PART II

DEEP HUMAN HISTORY

INTRODUCTION

The renewed Darwinian (RD) theory of human behavior that was presented in Part I cannot be considered complete until it also explains how the human brain, as described, could have evolved by Darwinian evolutionary mechanisms. This is the central task of Part II.

The chief theoretical puzzle that must be solved is the one posed by Wilson and cited in the Introduction: How could humans have evolved, by means of Darwin's natural selection mechanism, a brain which, before civilization existed, had the ability to create civilization? This question will be taken up immediately in Chapter 4. I will use Darwin's own method of deep historical analysis to provide our answer, drawing particularly on recent discoveries of paleontologists and physical anthropologists. In the process, I will make use of the two Darwinian selection mechanisms that have been relatively neglected by biologists but which are essential to the evolution of two special human features—the independent drives to bond and to comprehend. In doing this, I will need to answer the argument made by most biologists that a genetically-based tendency toward altruism (read *bonding*) could never become established in the hominid line, since it would quickly be eliminated by "free-riders" acting consistently with their natural-selection-based drives to acquire (dA), and to defend (dD).

Chapter 5 will address the period of transition from the deep pre-history period of human life to the historic period. This transition was ushered in by the well-known four big cultural/technological changes: the domestication of animals and plants, the development of settled agriculture, the invention of metallurgy, and the invention of writing. It was during this time that our genes yielded the cutting-edge of human change to cultural change and later to scientific change. Finally I will offer a brief overview of the genetic heritage of humans at this time of transition.

This transition also provides an opportunity to analyze the emergence of the human trait which, according to Darwin, most clearly distinguishes humans from the lower animals; namely, the human conscience. Is this really a genetically-based trait? If so, how could it have evolved in the presence of the free-riders who could be expected of take brutal advantage of conscience-

guided behavior? And, if the humans with a conscience persisted, what could have happened to all the free-riders? These questions will be addressed in Chapter 5, but not resolved until Part III.

Chapter 6 will conclude Part II with an overview of the renewed Darwinian (RD) theory of human behavior, before our story moves into the historical interpretation in Part III and contemporary application in Part IV.

CHAPTER 4

DARWIN REDISCOVERED:

HOW THE HUMAN BRAIN EVOLVED

It is not the strongest of the species that survives, nor the most intelligent.

It is the one most adaptable to change. ---Charles Darwin

For many years, evolutionary biologists, archeologists, and paleoanthropologists have been struggling with a serious puzzle, a mystery really. How did the line of smart hominids that evolved from the upright woodland ape/man, *Homo habilis,* make the evolutionary turns that produced modern *Homo sapiens?* The fact that sharpens the mystery is that the archeological record points to two dramatic shifts in the life of these hominids. The first took place around two million years ago with the emergence of a new species, *Homo erectus,* the first hominid to populate not only Africa, where it originated, but also large parts of Eurasia. The latest discoveries even indicate that *Homo erectus* probably survived in a dwarfed and isolated form until around 25,000 years ago. The second major shift, known as the Upper Paleolithic Transition (UPT), took place around 150,000 years ago. *Homo erectus,* a hominid whose tools were probably limited to fairly simple ones made of wood and stone, evolved into modern *Homo sapiens,* the human species which possessed language, sophisticated technologies, and complex tribal institutions, and which developed modern civilizations as we know them today.[i]

> Steven Pinker described the dramatic UPT shift in these terms:
>
> Calling it a revolution is no exaggeration. All other hominids come out of the comic strip *B.C.*, but the Upper Paleolithic people were the Flintstones. More than 45,000 years ago they somehow crossed sixty miles of open ocean to reach Australia, where they left behind hearths, cave paintings, the world's first polished tools, and today's aborigines. Europe (home of the Cro-Magnon) and the Middle East also saw unprecedented arts and technologies, which used new materials like antler, ivory, and bone as well as stone, sometimes transported hundreds of miles. The toolkit included fine blades, needles, awls, many kinds of axes and scrapers, spear points, spear throwers, bows and arrows, fishhooks,

> engravers, flutes, maybe even calendars. They built shelters, and they slaughtered large animals by the thousands. They decorated everything in sight—tools, cave walls, their bodies—and carved knick-knacks in the shapes of animals and naked women, which archeologists euphemistically call "fertility symbols." They were us... [This] first human revolution was not a cascade of changes set off by a few key inventions. Ingenuity itself was the invention, manifested in hundreds of innovations tens of thousands of miles and years apart.[ii]

Ingenuity, in RD theory terms, is an expression of the drive to comprehend (dC).

Scholars know much less about the earlier shift from *Homo habilis* to *Homo erectus* because the fossil and artifact record is much more limited, but it is known to have been a major step toward evolving the human brain.[iii] Some of the most recent findings about this transition have been pulled together in a new theory by Richard Wrangham and his colleagues in their 1999 paper, "The Raw and the Stolen: Cooking and the Ecology of Human Origins."[iv] They comment in their introduction: "Cooking is a human universal that must have had widespread effects on the nutrition, ecology, and social relationships of the species that invented it." They suggest that signs of the use of fire for cooking are being found that date around 1.9 million years ago, the same time period during which scholars estimated that the new species, *Homo erectus* evolved. In concluding their article, the authors discuss the emergence of pair-bonding: "The framework we have developed merely provides a starting point for understanding how sexual alliances influence the evolution of the nuclear family." The formation of the nuclear family would be the first concrete expression of an independent drive to bond (dB) in the adult males of the hominid line.

What happened at these two critical transition periods that can account for what science now knows about the modern human brain? Edward Wilson has framed this puzzle: "Natural selection… does not anticipate future needs. But this principle, while explaining so much so well, presents a difficulty. If the principle is universally true, how did natural selection prepare the mind for civilization before civilization existed? That is the great mystery of human evolution."[v] This is the transition mystery that must be solved before evolutionary biologists can take seriously the renewed Darwinian theory of human behavior presented in the previous chapters. This is the mystery I will now address, relying primarily on clues that Darwin himself has provided. To anticipate my argument, I believe the first transition was accomplished by

means of the Darwinian mechanism of natural selection in combination with the sexual selection mechanism, which was guided by an emerging mate-choice skill set first expressed in females. I believe the second transition was accomplished by natural and sexual selection in combination with the Darwinian mechanism of "group" selection. The changes at this time extended the drive to bond to the tribal level and established the independent drive to comprehend. This second change process was aided by an emerging skill set derived from dD: the ability to detect and control the cheating and anti-social behavior of others. In effect, the answer to Wilson's puzzle is that all three Darwinian mechanism were involved, not just natural selection. So by reexamining largely neglected clues that Darwin himself has provided, in combination with the various leads developed by contemporary scholars, I believe we have available a new explanation of Wilson's mystery that deserves careful testing. It is an explanation of the evolutionary path that led to the complex human brain described in previous chapters.

There have been, of course, many earlier efforts to explain the mysteries of these two transitions and these contributions will be fitted into my picture. I am referring primarily to the role of the new cognitive powers of the evolving human brain—powers that made possible spoken language, diverse skill sets, and a greatly enhanced memory. These, in turn, created culture, which proved to be a fundamental change agent in itself. These nature and nurture features co-evolved alongside the changing nature of our primary unconscious drives, our ultimate motives.

The long story starts with the triggering event proposed by Wrangham and his colleagues, the invention of cooking.

The Control of Fire and the Development of Cooking

Wrangham and his colleagues based their thinking on the obvious fact that, at some early point, hominids learned to control fire and subsequently discovered the utility of cooking. This was no minor invention. It triggered a sequence of events that changed many aspects of hominid life. The date of this discovery is disputable, but the magnitude of the changes it led to is hard to challenge. As Wrangham argues, cooking made it possible to consume many plants that were otherwise inedible, either because they were too tough to chew (such as many roots) or because they were toxic when eaten raw. Cooking also made it possible to retard spoiling, which allowed some storing of edibles. It also must have greatly shortened the time that had to be taken every

day to eat, by eliminating the time needed to chew up uncooked food. All of the above is evidenced by the smaller teeth of *H. erectus* compared to those of *H. habilis*. Further, Wrangham argues, the fact that the body mass of females increased at this time indicates a more adequate diet. However, since food would have to be brought to the fire and cooked before consumption, it would be much more vulnerable to theft, particularly by the larger males. The females, who most probably gathered the vegetables, would be looking for help in guarding the food, preferably reliable males willing to stick with them—to bond with them. The females who were successful in mating with dependable males would have improved the odds that their increasingly dependent offspring would survive environmental hazards, including infanticide, and grow to maturity.

Thus cooking, which almost certainly females would have done, seems, paradoxically, to have made a significant difference in the long, long struggle for equivalent power and rights for hominid females**.** It also would have sharpened the division of labor, since males would be freer to go on increasingly extensive and risky searches for meat, knowing that, even if unsuccessful, they would at least find some cooked vegetables to eat on their return home.

All of these factors led Wrangham to conclude that the advent of cooking was instrumental in establishing long-term pair-bonding in hominids, the defining characteristic of this new species. Up to this point, Wrangham's argument has all been based on the operation of natural selection on the behavior of late *H. habilis* and early *H. erectus*. It should be noted that this might have been the first time (the only time?) in biological history that a cultural/technical event (cooking) triggered, not just a genetic-based change, but even a transition to a new species.

At this point, I will introduce the argument for the key influence of sexual selection on the motivational/emotional brain of these hominids during this complex change process. This argument requires some background on sexual selection as a Darwinian mechanism and on the speciation process more generally.

The Power of Sexual Selection

In many species, sexual selection has been found to be a very powerful engine of genetic change, sometimes more powerful than natural selection. In Darwin's theory of evolution, three hurdles must be cleared for an individual organism's genes to be passed to the next generation. First, the organism must survive all environmental hazards and reach reproductive age. This is

the natural selection stage. Second, if it is a member of a bi-sexual species, it must find a willing or overpowerable mate with whom to consummate the reproductive act. This is the sexual selection step. Finally, their immature offspring must receive whatever nurturing is essential for surviving to adulthood. Only by clearing all three hurdles will the genes of any given individual organism survive beyond its lifetime. The circumstances of the hominid line two million years ago would most likely have enhanced the power of sexual selection in relation to natural selection. By that time, these smart hominids would have mastered many of the hazards of natural selection—predators, natural disasters, food and water shortage, disease, and so on—making the hurdle of sexual selection more decisive. In hominids, success with both the second and third hurdles is largely determined by the sexual (or mate) selection choice for reasons explained in the next few paragraphs.

Evolutionary biologists have hypothesized for some time that, at some point in the development of the hominid line, the natural selection process started to favor genes that delayed maturation, especially of the brain. This is evidenced by the fact that the skulls of human infants at birth are more pliable than those of chimpanzees, which enables the brains of human babies to continue to grow in size and complexity after birth, in comparison to those of other primates. As a result, our mature human brains are much larger than the size of the female birth canal would otherwise permit. However, the fragility of the brain cases of human infants, as well as other aspects of delayed maturation, mean that these infants require a much longer period of intense nurturing by adults in order to survive. It also means that human mothers—unlike chimpanzee mothers, who do essentially all the nurturing of their young—need significant help from other adults. Fathers, the suppliers of half of each infant's genes, are the logical candidates for this job.

Our hominid ancestors could not have known exactly how babies were made, but their genes surely provided them with a dA urge to experience the pleasures of sex after they reached puberty. They must have been observant enough to have figured out that sexual intercourse had a causal relationship to pregnancy. And, since human infants were maturing more slowly, the females figured out that it was not to their advantage to mate with the first male who expressed an interest in them but to be selective. They could see that they would have to experience nine months of pregnancy, then two to four years of breast-feeding, and even more years of protecting, feeding and training each child before it reached mature self-sufficiency. It would be difficult, and at times impossible, for the mothers to provide all of the required nurturing. And

there can be no doubt that, as mammal mothers, they loved their babies and their babies loved them. After all, the breast-feeding system must have evolved hand-in-hand with the long-term bond of mutual caring between mother and infant. The mothers must also have seen that their mates could either stick with them and help in this process or wander off in search of other females. With the advent of cooking, their need for a male to help guard the food was an additional reason to find a reliable mate. Female hominids realized that they had the power to choose which male they would mate with. It may even have dawned on them that this was no minor power, given the obvious strong urges of males to find some willing mate. Their minds were in all likelihood competent to realize, most likely with help from their mothers and other female friends in their group, that they were the gatekeepers to what males badly wanted. They could be choosy simply because males were not as choosy. Males had little at risk by engaging in the pleasures of sex compared to females. Evolutionary biologists term this *investment theory*: The greater investment of females in the consequences of the mating process placed most of the control of mate selection in their hands.

Mate Selection Criteria

Given their power of mate selection, whom would the *H. habilis* females tend to select as a "good" mate? Their choice would determine which male genes made it into the next generation. I submit that the answer is rather obvious. They would select the kind of mate that research tells us that women all over the world still prefer.[vi] Obviously, they would select a likely breadwinner with ambition, a person with a robust drive to acquire (dA). But that is not all. These females would also be looking for someone who was healthy, strong, and prepared to help in protecting them from all hazards, including food thieves—a person with a drive to defend them (dD). But that is still not all. They would also select a male who was in love with them, a person who, beyond all obvious self-interest, simply felt driven to bond with them in a long-term commitment (dB). This was the new criterion. They wanted a mate who had found the "sincerity" solution to the problem of making credible commitments, as discussed by the economist Robert Frank.[vii] They wanted a hunter who would actually bring the bacon home. In sum, I propose that the increasing female power of mate selection would have favored dA, dD, and also dB; three of the four innate drives which, according to the RD theory, underlie our distinctive humanity.

Darwin was always very interested in those who practiced selective breeding with animals and plants. Observing these professionals, he realized he was watching an evolutionary process guided by a purposeful mind. And the results were dramatic. Plants and animals could be guided by selective breeding to develop desired characteristics in a relatively limited number of generations. I argue that the females of the hominid line two million years ago had the mental cognitive capacity to act as selective breeders. They could look over the whole field for the males who displayed the innate traits they wanted in a mate. As long as the genes for a strong independent bonding drive manifested themselves in ways that choosy females could spot, those genes would wind up in some of their offspring. This was an awesome power and, in a small intermarrying group, this power could probably convert a population of totally promiscuous males into a population of good husbands and fathers in just a few thousand years. Monogamous nuclear families are not common among mammals, but there are examples such as the prairie voles we met in Chapter 2 and monkeys such as the muriqui and the marmoset, both in South America. Scientists have even done brain scans of marmosets, demonstrating that their brains respond to sexual scents not only in the usual sexual arousal area but also in other areas that reflect longer-term concerns. It can be done.

Where were these choice male hominids with dB as well as dA and dD coming from? They may have been the result of mutations, which delayed certain features of male maturation. The study of chimpanzees in the wild show clearly that both male and female infant chimpanzees display a drive to bond with their primary care giver, always their mother unless they are orphaned. And the mothers are clearly pre-wired to respond with maternal love (dB).[viii] All of this has been carefully reported by Jane Goodall and her collaborators. Richard Harlow also proved this many years ago with the famous experiments in which he offered baby monkeys a choice between cloth or wire "mothers." The babies greatly preferred the soft and cuddly cloth mothers even though the wire mothers had to be approached periodically since they had the nursing bottle attached. This drive to bond seems to be switched off in male chimpanzees when they reach puberty, but that hypothesis can and should be tested by further research. If it is true, then it is reasonable to presume that, during the transition from *H. habilis* to *H. erectus*, some males stopped experiencing a similar puberty switch-off. Once such males were preferentially selected for mating by females, this mutation for an independent drive to bond in males would have multiplied in a small interbreeding population. This process would logically progress to the

fixation of *H. erectus* as a reproductively separated species. The new species would be employing a stable family structure to its competitive advantage: A higher percentage of their babies would grow to maturity. While this transitional explanation is speculative, there can be no doubt about the big difference between the family life of *H. sapiens* and that of chimpanzees.

Studies of chimpanzees have made it very clear that their sexual behavior is radically different from that of humans. Long-term bonding between sexual partners has not been observed among chimpanzees nor among pigmy chimpanzees, the bonobos. To the contrary, both genders in both species are entirely promiscuous. Careful observers of the behavior of chimpanzees in the wild and in captivity cannot determine the paternity of newborns except by laborious DNA testing and there is no reason to believe the mothers or fathers can tell, either. Among humans, however, long-term mate bonding, monogamy, is the norm. Monogamy is observed as the norm in almost all cultures. Polygamy is rare in hunter-gatherer bands and, in the historical period, it has only been widely practiced among the elite ranks of highly stratified societies.

While marital infidelity occurs in all recorded cultures, it is seen as deviant behavior to be engaged in surreptitiously. It is a somewhat dangerous game in all cultures. The point of all this is that monogamy and fidelity in humans are founded primarily on an innate drive (dB) and only secondarily on cultural customs and laws.

This proposition is supported by research on the size differential between primate genders. Studies of a large variety of primates and other mammals in the wild have established that the difference in size between males and females is closely correlated with family structure. Greater relative size in males is associated with polygamy; nearer equality of size is associated with monogamy. The basis for these associations is fairly obvious. Sexual practices will evolve toward polygamy in those species in which the multiple offspring of larger dominant males can survive to reproductive age with limited or no help from their father. So both male size and polygamy will be favored. Sexual practices will evolve toward monogamy only in species where the offspring's survival to reproductive age depends heavily on paternal as well as maternal care. Late hominid species, given the long-term dependence of their infants on intensive care, are of this type. In such circumstances, size will tend to evolve toward equality between males and females and this shows up in the fossil record. Furthermore, paleoanthropologist studies report that monogamous pair-bonding and nuclear families seem to have been the pattern throughout

human history in hunter-gatherer societies.[ix] Among contemporary hunter-gatherers, we find that Australian aborigines, the Trobriand Islanders, pygmies, Kalahari Bushmen, and Amazonian Indian tribes all organize themselves into nuclear families.[x]

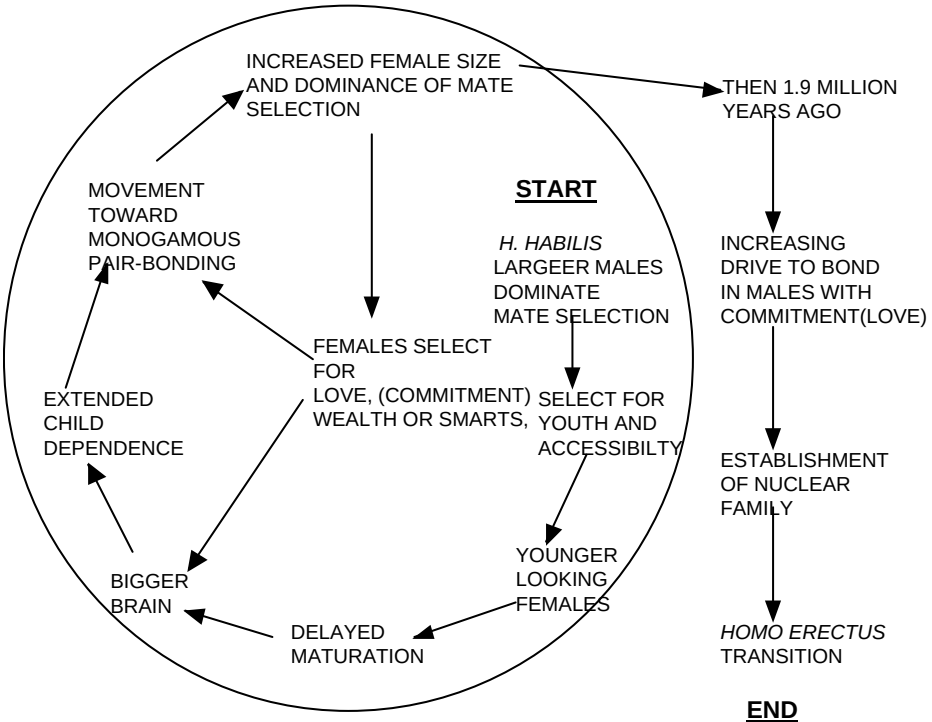
The self-reinforcing causation cycle underlying both the evolution of the bonding drive (dB) in hominid adult males and the establishment of the nuclear family is diagrammed in Figure 4.1

FIGURE 4.1

FIGURE 4.1

HYPOTHESIS OF THE EVOLUTION OF THE INDEPENDENT DRIVE TO BOND

DURING THE TRANSITION FROM *HOMO HABILIS* TO *HOMO ERECTUS*



ALL ABOVE DRIVEN AROUND AND AROUND
BY NATURAL SELECTION+SEXUAL SELECTION AS BRAIN GROWS,
DEVELOPING LARGER MEMORY, SKILL SETS, AND PREFRONTAL CORTEX

The figure illustrates the conclusion that, during the transition to *Homo erectus*, female hominids, through the sexual or mate selection process, were using their brains to select the

brains of the next generation. For billions of years evolution had been a blind, mindless, trial-and-error process. Now it was being guided by a purposeful mind. Hominids were, in effect, pulling themselves up by their bootstraps. And females, the "weaker sex," were in charge of the design team. In time, their mate choices led males themselves to include faithfulness in their mate selection criteria.[xi] These choices for the drive to bond by both women and men would have gradually built up the dB drive in the *H. erectus* gene pool, eventually enabling bonding to the tribe itself, the start of the social group selection process.

My argument on the importance of sexual selection in establishing the drive to bond in hominids does not in any way deny the argument of Wrangham's team on the roles that natural selection and the drive to acquire played in the transition to *H. erectus*. The two selection processes working together achieved the result. But I would argue that any form of pair-bonding based only on the drive to acquire and selected for only by natural selection would have been a much more fragile, opportunistic, and short-lived alliance. True love, the long-lasting glue of pair-bonding, would have been missing.

Darwin on Human Mate Selection

As a final argument on the role of female mate selection in the hominid evolution process, I turn once more to Darwin. On a careful rereading of Darwin, I discovered, to my surprise, that he had, in fact, discussed the power of the female choice of a mate in human evolution. Observations on the mate selection process from his amateur anthropological friends around the globe gave him the necessary clues that women played a larger role in mate selection than his own Victorian cultural beliefs would have suggested. "In utterly barbarous tribes the women have more power in choosing, rejecting, and tempting their lovers, or of afterwards changing their husbands, than might have been expected. As this is a point of some importance, I will give in detail such evidence as I have been able to collect."[xii]

His examples are quite humorous from our current perspective. "With the Kalmucks there is a regular race between the bride and bridegroom, the former having a fair start; and Clarke was assured that no instance occurs of a girl being caught, unless she has a partiality to the pursuer. Amongst the wild tribes of the Malay Archipelago there is also a racing match; and it appears from M. Burin's account, as Sir J. Lubbock remarks, that 'the race is not to the swift, nor the battle to the strong, but to the young man who has the good fortune to please his intended

bride.'"[xiii] Darwin also reports that a similar custom, with the same result, prevails with the Koraks of northeastern Asia. So at distant places on the globe, these "savage" women were using similar devices to trick the men into thinking that they were the ones that were actually picking their mates—but they were not.

Darwin concludes: "We thus see that with savages the women are not in quite so abject a state in relation to marriage as has often been supposed. They can tempt the men whom they prefer, and can sometimes reject those whom they dislike, either before or after marriage."[xiv]

Finally, and most importantly, Darwin demonstrates that he could have explained the mystery of the *H. erectus* transition even though he had no knowledge of its existence. He, in fact, understood that female mate selection might have been critical to the rapid evolutionary changes that produced the modern human mind. He, in fact, understood that evolution at the human level could well have stopped being a blind, mindless process and could have begun to be guided by a purposeful mind. And he got all of this in one sentence. Darwin writes on page 621 of *The Descent of Man*: "Preference on the part of the women, steadily acting in any one direction, would ultimately affect the character of the tribe; for the women would generally choose not merely the handsomest men, according to their standard of taste, but those who were at the same time best able to defend and support them." Darwin specifically used the term women, not females, and spoke of their making deliberate choices of men that would pair-bond with them in a long-term relationship to form the nuclear family. And this, he says, would have changed the "character of the tribe," signifying an important change in the innate features of the brain.

The emergence of pair-bonding and the transition from *H. habilis* to *H. erectus* was, in all likelihood, essential to the survival of the hominid line. As the length of time during which children were totally dependent on the nurturing care of their mother inexorably increased (see Figure 4.1 again), the mortality rate of these children would have been creeping up on the birth rate. This would, at some point, have created a population crash and inevitable extinction. The creation of the nuclear family might very well have saved the entire hominid line from this fate. After all, the *H. habilis* species did, at about this time, go extinct. This transition to *H. erectus* can be thought of as the first major step to "domesticating" the males of the hominid line, turning them from a "wild" animal to a "tame" one. I will explain this statement later in the chapter, drawing again on Wrangham's work.

Before moving on to the discussion of the Upper Paleolithic Transition, I will add an additional contemporary finding about the speciation process in general that helps explain the relative speed of the transition to *H. erectus* and later to *H. sapiens*. For decades, an argument has boiled among evolutionary biologists on the question of the speed of evolution and species transitions. Traditional Darwinians have emphasized the gradualness of the evolutionary process through the slow accumulation of small genetic mutations. Others have argued for "punctuated equilibrium" or evolutionary spurts with long periods of intervening stasis. Recent studies have helped to resolve this conflict. One particularly revealing study has been done of stickleback fish.[xv] These fish were studied in three completely separate lakes in western Canada, each of which contained two non-interbreeding species, a bottom-feeding stickleback species and a surface-feeding one. Genetic study revealed that both species had descended from a single ocean-dwelling stickleback species as recently as ten thousand years earlier. It was then discovered that the bottom-dwelling fish from each lake, while different, could interbreed, as could the three varieties of surface-dwellers.

These results can now be understood to arise from the fact that a number of the defining features of any given species display a considerable variation around the norm for each feature in a bell-shaped curve distribution. It is this variability that permits a fairly easy split of a single species into two species when a major ecological change is experienced.[xvi] Let us imagine the following hypothetical scenario regarding the sticklebacks. Suppose that the original ocean-dwelling stickleback had adapted to feed on a balanced mix of foods X and Y that were churned up together in the active waters near the ocean shore. These sticklebacks had a distribution of genes for this feeding adaptation that varied from the norm of feeding on a balanced menu of X and Y foods, to a much lesser number who had a bias for feeding on X food more than Y food, or vice versa. At some point three bodies of water were cut off from the ocean and became three separate landlocked lakes. In these placid waters the X food settled to the bottom and the Y food floated near the surface. The trapped stickleback fish were now in two different ecological niches, both different from the ocean.

The minority of sticklebacks who were biased toward the X food managed to survive as bottom-feeders and gradually became entirely specialized for living on this food. The sticklebacks biased toward feeding on Y food became specialized in feeding near the surface. The majority of fish, those adapted to a balanced diet of X and Y food, gradually died out. Over

time, the two varieties in each lake became two separate species that could not interbreed. It was later discovered that that each of these species could interbreed with similar fish from the other two lakes. While this is a hypothetical explanation, something of this kind must have happened to generate the known facts, and all by natural selection in only ten thousand years.

Other similar examples have been found for this type of speciation that occurred by the natural selection process in a relatively short time. By analogy, the invention of cooking by some isolated group of *H. habilis* hominids created a new ecological niche that eventually turned out to favor the small minority of males who were genetically programmed to bond with their mates. These males eventually became the norm within the group because they were purposefully selected as mates by the females, who were guided by their emerging mate-choice skill set. This process, along with the new ecological niche, was all it took for the transition to the new species of *H. erectus* in a relatively short period. This process was probably much faster than ten thousand years because now a purposeful mind was greatly speeding it up.

The Upper Paleolithic Transition (UPT)

At the start of this chapter, we relied on Pinker to provide a brief, colorful description of the hominids who were the first true humans, the first *Homo sapiens*. The explosive expansion of their tool kit led Pinker to conclude that ingenuity itself was their invention. This would suggest that the emergence of dC was the essence of this transition.

This second and final major transition has been named the Upper Paleolithic, referring to a period starting around 40,000 years ago. This title reveals the uncertainty of archeologists about the timing of this transition. The first big discoveries of the fossil bones and living sites of these people were made in France and dated to that time period, but since then much older sites have been found in Africa. Fossils of *H. sapiens* and plentiful tools, dating to around 100,000 years ago, were found at Klasies River Mouth in South Africa. Even older sites have now been found at Katanda in northern Zaire, but dating these by a variety of methods indicates a confusing spread of between 75,000 and 180,000 years ago. So the timing of the emergence of this new species is still to be resolved, but around 150,000 years ago seems for now to be the most frequently cited figure. There is no doubt, however, about the fact that a major turning point had been reached. *Homo sapiens* most likely evolved from *H. erectus* (possibly via *H.heidelbergeris;* see below*)* and the differences were dramatic. Most of the scholars who have

worked on defining these differences and theorizing about how they happened have emphasized the changes in the cognitive capacities of the new species and relied, once again, on natural selection as the Darwinian mechanism of explanation. I do not disagree with this line of analysis, but will add, as I did for the *H. erectus* transition, two other critical components; namely, (a) the role of another Darwinian mechanism— "group" selection—in partnership with the continuing role of sexual selection; and (b) the emergence of a fourth drive, the drive to comprehend (dC). I will start by asking what could have been the final trigger, the proximate cause —as cooking had been earlier—of this complex change process? Most scholars of this transition point to the emergence of spoken language.

The Role of Language

The theory that language triggered the changes of the UPT has been considered carefully by Jared Diamond, a physiologist, in his book, *The Third Chimpanzee*.[xvii] After drawing on all the relevant disciplines to assemble his argument, Diamond concludes, "Like some other scientists who have speculated about this question, I can think of only one plausible answer: the anatomical basis for spoken complex language. The answer seems to involve the structure of the larynx, tongue, and associated muscles that give us fine control over spoken sounds." These vocal structures involve a few small bones but mostly soft tissues that quickly decay, making it very difficult to date the origin of human language.

Terrance Deacon has recently offered additional evidence for the importance of hominid verbal language in explaining the UPT. In his comprehensive book, *The Symbolic Species: The Co-evolution of Language and the Brain,*[xviii] he argues that the feature that distinguishes human cognition from cognition in other species is the use of a complex system of multi-level symbolic representation. This symbolic system, he argues, has developed from simpler forms of representation, such as iconic sketches and drawings,[xix] in parallel with the long and gradual development from simpler forms of communication—such as facial expressions, verbal calls, hand sign language, and single words—toward complex verbal language with its sentence structure and capacity for abstract conceptualization.[xx] Moving language to higher levels of abstract representation greatly facilitated the social life of hominids and served, by mutual reinforcement, to gradually increase the size of the prefrontal area of the human brain where multiple ideas can be reviewed together (see Chapter 3 on the role of the dorsolateral module).

Symbolization created pressure for more working memory and an enlarged working memory enabled more symbolization. Deacon has concluded that the progression to multiple levels of abstraction greatly expanded the mind's capacity to conceptualize many more ways to solve daily problems. One can think of the six layers of the cortex (discussed in Chapter 1) as providing the physical embodiment of multiple levels of abstraction. It enabled humans to "think outside the box." He saw this as a truly distinctive feature of human cognition that became pre-wired or innate in our nature. This suggests to me that the establishment of this new cognitive feature was linked to

the emergence of a new independent drive, the drive to comprehend (dC).

The Intermingling of Skill Sets

Steven Mithen, an archeologist, adds to our understanding of the UPT in his book, *The Prehistory of the Mind: The Cognitive Origins of Art, Religion and Science.*[xxi] Mithen supports Pinker's case that the mind of the earlier forms of hominids gradually became pre-wired with different types of specialized skill sets. But he goes on to emphasize that, at first, these skill sets or modules were separated— literally disconnected from one another in the brain. The capstone of his argument is that, at some critical point, these separated modules were connected directly to one another via our working memory in the prefrontal cortex. For the first time, humans could use all their skills simultaneously to address complex, multidimensional problems. He concludes, quite persuasively, that it was the *intermingling* of our genetically-based skill sets that made the UPT possible. He points out that such a change in our mental wiring need not have taken terribly long in evolutionary time and suggests that the bridging made possible by our use of language must have helped the brain to combine genetically-grounded environmental skills such as hunting and gathering, technical skills such as tool-making, and social skills such as handling family relationships and coordinating hunting parties. For example, bridging between social skills and natural environmental skills led humans to somewhat anthropomorphize animals so that they could, for the first time, conceptualize the motives behind animal behavior and thereby better predict their behavior. This in turn could have enabled humans to combine their improved skills in predicting animal behavior with their technical tool-making skills and their social skills in organizing hunting parties in order to greatly improve their overall hunting prowess.

The interconnecting of skills in the human brain greatly increased the brain's cognitive power, a critical step toward the dramatic developments of the UPT.

Changes in the Motivational Brain

I propose that the transition to *H. sapiens* took place not only with the changes in the cognitive brain suggested above by Deacon and Mithen, but also with the changes in what LeDoux calls "the motivational brain" (see Chapter 1) that established both the independence of the drive to comprehend (dC) and the extension of the drive to bond (dB) beyond the family circle to larger human collectives such as the band and the tribe. How could these hypothesized changes in the motivational brain have taken place?

I believe that the establishment of dC in the brain as an independent drive was accomplished, as was the establishment of dB in males, primarily by female mate selection. I draw evidence of this change from the studies, referenced above, done by David Buss, an evolutionary psychologist. Now we need to examine these studies in more detail. Buss and his associates undertook a large-scale study of the traits which men and women—but especially women—currently seek in their mates. He set the stage for presenting his detailed findings on mate selection by saying, "A woman who preferred to mate with a reliable man who was willing to commit to her presumably would have had children who survived, and thrived, and multiplied." Buss got essentially the same results from 37 different samples in 33 countries and his findings are consistent with what we have reported above. He found that women seek mates who have resources or are ambitious (we code this for dA), who are strong and healthy (we code this for dD), who are committed to them, showing signs of love (we code this for dB), and—with special relevance to the drive to comprehend—who are intelligent (we code this for dC). Buss also reports that the men in his sample, in terms of their long-term mating choices, preferred beauty and youth (evidence of fecundity, as well as sexiness, that both help to fulfill their dA), love and faithfulness (dB), and intelligence (dC).[xxii] Buss argues that the widespread consistency of these findings suggests that these mate selection criteria exist as an innate skill set in all humans. While it is impossible to be sure when such sexual selection criteria could have been established genetically, to be consistent with the other evidence, they must have been established to some extent approximately during the first transition for dB and further extended during the second transition for dC. I also believe that, at some time during the UPT, the drive to bond was

extended beyond the nuclear family. I propose that this happened primarily by a Darwinian process that has been called group selection.

Darwin made a comment about "social instincts" that later led to significant controversy. In this passage, he stated, "With strictly social animals, natural selection sometimes acts on the individual, through the preservation of variations which are beneficial to the community. A community which includes a large number of [such] individuals increases in number, and is victorious over other less favored ones: even though each separate member gains no advantage over the others of the same community."[xxiii] Decades later, one school of biologists built on this comment and put forward the idea of "group selection"—the argument that genes could orient behavior toward the good of the group and even of the whole species. In response, mainstream evolutionary biological theorists argued that group selection was impossible because the survival of genes was totally dependent upon the survival and successful reproduction of individual carriers in accordance with natural selection. Further, any carrier with a genetic disposition to be nice to others (altruism in their terms) would, in time, be *wiped out* by what biologists called "free-riders"—those in the population who were only motivated by their narrow self-interest (dA and dD). This free-rider hazard seemed to rule out any possibility of genetically-based bonding to the family, much less to any larger collective, an argument that became dominant in the field. (To my knowledge, this was the first use of the term *free-rider*, which I will be using extensively in this book. The term has since been adopted by economists to describe the super-selfish behavior of individuals and/or firms who, by taking advantage of any bonding tendencies in others, drive them out of business.)

Now, however, the arguments over how group selection could work within Darwin's overall evolutionary framework have resumed. These ideas have been most systematically presented by Elliot Sober, an evolutionary philosopher, and David Sloan Wilson, an evolutionary biologist.[xxiv] They argue that once bonding drives have built up to a critical mass in any inter-breeding group, the advantages that bonding brings to the whole group will give that group, and hence all its *individual* members, a competitive advantage over other groups. At this point the natural selection process will have moved to the group level. However, as their critics point out, they do not seem to have an explanation of how bonding drives could build up to this critical mass, this tipping point, given the free-rider hazard within their own group. But now we can see how it could have happened in *H. erectus* groups as the mate selection choices of the females

worked to the individual advantage of males with a drive to bond and gradually built up this drive in the adult male population. Once such adults of both sexes were a strong majority in any group, they could bond together to find effective ways to identify and control the super-selfish, disruptive behavior of the remaining free-rider males in their midst.[xxv] Such controlling behavior, if it was not too costly or unsafe, would be to the competitive advantage of each individual involved and only as a second step would it provide an advantage to the entire group. So the bonding drive, first to the family and secondly to the band, emerged because it initially provided a competitive advantage to the individuals involved. It was probably a mistake ever to have called it "group" selection.

Sanctions to control free-riders could be as simple as face-to-face social ostracism and isolation. If these failed, the group could move on to exile or even to execution. Wrangham has pulled together evidence that many hunter-gatherer tribes have made extensive use of capital punishment to eliminate free-rider traits from their communities.[xxvi] It should be noted for future reference, however, that such control of free-riders does not guarantee that the genes carrying these traits were totally removed from the gene pool. We will return to this issue repetitively in later chapters, which describe how the historic struggle with free-riders in our midst has been played out over the centuries. As we will see, the biologists who predicted that free-riders would wipe out any "altruistic" tendencies were not entirely wrong. Free-riders over the years have, at times, been able to enact a terrible toll on normal people with a drive to bond.

Once strong bonding could be extended by individuals to their collective itself as an entity, that collective would have taken on the characteristics of a traditional tribe. Using their new tool of language and their enhanced cognitive capacity, these transitional hominids could conceptualize and *name* their collectives. Rituals of initiation and membership could be developed, along with all the symbols, songs, dances, and creation stories needed to reinforce the individual's commitment to the collective. This would have been the start of the implicit (or explicit) social contract of mutual caring between individual members and their tribe. The ideal among members would be "all for one and one for all." All the studies of contemporary tribes note the strength of the tribal bond. It is a lifetime commitment. It is not hard to imagine the superior strength of a committed tribe in direct competition with another tribe of equivalent size but made up of unbonded, uncommitted individuals.

Even though I am arguing that some 150,000 years ago the new species *H. sapiens* was launched by the combination of the steps I have described, this does not mean that the transitional period was completely over. Wrangham has discovered that all mammals that move from a "wild" state to a "tame" stage go through a transitional process, termed gracilization, when a related set of changes occur in their bodies and in their behavior.[xxvii] Wrangham has developed a strong case that this "taming" of all such mammals follows a similar evolutionary track: The bones generally become lighter, the jawbones and face become shorter, the teeth become smaller, and even the brain becomes slightly smaller. He shows that this process has taken place in parallel in several well-known domesticated species and even in the "self-domesticated" species of bonobos.

The best documented process of such domestication has been carried out by Dmitri Belyaev, a Russian biologist, who took a population of 100 female and 30 male wild silver foxes to Siberia in 1959 and started a careful process of interbreeding for "docility". Taming evolved amazingly quickly. By the 30th to 35th generation, 70 to 80% of the foxes behaved as tamely as dogs. Bodily changes paralleled this behavioral change as predicted. Wrangham pulls all this evidence together to show that this same gracilization process has been occurring in humans and that this is confirmed in the fossil record.

Wrangham emphasizes that the most conspicuous behavioral similarity among species that have gone through the gracilization process is their "low propensity for impulsive aggression."

> Since we know that humans have a low propensity for impulsive aggression the evidence that we've just reviewed is critical. The diverse sources of evidence—from the farmyard, Belyaev's foxes, and bonobos—reveal such a consistent association between gracility, on the one hand, and selection against impulsive aggression, on the other, that we might reasonably expect to find the same association in any species, even humans. The fact that humans behave like a tame animal therefore means that we expect to see gracilization at least once in our ancestry… Our ancestors became gracilized relatively recently, it turns out, and the rate of gracilization has been increasing. The implication is clear. If the signal of gracility is to be believed, we have been getting tamer and calmer in recent times—especially the last 100,000 years.[xxviii]

In the terms of this book, “tame” humans are the ones who have a drive to bond with others. The only difference is one of perspective. The behavior looks tame from the outside but it is experienced subjectively, from the inside, as the desire to bond with others.

While the process of gracilization clearly seems to have been occurring in humans, the question remains as to who or what was driving the process? I have made the case for the selective judgment of women in picking tame husbands, ones who had “fallen” for them. Wrangham has made a case that the transition has been driven by the capital punishment of free-riders as people who presented a major threat to other members of the tribe. Perhaps we are both right, with sexual selection the key selector in the *H. erectus* transition that started the taming of males and with “social group” selection, to use Ernst Mayr’s apt phrase,[xxix]—which we can now see was started at the individual level—as the key selector in the *H. sapiens* transition that continued the taming of males.

Summary of the Upper Paleolithic Transition

In summary, I propose that, during the critical developmental period that triggered the transition to *H. sapiens*, the brain evolved in four related and mutually reinforcing ways:

- The cognitive capacity of the brain was enhanced by its increase in size and by the maturing of complex language skills, which, in turn, enabled multi-level symbolic representation, which, in turn, enabled humans to conceptualize their collective, the tribe.
- Cognitive capacities were also enhanced by the intermingling of the separate skill sets in the prefrontal cortex; this, in turn, enabled the prefrontal cortex to generate complex action options to check and balance the primary drives (see Chapter 3).
- The drive to comprehend (dC) was strengthened to the point of becoming a primary independent drive, mainly by means of the sexual selection process, which included intelligence as a selection criterion.
- The drive to bond (dB) was increasing gradually in *H. erectus*. This extension of dB was propagated by individuals who, by various ways, de-selected free-riders with the help of a cheat-detecting skill. This process contributed to the overall result of a new species that bonded together as a tribe that could out-compete unbonded groups.

These combined changes sped up a gracilization process that reflected the step-by-step “domestication” of the adult males and reduced the proportion of free-riders in the human

population. The two newer drives (dB and dC), alongside the ancient drives to acquire (dA) and to defend (dD), provided humans with internal, often conflicting, impulses, while the enhanced cognitive developments provided the checks and balances needed to guide these powerful new capacities of *H. sapiens*. I propose that these concurrent brain developments triggered the Upper Paleolithic Transition and that, without them, the remarkable development of sophisticated humans able to create modern civilizations could not have taken place.

On these points, I am again following Darwin, who discussed the human "social instinct" at length. For instance, he said, "Every one will admit that man is a social being. We see this in his dislike of solitude and in his wish for society beyond that of his own family. Solitary confinement is one of the severest punishments which can be inflicted."[xxx] Again: "The small strength and speed of man, his want of natural weapons, etc., are more than counterbalanced by his social qualities which lead him to give and receive aid from his fellow-men."[xxxi] And remember also that Darwin, in launching the whole controversial idea of group selection, said that group selection would kick in only when "a community includes a large number of [such] individuals," referring to those with "social instincts." Darwin also dealt with the extension of bonding to a widening circle of humans:

> As man advances in civilization, and small tribes are united into larger communities, the simplest reason would tell each individual that he ought to extend his social instincts and sympathies to all the members of the same nation, though personally unknown to him. This point being once reached, there is only an artificial barrier to prevent his sympathies extending to the men of all nations and races. If, indeed, such men are separated from him by great differences in appearance or habits, experience unfortunately shows us how long it is, before we look at them as our fellow-creatures.[xxxii]

This last point of Darwin's seems to me to accurately describe our human situation as we enter the 21st century. More of this later.

Darwin also commented on the drive to comprehend: "As soon as the important faculties of the imagination, wonder, and curiosity, together with some power of reasoning, had become partially developed, man would naturally crave to understand what was passing around him, and would have vaguely speculated on his own existence."[xxxiii] To me, Darwin's use of the word "crave" strongly suggests a drive to comprehend**.**

Geneticists and evolutionary biologists now hypothesize, based on the remarkable sameness of genes across all contemporary human populations, that our ancestors were a group of as few as four to ten thousand people that lived around 150,000 years ago somewhere along the Rift Valley of Africa. They argue that the genetic changes that enabled the UPT took place in this relatively small group, and that these humans with biologically modern brains multiplied and dispersed from Africa around 50,000 to 60,000 years ago. These people, in all likelihood, lived in sophisticated, fairly egalitarian hunter/gatherer bands or tribes, probably equipped with wood, stone, bone, and fiber tools; with shelters, clothing, fire, and cooking; and perhaps with domesticated dogs. To have created such artifacts, each such group would probably have been, in effect, a complete, well-developed, tightly bonded organization with a common language and probably with a decision-making or governance system with a simple chain of command, a division of labor, a set of behavioral ground rules (norms) with associated incentives (rewards and punishments), and a belief system, including myths and rituals, that addressed the meaning of human existence. Such a social system, in combination with their enhanced technologies, would have given these migrant groups a massive advantage in overall fitness over all other creatures, including any other variety of hominids.

The story of the travel route and timing of the historic migration of *H. sapiens* to all parts of the globe has only recently been assembled by geneticists and reported in *The Journey of Man.*[xxxiv] The researchers studied the pattern of variations in the Y-chromosomes found in blood samples of males from all over the globe. They found the fewest variations, and hence the "oldest" human group, in the blood of the Sans people, the "bushmen" of the Kalahari desert in Namibia. Luckily, the way of life of these fascinating people was carefully recorded on film by the Marshall family many years ago, well before it was seriously disrupted. These people display all the features cited above plus many more. It was the direct ancestors of these contemporary Sans people who must have left Africa through the Middle East and first walked the coastline of Southeast Asia and crossed the water to Australia over 50,000 years ago. They later migrated to central Asia and there split east and west into Europe and into East Asia and Siberia and beyond into the Americas. Even though this is obviously a very simplified version of a complex story, it does clearly make the point that humans are one family. We are all descendents—through only around 2,000 generations—of the same ancestors.

I believe we are now ready to answer Edward Wilson's "great mystery of human evolution." He asked: "Natural selection, in short, does not anticipate future needs. But this principle, while explaining so much so well, presents a difficulty. If the principle is universally true, how did natural selection prepare the mind for civilization before civilization existed?" The answer is amazingly simple. It was not Darwin's natural selection mechanism alone that did the job. It was done by Darwin's sexual and social group selection mechanisms, along with natural selection. These methods in combination can anticipate the future in a way that natural selection alone cannot. The vital method was the capacity of women to anticipate the consequences of intercourse and choose their mate with a keen eye on the future.[xxxv]

I will add one final speculation about the transition from H. *erectus* to *H. sapiens.* In their new book, *Dragon Bone Hill*, Boaz and Ciochon[xxxvi] report on their findings from the fossils of late *H. erectus* in northern China. They found evidence that the skulls of these hominids were twice the thickness of modern *H. sapiens* skulls and they explain this as a protective function. They buttress this argument by the number of skulls they found that showed clear signs of being damaged by blows to the head, as from a club. The nuclear families of *H. erectus* may have given the species a competitive advantage over *H. habilis* but some of the males still in their midst, whose bonding was limited to their family circle, might still have been prone to deadly inter-clan feuding and head-bashing. This might have had something to do with their extinction. Perhaps the Upper Paleolithic Transition was also essential for the continuance of the hominid line.

Figure 4.2 is a schematic diagram that summarizes how the different selection mechanisms have been added, one on top of another, in the transitions discussed. The reader will also note the addition of cultural selection and scientific selection as an indication of where the cutting edge of change in human affairs has moved. Selection in these latter two stages, while not carried by genetic change, is still moving by the variety/selection/retention process in the minds of humans. All five of these basic selection influences on human behavior are currently at work and none of them can be stopped.

FIGURE 4.2

ACCUMULATIVE SELECTION TIME LINE
OF MAJOR HOMINID TRANSITIONS

SCIENCE SELECTION via systematic science: Modern Period, worldwide bonding?

CULTURAL SELECTION via agriculture, domesticated animals, writing & metallurgy: Classical Period, national bonding

SOCIAL GROUP SELECTION via language, skill-mixing, and free-ride control: Deep History *H. Sapiens* with dC and tribal bonding

SEXUAL SELECTION via fire, cooking and future-oriented female mate choice: *H. Erectus* with dB and nuclear family bonding

NATURAL SELECTION
H. Habilis with dA, dD, Mother-Infant Bonding and male dominated mate choice

1.9M 150K 10K 5C
Approximate dates BP

We will discuss the transition by means of cultural selection in the next chapter, but first we need to consider the whole issue of Darwinism over the years.

Darwin Misunderstood

Serious confusions and controversies are still plaguing Darwin's theories in scientific as well as in lay circles. While I do not propose to examine all the ins and outs of this prolonged debate, I hope to foster an open-minded consideration of the Darwinian-based propositions in this book by addressing the major points.

Religion: It is generally well known that the first major attack, and the most persistent attack, on Darwin's theories came from organized religion with its millions of adherents. The response of the religious establishment at the time of the publication of Darwin's *On the Origin*

of Species can best be summarized as horrified. The debate was energetically engaged, not only by the most distinguished prelates of England, but also by many of the most famous naturalists, also on religious grounds. The theory seemed to undermine the most basic of religious beliefs, the very existence of God. Over the years the debate quieted down somewhat, but recently it has heated up again. It is clearly not resolved. A recent poll indicated that a significant majority of Americans favor creationist theories on the origin of all living things over Darwin's theory of evolution. This is true even though many major religious leaders, including the late Pope John Paul II, accepted the general idea of Darwin's evolutionary theory as an explanation of how God created living species. Given this current mind-set, many people will therefore reject my new synthesis on religious grounds. Can I address their understandable concerns? I will hold my comments on this stubborn controversy for Chapter 9.

Social Darwinism: The second wave of controversy and confusion over Darwin's theories was created by Herbert Spencer with his ideas on Social Darwinism. These ideas were and still are a major obstacle to the understanding of Darwinism. It was Spencer, not Darwin, who coined the vivid but misleading phrase "survival of the fittest." Darwin might have agreed on the condition that "fit" was understood to mean "adaptable" (as in "fit in"). As quoted at the beginning of this chapter, Darwin said, "It is not the strongest of the species that survive, nor the most intelligent. It is the one most adaptable to change." But in fact, the phrase is almost universally understood to mean "survival of the toughest and most ruthless." This is very clearly not at all what Darwin meant, yet it has come to summarize, for most of the public, what Darwinism is all about. I have yet to find a single use of the term "Darwinian" in contemporary print that did not reference this distorted version of Darwin's ideas. Given such a massive basic misunderstanding of Darwin, is it any wonder that a majority of the American public resists his ideas?

The Response of Mainstream Biologists: The next source of misunderstanding about Darwin has come, rather surprisingly, from the evolutionary biologists themselves. As a prime example, consider Richard Dawkins, whose widely read and respected writings, especially *The Selfish Gene*, have inadvertently served to reinforce Spencer's erroneous interpretation of Darwin. So has some of the popular work of Stephen Jay Gould. This has all happened over the years in a rather complex way that has been clearly explained by Ernst Mayr, a key contributor to the modern synthesis of Darwin's theories with the theories of genetics. In his book *One Long*

Argument,[xxxvii] Mayr explains how confusion arose among biologists; I will be drawing on Mayr's analysis in the following paragraph.

Darwin's theory of the "common descent" of all organisms from a primordial ancestor was quite quickly accepted by biologists. After Darwin's death, however, his theory of "natural selection" remained controversial among biologists for several decades. This controversy, while eventually resolved in the confirmation of Darwin, had led biologists to focus on the natural selection mechanism as if it were the one and only mechanism that Darwin used to explain the process of evolution. While natural selection was the most prominent evolutionary mechanism for Darwin, it was by no means the only one. Darwin emphasized the mechanism of sexual selection as a crucial mechanism in explaining evolution. Sexual selection is the focus of his second major book on evolution, *The Descent of Man* which also is, of course, the book that offers almost everything that Darwin had to say about humans. Yet sexual selection is still treated as a relatively minor mechanism by many biologists who often subsume it as one aspect of natural selection. In addition, Darwin's extensive discussion in *Descent* of "morality" as being derived from "social instincts" has also been almost totally ignored by subsequent biologists. And it is probably fair to say that most biologists still reject Darwin's idea of "group selection" as a valid selection mechanism. Another of his ideas was that biological variations were subject to the "use it or lose it" principle. For years, biologists who otherwise embrace Darwin's theories have cited this as one of his mistakes. Now we know that this is exactly the way that the brain works. The brains of young children contain many more synapses then will ever be used and they are pruned by disuse. Darwin at times also referred to variations being established by "habit." If this is taken literally, it is clearly a Lamarckian mistake. But, as Baldwin (a contemporary of Darwin) pointed out, acquired habits (read *culture*) could change the context of human life and hence change the selection pressures in ways that could, by natural selection, change the gene pool. For example, if humans acquired the cultural "habit" of wearing fur clothing and, partly as a result of that, moved to colder climes, the change in climate would generate natural selection pressure for fair skin and blue eyes, which is probably what happened. Also, any widespread "habit" will have been established in society by Darwin's V/S/R process, even though it will have been spread by culture, not by genes.

Determinism—or even fatalism—is the other idea that mainstream evolutionary biologists have reinforced and, by inference, attributed to Darwin, creating a massive obstacle to

the acceptance of his ideas. Determinism clearly suggests that humans have no possible way to improve the condition of their lives. As Dawkins wrote in the preface to his book, *The Selfish Gene*, "We are survival machines—robot vehicles blindly programmed to preserve the selfish molecules known as genes. This is a truth which still fills me with astonishment."[xxxviii] Such a view flies in the face of all common sense and of the historical record of humankind. It creates only despair about the human condition. When Darwin's most widely recognized spokesperson of our times makes such statements, would it be any wonder if a theory built directly on Darwin's were to meet resistance? Yet Darwin himself said no such thing. He recognized the fact of human choice and the resulting possibilities for human improvement.

The Response of the Social Sciences: A fourth source of massive misunderstanding of Darwin has come from the social sciences. Every since Darwin's work became available, social scientists have essentially given it the silent treatment. They have, of course, accepted that Darwin was right about the evolution of our bodily parts but they have almost entirely denied that his theory can in any way explain human *behavior*. This is what has become known as the "blank slate" assumption. The idea is that the brain is a passive (blank) organ at birth that gradually fills up over our lives with things learned from our cultures and other aspects of our environment. This is also known as the social construction of reality. There is little doubt that this early and persistent rejection of Darwinism was triggered by Spencer's Social Darwinism with its tooth-and-claw determinism. This broad worldview about the human condition horrified and revolted the social scientists for totally understandable reasons. It clearly could be used to advance racist and sexist agendas—and it was in Hitler's Germany. Social Darwinism was totally at odds with the view social scientists that humans are flawed but have a capacity for compassion and cooperation and are always striving to improve their condition. If Darwinism denied all of this, social scientists wanted no part of it; their aversion to understanding Darwin struck very deeply into the essence of their professional outlook, triggering a visceral reaction that persists in many circles today. This was the response to Darwinism that created the "blank slate" doctrine and these ideas are still mainstream among social scientists, even though they are currently under vigorous attack from evolutionary psychologists (see Pinker's *Blank Slate*[xxxix]) and from a few behavioral economists.

The psychologists who highlighted Social Darwinian ideas about human behavior were Watson and later Skinner. They argued that all human behavior can be explained as responses to

environmental conditioning by a reward-and-punishment process. This is ironic since Watson's ideas were built upon those of McDougal, the extreme instinctivist disciple of James. It is even more ironic that, in sociology, the blank slate tradition was established by Durkheim (as noted in the Introduction) and yet Durkheim himself conducted the empirical study that presented the most compelling evidence of the essential role of bonding to human survival itself. Durkheim studied the rates of suicide in a wide variety of collectives across Europe. He found a consistent pattern. The people who had the fewest number of bonded relationships with others had the highest suicide rates. For instance, he found that among religious communities, Protestants with the "least degree of integration" had more suicides than Catholics and that Jews, with the densest network of social bonds, had the fewest suicides. He found the same pattern among families. People living alone were most likely to kill themselves, married couples less likely, and married couples living with children, still less likely. This research offers powerful proof of the existence of Darwin's social instincts by demonstrating the extreme cost of human isolation.[xl]

The Response of the Physical Sciences: While the physicists and chemists of Darwin's time did not notably attack Darwin's ideas and have not done so since his time, the fact is that many of the well-established scientific ground rules for pursuing knowledge about physical phenomena could not be applied directly and consistently to biological phenomena. To develop his ideas, Darwin was forced to invent his own ground rules and methods, tailored to the emerging study of biological phenomena. This caused problems and confusions concerning appropriate scientific methods, which greatly delayed the acceptance of Darwin's ideas in some scientific circles. Mayr has only recently clarified this complex issue in *What Makes Biology Unique?* His chapter. "On the Autonomy of Biology," spells out the problems that have been caused by the misapplication of the scientific methods of physics and chemistry to biology and to all its branches in the social sciences.

As Mayr reports, "Darwin's ideas were particularly important in the discovery that a number of basic concepts of the physical sciences are not applicable to biology."[xli] Mayr went on to specify a number of very important differences:

> **The Absence of Universal Natural Laws in Biology**. Owing to the probabilistic nature of most generalizations in evolutionary biology, it is impossible to apply Popper's method of falsification for theory testing because a particular case of a seeming refutation of a certain law may not be anything but an exception, as are common in biology. Most

theories in biology are based not on laws but on concepts. Examples of such concepts are, for instance, selection, speciation, phylogeny, competition, population, imprinting, adaptedness, biodiversity, development, ecosystem and function.[xlii]

The Complexity of Living Systems. There are no inanimate systems in the mesocosmos that are even anywhere near as complex as the biological systems of the macromolecules and cells. These systems are rich in emergent properties because forever new groups of properties emerge at every level of integration… Owing to their complexity, biological systems are richly endowed with capacities such as reproduction, metabolism, replication, regulation, adaptedness, growth, and hierarchical organization. Nothing of the sort exists in the inanimate world.[xliii]

Dual Causation. "All biological processes differ in one respect fundamentally from all processes in the inanimate world; they are subject to *dual causation.* In contrast to purely physical processes, these biological ones are controlled not only by natural laws but also by *genetic programs.* This duality fully provides a clear demarcation between inanimate and living processes.[xliv]

Evolutionary Biology Is a Historical Science. " It is very different from the exact sciences in its conceptual framework and methodology. It deals, to a large extent, with unique phenomena, such as the extinction of the dinosaurs, the origin of humans, the origin of evolutionary novelties, the explanation of evolutionary trends and rates, and the explanation of organic diversity. There is no way to explain these phenomena by laws… We cannot experiment about the extinction of the dinosaurs or the origin of mankind. With the experiment unavailable for research in historical biology, a remarkable new heuristic method has been introduced, that of *historical narratives.* Just as in much of theory formation, the scientist starts with a conjecture and thoroughly tests it for its validity, so in evolutionary biology the scientist constructs a historical narrative, which is then tested for its explanatory value.[xlv]

Chance. The natural laws usually effect a rather deterministic outcome in the physical sciences. Neither natural nor sexual selection guarantees such determinism. Indeed, the outcome of an evolutionary process is usually the result of an interaction of numerous incidental factors. Chance with respect to functional and adaptive outcome is rampant in the production of variation. Curiously, it was this chance aspect of natural selection for

which this theory was most often criticized. Some of Darwin's contemporaries, for instance, the geologist Adam Sedgwick, declared that invoking chance in any explanation was unscientific. Actually, it is precisely the chanciness of variation that is so characteristic of Darwinian evolution.[xlvi]

Holistic Thinking. Reductionism is the declared philosophy of the physicalists. Reduce everything to the smallest parts, determine the properties of these parts, and you have explained the whole system. However, in a biological system there are so many interactions among the parts, that a complete knowledge of the properties of the smallest parts gives necessarily only a partial explanation… How the smaller units are organized into larger units is critically important for the particular properties of the larger units. This aspect of organization and the resulting emergent properties are what the reductionists had neglected.[xlvii]

Observation and Comparison. These are highly important methods [not only in biology but] also in the humanities, and therefore biology functions as an important bridge between the physicalist sciences and the humanities. The foundation of a philosophy of biology is particularly important for the explanation of mind and consciousness. Evolutionary biology has revealed that in such explanations there is no fundamental difference between humans and animals. Evolutionary thinking and the recognition of the role of chance and of uniqueness are now also appreciated in the humanities.[xlviii]

All the branches of human biology are still suffering to some extent from the effects of "physics envy." This ailment condemns its victims to trying futilely to practice their science by the rules and methods of the physical sciences instead of by the rules and methods relevant to the life sciences that Mayr has so helpfully articulated. Not the least of Mayr's contributions is to elevate historical analysis to a totally legitimate scientific method that is essential to the full range of life sciences. It is in this spirit that I have, for example in this chapter, applied historic analysis to the hominid line.

Despite so many sources of confusion, Darwin's ideas have stood the test of time and won the day. Based upon a careful study of what Darwin actually said, I find myself in awe of his accomplishments. His insights are especially amazing when one realizes that he made them without the benefit of knowing many things that we know today. He worked without any

knowledge about how genes work. He had practically no information about hominid fossils, very limited and, at times, erroneous facts about the behavior of primates in the wild, no systematic anthropological information except from his amateur recruits, and essentially no direct knowledge of the inner workings of the brain. In spite of all of these limitations, he got so much right that we are only now developing more complete maps of the virgin terrain that he first pioneered and surveyed.

His brain must have had a particularly powerful drive to comprehend. He spent his entire life pondering the meaning of the observations he made as a young naturalist on the *Beagle*. He knew very well that his theories would challenge the most basic assumptions of the society of which he was an elite member. Before publishing his ideas, he refined and reflected on them for more than two decades in order to make them as accurate and clear as possible. He will always be a preeminent example of a person who acted with courage and persistence on his convictions.

In this connection, readers may want to review Figure 1 in the Introduction, which diagrams the flow of ideas and some of the principal players in the intellectual history of theories of human behavior, starting with Darwin.

In this chapter, I have presented a renewed Darwinian theory of how hominids evolved into humans, drawing on Darwin's original insights and updating them with the recent work of scholars from many relevant disciplines. I have presented this renewed Darwinian theory as the final piece of the puzzle of the *H. erectus* transition and the Upper Paleolithic Transition to *H. sapiens*. In so doing, I hope to have resolved most of the controversies and confusions associated with social Darwinism and determinism, while restoring and advancing Darwin's neglected or misunderstood ideas regarding sexual and group selection, social instincts, and human choice. I will address the religion issue in Chapter 9. By directly addressing these issues, I hope to break through the "silent treatment" that many of my fellow social scientists have so far given to Darwinian theories of human behavior.

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[i] Readers of *Driven* will note that this 'two transition' story of human evolution is different than that in the earlier book. There we conflated the two steps into one. The story presented here is based on more recent information. Such changes in the particulars of our understanding of these steps and their timing will undoubtedly continue as new evidence becomes available.

[ii] Pinker, 1997. p. 202-203.

[iii] See especially, Boaz, N. and K. Ciochon, 2004, *Dragon Bone Hill*, New York, Oxford University Press.

[iv] Wrangham, R., J. Jones, G. Laden, D. Pilbeam, and N. Conklin-Brittain, Dec. 1999, "The Raw and the Stolen: Cooking and the Ecology of Human Origins", *Current Anthropology*, Vol. 40, No. 5.
.[v] Wilson, E. O., 1998. p. 48
[vi] See Buss, 1999.
[vii] Frank, 1999.
[viii] See the treatment of this subject in Marneffe, D., 2004, *Maternal Desire, On Children, Love, and the Inner Life*, , Little, Brown and Company, New York.
[ix] Harrell, S., 1997, *Human Families*, Boulder, CO. Westview, p. 26-30,.
[x] Kuper, A. *The Chosen Primate: Human Nature and Cultural Diversity***,** Cambridge, NA, Harvard University Press, p. 174.
[xi] Buss, 1999.
[xii] Darwin, 1998, *Descent*, p. 619-620.
[xiii] Darwin, 1998, *Descent*, p. 620.
[xiv] Darwin, 1998, *Descent*, p. 619-621.
[xv] See the description of these studies in Morris, R. 2001, *The Evolutionists*, New York, Freeman, p. 214-215.
[xvi] This adaptive mechanism is know as the Baldwin Effect and is described in Kirschner, M. and J. Gerhart, 2005, *The Plausibility of Life*, New Haven, Yale University Press, p. 78-79.
[xvii] Diamond, J. 1992, *The Third Chimpanzee: The Evolution and Future of the Human Animal.* New York, Harper Collins.
[xviii] Deacon, T. W. 1997, *The Symbolic Species: The Co-evolution of Language and the Brain, New* York, W. W. Norton,.
[xix] In his book, *Art and the Evolution of Man*, 1951, Sir Herbert Read argues that such drawings were the start of art and were an essential step toward the development of symbolic language in humans., London, Freedom Press.
[xx] See especially Hauser, M., 1997, *The Evolution of Communication*, New York, Harper.
[xxi] Mithen, S. 1996, *The Prehistory of the Mind: The Cognitive Origins of Art, Religion and Science.* London, Thames and Hudson,.
[xxii] However, Buss also found that men, unlike women, also showed evidence of employing at times what he termed a "short-term" mating strategy—with sheer sexual accessibility being the criterion of choice. This short-term strategy could better be termed the "ancient" strategy since it mirrors that of male chimpanzees.
[xxiii] Darwin, 1998, *Descent* p. 108.
[xxiv] See Sober, 1998.
[xxv] Evolutionary psychologists have identified a skill set they call "cheat detecting" that not only helps the detection process but also contributes to trying to control it. See Thomas Hayden, June 13, 1995, "Why We Need Nosy Parkers," *U.S. News and World Report*,.
[xxvi] Wrangham, R., unfinished book.
[xxvii] Wrangham, R., unfinished book.
[xxviii] Wrangham, R., unfinished book
[xxix] Mayr, E., 2004, *What Makes Biology Unique*, Cambridge, UK, Cambridge University Press, p. 147-148.
[xxx] Darwin, 1998, *Descent*, p. 111.
[xxxi] Darwin, 1998, *Descent*, p. 65

[xxxii] Darwin, 1998, *Descent*, p. 126-127.
[xxxiii] Darwin, 1998, *Descent*, p. 97.
[xxxiv] Wells, S., 2002, *The Journey of Man; A Genetic Odyssey*, Princeton, N.J., Princeton, University Press.
[xxxv] Some evolutionary biologists have hypothesized a somewhat different story of the hominid transition from *H. erectus* to *H. sapiens*, proposing the existence of an intervening species known variously as *archaic H. sapiens* and *H. heidelbergensis*. If this theory proves to be supported by additional evidence, we would hypothesize that the first step, from *H. erectus* to *H. heidelbergensis*, would have hinged on the extension of the dB bond from the nuclear family to the band or tribe. The second transition, from *H. heidelbergensis* to modern *H. sapiens*, would have hinged on the further development of the pre-frontal cortex and the establishment of the independent drive to comprehend.
[xxxvi] Boaz, 2004, see especially p. 81-82.
[xxxvii] Mayr, E., 1991, *One Long Argument*: *Charles Darwin and the Genesis of Modern Evolutionary Thought*, Cambridge, MA. Harvard University Press,.
[xxxviii] Dawkins, R. 1976, *The Selfish Gene*, (new ed.) New York, Oxford University Press, p. ix.
[xxxix] Pinker, S., 2002. *The Blank Slate: The Modern Denial of Human Nature*, New York, Viking.
[xl] Durkheim, E. (1951/1897), *Suicide*, (J.A. Spalding & G. Simpson, Trans.), Free Press, New York. On a personal note I read this book as part of my doctoral training in 1947 but only recently recognized the irony of Durkheim's inconsistency.
[xli] Mayr, E., 2004, *What Makes Biology Unique?*, New York, Cambridge University Press, p. 26.
[xlii] Mayr, 2004, p. 28.
[xliii] Mayr, 2004, p. 29.
[xliv] Mayr, 2004, p. 30.
[xlv] Mayr, 2004, p 32.
[xlvi] Mayr, 2004, p. 34.
[xlvii] Mayr, 2004, p. 34-35.
[xlviii] Mayr, 2004, p. 35.