both reveal the behavioral propensity to calculate fairness in the exchange of resources. A capuchin monkey, for example, will stop exchanging with a trainer if another monkey is getting more food (Bronson et al. 2003, 2005). Chimpanzees will do the same thing, and in fact, they can often get violent if they feel left out of the distribution of resources. Moreover, a recent study reports that one chimpanzee exchanging with a trainer stopped when it saw that another chimp was not getting his fair share of resources, indicating a complex process of role taking, empathy,

reciprocity, and justice calculations leading to altruistic behavior, which, it seems, all great apes possess, as did our common ancestor. Rather complicated calculations of justice and fairness involving shares of resources, behaviors produced to receive these resources, and comparisons of one's resources with those received by others can, again, occur without culture or even rules of fair exchange; and this hard-wired ability could be selected upon to promote group solidarity. What is necessary is the capacity to arouse emotions over these calculations, with fairness and unfairness generating automatic emotional arousal without invoking a moral yardstick calibrated by cultural symbols. While the notion of non-cultural morality may seem an oxymoron, such a conclusion only highlights the sociological bias toward social constructivist arguments. Morality is not just cultural; it is deeply sedimented in human neuroanatomy and evident early in primate evolution. Indeed, morality would have no power to control people if such was not the case. Morality is driven by emotions and only later in hominin evolution, perhaps with late *Homo erectus*, did cultural codes become a part of the hard-wired emotional capacity to sense justice and fairness in exchanges. Morality in this biological sense enhances solidarity and binds individuals to groups, and so it was likely grabbed by natural selection and enhanced in hominins long before the neurological capacity for symbolization with arbitrary signs and the consequent development of beliefs and ideologies in late hominins evolved.

6. *The ability to recognize an image in a mirror as a reflection of self as an object in the environment* (Gallup 1970, 1979, 1982). This capacity exists among all of the great apes, and a few other higher mammals (elephants, dolphins, and probably whales, but how would one find a mirror large enough to measure this in a whale?). All of the behavioral capacities listed above are dramatically enhanced with self-recognition and self-awareness. When animals can see themselves as objects vis-à-vis others, they are more likely to evaluate

themselves in reference to what they perceive to be the expectations of others, the expectations for reciprocity, the expectations for fairness and justice in distributions of resources, and the expectations that come with empathy and role-taking. By simply enhancing sense of self as “an object in the environment” (as G. H. Mead 1934, phrased the matter), self-directed and controlled behavior involving expectations, emotions, and non-cultural morality can evolve. Selection could have hit upon enhancing the capacity to see oneself as an object, and in conjunction with increasing the complexity and nuance of emotions so that hominins could experience such emotions as pride and shame (as emphasized by Charles Horton Cooley 1902), thereby increasing the capacity for self-control through the language of emotions. And, this kind of self-control could be achieved millions of years before cultural forms of morality evolved. And so, while chimpanzees cannot experience pride and shame (Boehm 2012), proto-shame and guilt could conceivably have evolved early in hominin evolution after the split with the ancestors of chimpanzees and other great apes.

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## 2.4 New Kinds of Selection Pressures and Co-evolution

Natural selection was working under intense pressures to make hominins more social and group oriented. Emotions were the key to this transformation of hominin neuroanatomy, in several senses. First, emotions, *per se*, create social bonds if they are positive; and so natural selection worked to expand the palate of emotions in ways that increased the proportion of positive emotions and dampened the effects of negative emotions. Second, the expansion of emotions as outlined in Tables 2.2, 2.3, and 2.4 would increase the power of all of the additional characteristics of apes and hominids that increase sociality. A more nuanced palate of emotions intensifies empathizing, role taking, a reciprocating, calculating justice, viewing self and others, social control, or just about any other capacity that facilitates bonding.

In addition to these interaction effects, these additional behavioral traits can be seen as exerting selection pressures on the enhancement of emotionality. If emotions enhance sociality, bonding and group formation, *per se*, it has even more power when attached to these additional behavioral capacities possessed by all great apes and the common ancestor to apes and humans. And so, the existence of abilities that could potentially increase group formation were already wired into apes and, little doubt, hominin neuroanatomy; and these hard-wired propensities exerted selection pressures to enhance emotions. Indeed, since these capacities are already so developed in apes, it may be that they were enhanced by simply expanding the emotional palate and integrating it with the wiring for empathy, role taking, reciprocity, justice calculations, and self-conceptions.

If this argument is plausible, it helps explain why the emotional capabilities of hominins and humans developed so far beyond the ape measure. I have often thought that there were enough extant capacities for social bonding and group formation that could be enhanced so as to make the expansion of emotions less necessary for group formation. Surely, if empathy, role taking, self-awareness, senses of justice, reciprocity, and the like could be further developed by natural selection, the dramatic expansions of emotions would have been unnecessary, especially since emotions can turn so negative and disrupt social relations. I have never had an answer to this issue, but perhaps it has been starting me in the face all along. If emotions are the best way to enhance and give more power to all other interpersonal behaviors that are also wired into ape and hominin neuroanatomy, then these behavioral capacities put selection pressures on emotions to expand, because only with emotions do these interpersonal processes begin to have real power and teeth in controlling individualistic apes and making them more social and group oriented.

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## 2.5 Conclusion

There is a great deal of speculation in this chapter, but it is speculation that uses empirical facts, such as the dramatic rewiring of the subcortical

areas of the brain for emotions. The methodology that I have proposed and employed with Alexandra Maryanski provides, I believe, a strategy that allows us to get a handle of what happened in the distant past; and while speculation will always be involved because social behaviors do not fossilize, it is speculation that fits the current data that can be assembled. For some, a chapter like this is not only speculative but irrelevant since many believe that humans construct their reality with their capacities for language and culture. This standard social science model is no longer adequate, however. Humans are animals that evolved like any other animal; and our traits are the consequence of adaptation to various habitats and niches in these habitats by our distant and near primate relatives. To assume that culture explains everything is, in essence, an approach that explains very little. Hominins had had to get organized, or die, long before the neocortex grew much beyond that of a contemporary chimpanzee; and thus, it is inconceivable that the only force regulating social conduct and social organization is cultural. Hominins had to get organized without the benefit of culture; and the only hard evidence about how they did so is in the wiring of human brain when compared to the brain of a chimpanzee or any great ape. The differences in subcortical areas of the brain and in the level of connectivity between the subcortex and neocortex are the “smoking gun” of what natural selection did, long before culture evolved as a consequence of natural selection late in hominin development. If we know how the brain became rewired, what the selection pressures were that drove this rewiring, and how emotionality interacts with other hard-wired behavioral propensities of our closest relatives, we have a pretty good idea of how emotions evolved but, equally important, we have much more understanding of how they operate among humans in the present, and what the neurological mechanisms driving this operation are. In essence, we know more than we did before adopting an evolutionary perspective that calls into question many of the false presumptions about culture advanced by social constructionists. With time, and in the not too distant future, the methodologies for measur-

ing and understanding specific brain assemblages will increase, and dramatically so since it is almost impossible today to keep up with advances in neuroscience. Sociologists need to be more than bystanders as this band marches by us; we need to be in the band, using this knowledge to help us understand our domain of the universe. Moreover, neurology can benefit from a sociological perspective because we have a better understanding, if we will only open our eyes to evolutionary thinking, about the selection pressures that led to the rewiring of the brain; and this knowledge can help neurologists in their search to understand brain systems. This is why I advocate for a neurosociology as a central, rather than marginal or fringe activity, in the discipline (Franks and Turner 2012).

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