Dædalus

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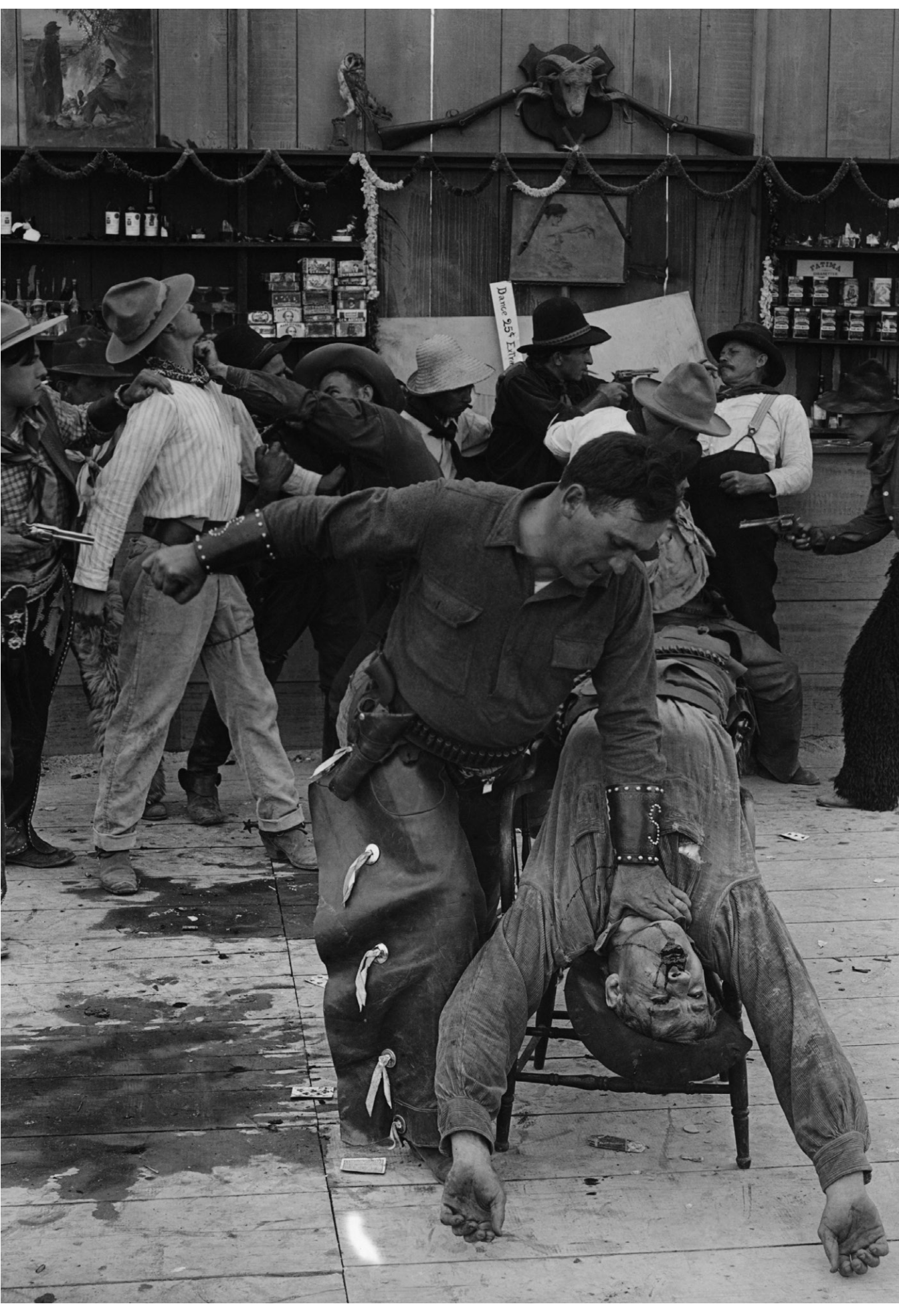
Fall 2004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Inside front cover: Nasty, brutish, and short: a tipple turns ugly in the Wild West. A still from a silent-era Western film. See Jonathan Haidt & Craig Joseph on *Intuitive ethics: how innately prepared intuitions generate culturally variable virtues,* pages 55 – 66: "People love to exercise their third-party moral intuitions so much that they pay money to see and hear stories about fictional strangers who do bad things to each other." Photograph © Bettmann/Corbis.

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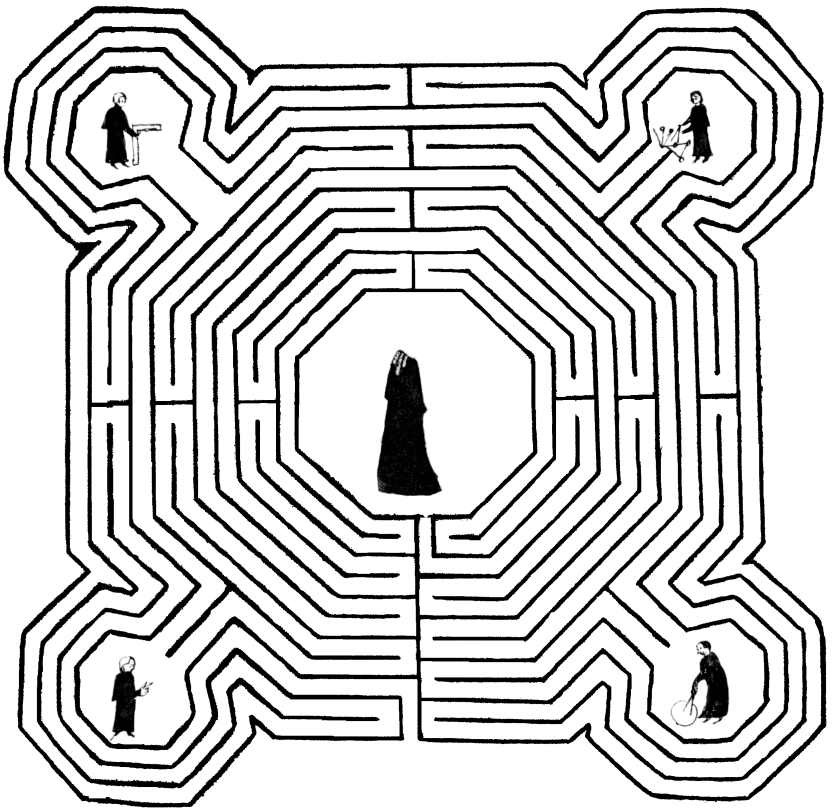

The pavement labyrinth once in the nave of Reims Cathedral (1240), in a drawing, with figures of the architects, by Jacques Cellier (c. 1550 – 1620).

Dædalus was founded in 1955 and established as a quarterly in 1958. The journal's namesake was renowned in ancient Greece as an inventor, scientist, and unriddler of riddles. Its emblem, a maze seen from above, symbolizes the aspiration of its founders to "lift each of us above his cell in the labyrinth of learning in order that he may see the entire structure as if from above, where each separate part loses its comfortable separateness."

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Steven Pinker

Why nature & nurture won't go away

When Richard Mulcaster referred in 1581 to "that treasure... bestowed on them by nature, to be bettered in them by nurture," he gave the world a euphonious name for an opposition that has been debated ever since. People's beliefs about the relative importance of heredity and environment affect their opinions on an astonishing range of topics. Do adolescents engage in violence because of the way their parents treated them early in life? Are people inherently aggressive and selfish, calling for a market economy and a strong police, or could they become peaceable and cooperative, allowing the state to wither and a spontaneous socialism to blossom? Is there a universal aesthetic that allows great art to transcend time and place, or are people's tastes determined by their era and culture? With so much seemingly at stake in so many fields, it is no surprise that debates over nature and nurture evoke more rancor than just about any issue in the world of ideas.

During much of the twentieth century, a common position in this debate was to deny that human nature existed at all – to aver, with José Ortega y Gasset, that "Man has no nature; what he has is history." The doctrine that the mind is a blank slate was not only a cornerstone of behaviorism in psychology and social constructionism in the social sciences, but also extended widely into mainstream intellectual life.[1]

Part of the blank slate's appeal came from the realization that many differences among people in different classes and ethnic groups that formerly were

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1 Carl N. Degler, *In Search of Human Nature: The Decline and Revival of Darwinism in American Social Thought* (New York: Oxford University Press, 1991); Steven Pinker, *The Blank Slate: The Modern Denial of Human Nature* (New York: Viking, 2002); Robin Fox, *The Search for Society: Quest for a Biosocial Science and Morality* (New Brunswick, N.J.: Rutgers University Press, 1989); Eric M. Gander, *On Our Minds: How Evolutionary Psychology Is Reshaping the Nature-Versus-Nurture Debate* (Baltimore: Johns Hopkins University Press, 2003); John Tooby and Leda Cosmides, "The Psychological Foundations of Culture," in *The Adapted Mind: Evolutionary Psychology and the Generation of Culture*, ed. Jerome H. Barkow, Leda Cosmides, and John Tooby (New York: Oxford University Press, 1992).

thought to reflect innate disparities in talent or temperament could vanish through immigration, social mobility, and cultural change. But another part of its appeal was political and moral. If nothing in the mind is innate, then differences among races, sexes, and classes can never be innate, making the blank slate the ultimate safeguard against racism, sexism, and class prejudice. Also, the doctrine ruled out the possibility that ignoble traits such as greed, prejudice, and aggression spring from human nature, and thus held out the hope of unlimited social progress.

Though human nature has been debated for as long as people have pondered their condition, it was inevitable that the debate would be transformed by the recent efflorescence of the sciences of mind, brain, genes, and evolution. One outcome has been to make the doctrine of the blank slate untenable.[2] No one, of course, can deny the importance of learning and culture in all aspects of human life. But cognitive science has shown that there must be complex innate mechanisms for learning and culture to be possible in the first place. Evolutionary psychology has documented hundreds of universals that cut across the world's cultures, and has shown that many psychological traits (such as our taste for fatty foods, social status, and risky sexual liaisons) are better adapted to the evolutionary demands of an ancestral environment than to the actual demands of the current environment. Developmental psychology has shown that infants have a precocious grasp of objects, intentions, numbers, faces, tools, and language. Behavioral genetics has shown that temperament emerges early in life and remains fairly constant throughout the life span, that much of the variation among people within a culture comes from differences in genes, and that in some cases particular genes can be tied to aspects of cognition, language, and personality. Neuroscience has shown that the genome contains a rich tool kit of growth factors, axon guidance molecules, and cell adhesion molecules that help structure the brain during development, as well as mechanisms of plasticity that make learning possible.

These discoveries not only have shown that the innate organization of the brain cannot be ignored, but have also helped to reframe our very conception of nature and nurture.

Nature and nurture, of course, are not alternatives. Learning itself must be accomplished by innate circuitry, and what is innate is not a set of rigid instructions for behavior but rather programs that take in information from the senses and give rise to new thoughts and actions. Language is a paradigm case: though particular languages such as Japanese and Yoruba are not innate, the capacity to acquire languages is a uniquely human talent. And once acquired, a language is not a fixed list of sentences, but a combinatorial algorithm allowing an infinite number of new thoughts to be expressed.

Moreover, because the mind is a complex system composed of many interacting parts, it makes no sense to ask whether humans are selfish or generous or nasty or noble across the board. Rather, they are driven by competing motives elicited in different circumstances. And

2 Pinker, *The Blank Slate*; Gary F. Marcus, *The Birth of the Mind: How a Tiny Number of Genes Creates the Complexities of Human Thought* (New York: Basic Books, 2004); Matt Ridley, *Nature Via Nurture: Genes, Experience, and What Makes Us Human* (London: Fourth Estate, 2003); Robert Plomin, Michael J. Owen, and Peter McGuffin, "The Genetic Basis of Complex Human Behaviors," *Science* 264 (1994): 1733–1739.

if genes affect behavior, it is not by tugging on the muscles directly, but by their intricate effects on the circuitry of a growing brain.

Finally, questions of what people innately have in common must be distinguished from questions of how races, sexes, or individuals innately differ. Evolutionary biology gives reasons to believe that there are systematic species-wide universals, circumscribed ways in which the sexes differ, random quantitative variation among individuals, and few if any differences among races and ethnic groups.[3]

This reframing of human nature also offers a rational way to address the political and moral fears of human nature.[4] Political equality, for example, does not hinge on a dogma that people are innately indistinguishable, but on a commitment to treat them as individuals in spheres such as education and the criminal justice system. Social progress does not require that the mind be free of ignoble motives, only that it have other motives (such as the emotion of empathy and cognitive faculties that can learn from history) that can counteract them.

By now most scientists reject both the nineteenth-century doctrine that biology is destiny and the twentieth-century doctrine that the mind is a blank slate. At the same time, many express a discomfort with any attempt to characterize the innate organization that the mind does have (even in service of a better understanding of learning). Instead, there is a widespread desire that the whole issue would somehow just go away. A common position on nature and nurture among contemporary scientists can be summarized as follows:

Why nature & nurture won't go away

> No one today believes that the mind is a blank slate; to refute such a belief is to tip over a straw man. All behavior is the product of an inextricable interaction between heredity and environment during development, so the answer to all nature-nurture questions is "some of each." If people only recognized this truism, the political recriminations could be avoided. Moreover, modern biology has made the very distinction between nature and nurture obsolete. Since a given set of genes can have different effects in different environments, there may always be an environment in which a supposed effect of the genes can be reversed or canceled; therefore the genes impose no significant constraints on behavior. Indeed, genes are expressed in response to environmental signals, so it is meaningless to try to distinguish genes and environments; doing so only gets in the way of productive research.

The attitude is often marked by words like 'interactionist,' 'developmentalist,' 'dialectic,' 'constructivist,' and 'epigenetic,' and is typically accompanied by a diagram with the labels 'genes,' 'behavior,' 'prenatal environment,' 'biochemical environment,' 'family environment,' 'school environment,' 'cultural environment,' and 'socioeconomic environment,' and arrows pointing from every label to every other label.

This doctrine, which I will call holistic interactionism, has considerable appeal. It is based on some unexceptionable points, such as that nature and nurture are not mutually exclusive, that genes cannot cause behavior directly, and that the direction of causation can go both

3 John Tooby and Leda Cosmides, "On the Universality of Human Nature and the Uniqueness of the Individual: The Role of Genetics and Adaptation," *Journal of Personality* 58 (1990): 17–67.

4 Pinker, *The Blank Slate*.

ways (for example, school can make you smarter, and smart people are most engaged by schooling). It has a veneer of moderation, of conceptual sophistication, and of biological up-to-dateness. And as John Tooby and Leda Cosmides have put it, it promises "safe conduct across the politicized minefield of modern academic life."[5]

But the very things that make holistic interactionism so appealing should also make us wary of it. No matter how complex an interaction is, it can be understood only by identifying the components and how they interact. Holistic interactionism can stand in the way of such understanding by dismissing any attempt to disentangle heredity and environment as uncouth. As Dan Dennett has satirized the attitude: "Surely 'everyone knows' that the nature-nurture debate was resolved long ago, and neither side wins since everything-is-a-mixture-of-both-and-it's-all-very-complicated, so let's think of something else, right?"

In the following pages I will analyze the tenets of holistic interactionism and show that they are not as reasonable or as obvious as they first appear.

"No one believes in the extreme nurture position that the mind is a blank slate." Whether or not this is true among scientists, it is far from true in the rest of intellectual life. The prominent anthropologist Ashley Montagu, summing up a common understanding in twentieth-century social science, wrote in 1973 that "With the exception of the instinctoid reactions in infants to sudden withdrawals of support and to sudden loud noises, the human being is entirely instinctless....Man is man because he has no instincts, because everything he is and has become he has learned...from his culture, from the man-made part of the environment, from other human beings."[6] Postmodernism and social constructionism, which dominate many of the humanities, vigorously assert that human emotions, conceptual categories, and patterns of behavior (such as those characterizing men and women or homosexuals and heterosexuals) are social constructions. Even many humanists who are not postmodernists insist biology can provide no insight into human mind and behavior. The critic Louis Menand, for instance, recently wrote that "every aspect of life has a biological foundation in exactly the same sense, which is that unless it was biologically possible it wouldn't exist. After that, it's up for grabs."[7]

Nor is a belief in the blank slate absent among prominent scientists. Richard Lewontin, Leon Kamin, and Steven Rose, in a book entitled *Not in Our Genes*, asserted that "the only sensible thing to say about human nature is that it is 'in' that nature to construct its own history."[8] Stephen Jay Gould wrote that the "brain [is] capable of a full range of behaviors and predisposed to none."[9] Anne Fausto-Sterling expressed a common view of the origin of sex differences: "The key biological fact is that boys and girls have different genitalia,

5 Tooby and Cosmides, "The Psychological Foundations of Culture."

6 Ashley Montagu, ed., *Man and Aggression*, 2nd ed. (New York: Oxford University Press, 1973).

7 Louis Menand, "What Comes Naturally," *The New Yorker*, 25 November 2002.

8 R. C. Lewontin, Steven Rose, and Leon J. Kamin, *Not in Our Genes: Biology, Ideology, and Human Nature* (New York: Pantheon Books, 1984).

9 Stephen Jay Gould, "Biological Potential vs. Biological Determinism," in *Ever Since Darwin: Reflections in Natural History*, ed. Stephen Jay Gould (New York: Norton, 1977).

and it is this biological difference that leads adults to interact differently with different babies whom we conveniently color-code in pink or blue to make it unnecessary to go peering into their diapers for information about gender."[10]

These opinions spill into research and policy. Much of the scientific consensus on parenting, for example, is based on studies that find a correlation between the behavior of parents and the behavior of children. Parents who spank have children who are more violent; authoritative parents (neither too permissive nor too punitive) have well-behaved children; parents who talk more to their children have children with better language skills. Virtually everyone concludes that the behavior of the parent causes the outcomes in the child. The possibility that the correlations may arise from shared genes is usually not even mentioned, let alone tested.[11]

Other examples abound. Many scientific organizations have endorsed the slogan "violence is learned behavior," and even biologically oriented scientists tend to treat violence as a public health problem like malnutrition or infectious disease. Unmentioned is the possibility that the strategic use of violence could have been selected for in human evolution, as it has been in the evolution of other primate species.[12] Gender differences in the professions, such as that the proportion of mechanical engineers who are women is less than 50 percent, are attributed entirely to prejudice and hidden barriers. The possibility that, on average, women might be less interested than men in people-free pursuits is similarly unspeakable.[13] The point is not that we know that evolution or genetics are relevant to explaining these phenomena, but that the very possibility is often treated as an unmentionable taboo rather than as a testable hypothesis.

"For every question about nature and nurture, the correct answer is 'some of each.'" Not true. Why do people in England speak English and people in Japan speak Japanese? The 'reasonable compromise' would be that the people in England have genes that make it easier to learn English and the people in Japan have genes that make it easier to learn Japanese, but that both groups must be exposed to a language to acquire it at all. This compromise is, of course, not reasonable but false, as we see when children exposed to a given language acquire it equally quickly regardless of their racial ancestry. Though people may be genetically predisposed to learn language, they are not genetically predisposed, even in part, to learn a particular language; the explanation for why people in different countries speak differently is 100 percent environmental.

Sometimes the opposite extreme turns out to be correct. Psychiatrists commonly used to blame psychopathology on mothers. Autism was caused by 'refrigerator mothers' who did not emotionally engage their children, schizophrenia by mothers who put their children in double binds. Today we know that autism

10 Anne Fausto-Sterling, *Myths of Gender: Biological Theories About Women and Men* (New York: Basic Books, 1985).

11 David C. Rowe, *The Limits of Family Influence: Genes, Experience, and Behavior* (New York: Guilford Press, 1994); Judith Rich Harris, *The Nurture Assumption: Why Children Turn Out the Way They Do* (New York: Free Press, 1998).

12 Martin Daly and Margo Wilson, *Homicide* (New York: A. de Gruyter, 1988).

13 David Lubinski and Camilla Benbow, "Gender Differences in Abilities and Preferences Among the Gifted: Implications for the Math-Science Pipeline," *Current Directions in Psychological Science* 1 (1992): 61–66.

and schizophrenia are highly heritable, and though they are not completely determined by genes, the other plausible contributors (such as toxins, pathogens, and developmental accidents) have nothing to do with how parents treat their children. Mothers don't deserve some of the blame if their children have these disorders, as a nature-nurture compromise would imply. They deserve none of it.

"If people recognized that every aspect of behavior involves a combination of nature and nurture, the political disputes would evaporate." Certainly many psychologists strive for an innocuous middle ground. Consider this quotation:

> If the reader is now convinced that either the genetic or environmental explanation has won out to the exclusion of the other, we have not done a sufficiently good job of presenting one side or the other. It seems highly likely to us that both genes and environment have something to do with this issue.

This appears to be a reasonable interactionist compromise that could not possibly incite controversy. But in fact it comes from one of the most incendiary books of the 1990s, Herrnstein and Murray's *The Bell Curve*. In this passage, Herrnstein and Murray summed up their argument that the difference in average IQ scores between American blacks and American whites has both genetic and environmental causes. A "some-of-each" position did not protect them from accusations of racism and comparisons to Nazis. Nor, of course, did it establish their position was correct: as with the language a person speaks, the black-white average IQ gap could be 100 percent environmental. The point is that in this and many other domains of psychology, the possibility that heredity has any explanatory role at all is still inflammatory.

"The effects of genes depend crucially on the environment, so heredity imposes no constraints on behavior." Two examples are commonly used to illustrate the point: different strains of corn may grow to different heights when equally irrigated, but a plant from the taller strain might end up shorter if it is deprived of water; and children with phenylketonuria (PKU), an inherited disorder resulting in retardation, can end up normal if given a diet low in the amino acid phenylalanine.

There is an aspect of this statement that indeed is worth stressing. Genes do not determine behavior like the roll of a player piano. Environmental interventions – from education and psychotherapy to historical changes in attitudes and political systems – can significantly affect human affairs. Also worth stressing is that genes and environments may interact in the statistician's sense, namely, that the effects of one can be exposed, multiplied, or reversed by the effects of the other, rather than merely summed with them. Two recent studies have identified single genes that are respectively associated with violence and depression, but have also shown that their effects are manifested only with particular histories of stressful experience.[14]

At the same time, it is misleading to invoke environment dependence to deny

14 Avshalom Caspi, Karen Sugden, Terrie E. Moffitt, Alan Taylor, and Ian W. Craig, "Influence of Life Stress on Depression: Moderation by a Polymorphism in the 5-HTT Gene," *Science* (2003): 386 – 389; Avshalom Caspi, Joseph McClay, Terrie E. Moffitt, Jonathan Mill, Judy Martin, and Ian W. Craig, "Evidence that the Cycle of Violence in Maltreated Children Depends on Genotype," *Science* 297 (2002): 727 – 742.

the importance of understanding the effects of genes. To begin with, it is simply not true that any gene can have any effect in some environment, with the implication that we can always design an environment to produce whatever outcome we value. Though some genetic effects may be nullified in certain environments, not all of them are: studies that measure both genetic and environmental similarity (such as adoption designs, where correlations with adoptive and biological parents can be compared) show numerous main effects of personality, intelligence, and behavior across a range of environmental variation. This is true even for the poster child of environmental mitigation, PKU. Though a low-phenylalanine diet does prevent severe mental retardation, it does not, as is ubiquitously claimed, render the person 'perfectly normal.' PKU children have mean IQs in the 80s and 90s and are impaired in tasks that depend on the prefrontal region of the cerebral cortex.[15]

Also, the mere existence of *some* environment that can reverse the expected effects of genes is almost meaningless. Just because extreme environments can disrupt a trait does not mean that the ordinary range of environments will modulate that trait, nor does it mean that the environment can explain the nature of the trait. Though unirrigated corn plants may shrivel, they won't grow arbitrarily high when given ever-increasing amounts of water. Nor does their dependence on water explain why they bear ears of corn as opposed to tomatoes or pinecones. Chinese foot-binding is an environmental manipulation that can radically affect the shape of the foot, but it would be misleading to deny that the anatomy of the human foot is in an important sense specified by the genes, or to attribute it in equal parts to heredity and environment. The point is not merely rhetorical. The fact that kittens' visual systems show abnormalities when their eyelids are sewn shut in a critical period of development does not imply (as was believed in the 1990s) that playing Mozart to babies or hanging colorful mobiles in their cribs will increase their intelligence.[16]

In short, the existence of environmental mitigations doesn't make the effects of the genes inconsequential. On the contrary, the genes specify what kinds of environmental manipulations will have what kinds of effects and with what costs. This is true at every level, from the expression of the genes themselves (as I will discuss below) to large-scale attempts at social change. The totalitarian Marxist states of the twentieth century often succeeded at modifying behavior, but at the cost of massive coercion, owing in part to mistaken assumptions about how easily human motives would respond to changed circumstances.[17]

Conversely, many kinds of genuine social progress succeeded by engaging specific aspects of human nature. Peter Singer observes that normal humans in

15 Adele Diamond, "A Model System for Studying the Role of Dopamine in the Prefrontal Cortex During Early Development in Humans: Early and Continuously Treated Phenylketonuria," in *Handbook of Developmental Cognitive Neuroscience*, ed. Charles A. Nelson and Monica Luciana (Cambridge, Mass.: MIT Press, 2001).

16 John T. Bruer, *The Myth of the First Three Years: A New Understanding of Early Brain Development and Lifelong Learning* (New York: Free Press, 1999).

17 Jonathan Glover, *Humanity: A Moral History of the Twentieth Century* (London: J. Cape, 1999); Peter Singer, *A Darwinian Left: Politics, Evolution, and Cooperation* (London: Weidenfeld & Nicolson, 1999).

all societies manifest a sense of sympathy: an ability to treat the interests of others as comparable to their own.[18] Unfortunately, the size of the moral circle in which sympathy is extended is a free parameter. By default, people sympathize only with members of their own family, clan, or village, and treat anyone outside this circle as less than human. But under certain circumstances the circle can expand to other clans, tribes, races, or even species. An important way to understand moral progress, then, is to specify the triggers that prompt people to expand or contract their moral circles. It has been argued that the circle may be expanded to include people to whom one is bound by networks of reciprocal trade and interdependence,[19] and that it may be contracted to exclude people who are seen in degrading circumstances.[20] In each case, an understanding of nonobvious aspects of human nature reveals possible levers for humane social change.

"Genes are affected by their environments, and learning requires the expression of genes, so the nature-nurture distinction is meaningless." It is, of course, in the very nature of genes that they are not turned on all the time but are expressed and regulated by a variety of signals. These signals in turn may be triggered by a variety of inputs, including temperature, hormones, the molecular environment, and neural activity.[21] Among the environmentally sensitive gene-expression effects are those that make learning itself possible. Skills and memories are stored as physical changes at the synapse, and these changes require the expression of genes in response to patterns of neural activity.

These causal chains do not, however, render the nature-nurture distinction obsolete. What they do is force us to rethink the casual equation of 'nature' with genes and of 'nurture' with everything beyond the genes. Biologists have noted that the word 'gene' accumulated several meanings during the twentieth century.[22] These include a unit of heredity, a specification of a part, a cause of a disease, a template for protein synthesis, a trigger of development, and a target of natural selection.

It is misleading, then, to equate the prescientific concept of human nature with 'the genes' and leave it at that, with the implication that environment-dependent gene activity proves that human nature is indefinitely modifiable by experience. Human nature is related to genes in terms of units of heredity, development, and evolution, particularly those units that exert a systematic and lasting effect on the wiring and chemistry of the brain. This is distinct from the most common use of the term 'gene' in molecular biology, namely, in reference to stretches of DNA that code for a

18 Peter Singer, *The Expanding Circle: Ethics and Sociobiology* (New York: Farrar, Straus & Giroux, 1981).

19 Robert Wright, *NonZero: The Logic of Human Destiny* (New York: Pantheon Books, 2000).

20 Glover, *Humanity*; Philip G. Zimbardo, Christina Maslach, and Craig Haney, "Reflections on the Stanford Prison Experiment: Genesis, Transformations, Consequences," in *Obedience to Authority: Current Perspectives on the Milgram Paradigm*, ed. Thomas Blass (Mahwah, N.J.: Lawrence Erlbaum Associates, 2000).

21 Marcus, *The Birth of the Mind*; Ridley, *Nature Via Nurture*.

22 Ridley, *Nature Via Nurture*; Richard Dawkins, *The Extended Phenotype: The Gene as the Unit of Selection* (San Francisco: W. H. Freeman & Company, 1982); Seymour Benzer, "The Elementary Units of Heredity," in *A Symposium on the Chemical Basis of Heredity*, ed. William D. McElroy and Bentley Glass (Baltimore: Johns Hopkins Press, 1957).

protein. Some aspects of human nature may be specified in information carriers other than protein templates, including the cytoplasm, noncoding regions of the genome that affect gene expression, properties of genes other than their sequence (such as how they are imprinted), and cross-generationally consistent aspects of the maternal environment that the genome has been shaped by natural selection to expect. Conversely, many genes direct the synthesis of proteins necessary for everyday metabolic function (such as wound repair, digestion, and memory formation) without embodying the traditional notion of human nature.

The various concepts of 'environment,' too, have to be refined. In most nature-nurture debates, 'environment' refers in practice to aspects of the world that make up the perceptual input to the person and over which other humans have some control. This encompasses, for example, parental rewards and punishments, early enrichment, role models, education, laws, peer influence, culture, and social attitudes. It is misleading to blur 'environment' in the sense of the psychologically salient environment of the person with 'environment' in the sense of the chemical milieu of a chromosome or cell, especially when that milieu itself consists of the products of other genes and thus corresponds more closely to the traditional notion of heredity. There are still other senses of 'environment,' such as nutrition and environmental toxins; the point is not that one sense is primary, but that one should seek to distinguish each sense and characterize its effects precisely.

A final reason that the environment dependence of the genes does not vitiate the concept of human nature is that an environment can affect the organism in very different ways. Some aspects of the perceptual environment are instructive in the sense that their effects are predictable by the information contained in the input. Given a child who is equipped to learn words in the first place, the content of her vocabulary is predictable from the words spoken to her. Given an adult equipped to understand contingencies, the spot where he will park his car will depend on where the No Parking signs are posted. But other aspects of the environment, namely, those that affect the genes directly rather than affecting the brain through the senses, trigger genetically specified if-then contingencies that do not preserve information in the trigger itself. Such contingencies are pervasive in biological development, where many genes produce transcription factors and other molecules that set off cascades of expression of other genes. A good example is the Pax6 gene, which produces a protein that triggers the expression of twenty-five hundred other genes, resulting in the formation of the eye. Highly specific genetic responses can also occur when the organism interacts with its social environment, as when a change of social status in a male cichlid fish triggers the expression of more than fifty genes, which in turn alter its size, aggressiveness, and stress response.[23] These are reminders both that innate organization cannot be equated with a lack of sensitivity to the environment, and that responses to the environment are often not specified by the stimulus but by the nature of the organism.

"Framing problems in terms of nature and nurture prevents us from understanding human development and mak-

23 Russell Fernald, "How Does Behavior Change the Brain? Multiple Methods to Answer Old Questions," *Integrative Comparative Biology* 43 (2003): 771–779.

ing new discoveries." On the contrary, some of the most provocative discoveries in twentieth-century psychology would have been impossible if there had not been a concerted effort to distinguish nature and nurture in human development.

For many decades psychologists have looked for the causes of individual differences in cognitive ability (as measured by IQ tests, school and job performance, and indices of brain activity) and in personality (as measured by questionnaires, ratings, psychiatric evaluations, and tallies of behavior such as divorce and crime). The conventional wisdom has been that such traits are strongly influenced by parenting practices and role models. But recall that this belief is based on flawed correlational studies that compare parents and children but forget to control for genetic relatedness.

Behavioral geneticists have remedied those flaws with studies of twins and adoptees, and have discovered that in fact virtually all behavioral traits are partly (though never completely) heritable.[24] That is, some of the variation among individual people within a culture must be attributed to differences in their genes. The conclusion follows from repeated discoveries that identical twins reared apart (who share their genes but not their family environment) are highly similar; that ordinary identical twins (who share their environment and all their genes) are more similar than fraternal twins (who share their environment but only half their variable genes); and that biological siblings (who share their environment and half their variable genes) are more similar than adoptive siblings (who share their environment but none of their variable genes). These studies have been replicated in large samples from several countries, and have ruled out the most common alternative explanations (such as selective placement of identical twins in similar adoptive homes). Of course, concrete behavioral traits that patently depend on content provided by the home or culture – which language one speaks, which religion one practices, which political party one supports – are not heritable at all. But traits that reflect the underlying talents and temperaments – how proficient with language a person is, how religious, how liberal or conservative – *are* partially heritable. So genes play a role in making people different from their neighbors, and their environments play an equally important role.

At this point it is tempting to conclude that people are shaped both by genes and by family upbringing: how their parents treated them and what kind of home they grew up in. But the conclusion is unwarranted. Behavioral genetics allows one to distinguish two very different ways in which people's environments might affect them. The *shared* environment is what impinges on a person and his or her siblings alike: their parents, home life, and neighborhood. The *unique* environment is everything else: anything that happens to a person that does not necessarily happen to that person's siblings.

Remarkably, most studies of intelligence, personality, and behavior turn up few or no effects of the shared environment – often to the surprise of the researchers themselves, who thought it was obvious that nongenetic variation

24 Plomin, Owen, and McGuffin, "The Genetic Basis of Complex Human Behaviors"; Eric Turkheimer, "Three Laws of Behavior Genetics and What They Mean," *Current Directions in Psychological Science* 9 (5) (2000): 160 – 164; Thomas J. Bouchard, Jr., "Genetic and Environmental Influences on Intelligence and Special Mental Abilities," *Human Biology* 70 (1998): 257 – 259.

had to come from the family.[25] First, adult siblings are about equally correlated whether they grew up together or apart. Second, adoptive siblings, when tested as adults, are generally no more similar than two people from the same culture chosen at random. And third, identical twins are no more similar than one would expect from the effects of their shared genes. Setting aside cases of extreme neglect or abuse, whatever experiences siblings share by growing up in the same home in a given culture make little or no difference to the kind of people they turn into. Specific skills like reading and playing a musical instrument, of course, can be imparted by parents, and parents obviously affect their children's happiness and the quality of family life. But they don't seem to determine their children's intellects, tastes, and personalities in the long run.

The discovery that the shared family environment has little to no lasting effect on personality and intelligence comes as a shock to the traditional wisdom that "as the twig is bent, so grows the branch." It casts doubt on forms of psychotherapy that seek the roots of an adult's dysfunction in the family environment, on theories that attribute adolescents' alcoholism, smoking, and delinquency to how they were treated in early childhood, and on the philosophy of parenting experts that parental micromanagement is the key to a well-adjusted child. The findings are so counterintuitive that one might doubt the behavioral genetic research that led to them, but they are corroborated by other data.[26] Children of immigrants end up with the language, accent, and mores of their peers, not of their parents. Wide variations in child-rearing practices – day-care versus stay-at-home mothers, single versus multiple caregivers, same-sex versus different-sex parents – have little lasting effect when other variables are controlled. Birth order and only-child status also have few effects on behavior outside the home.[27] And an extensive study testing the possibility that children might be shaped by *unique* aspects of how their parents treat them (as opposed to ways in which parents treat all their children alike) showed that differences in parenting within a family are effects, not causes, of differences among the children.[28]

The discovery of the limits of family influence is not just a debunking exercise, but opens up important new questions. The finding that much of the variance in personality, intelligence, and behavior comes neither from the genes nor from the family environment raises the question of where it does come from. Judith Rich Harris has argued that the phenomena known as socialization – acquiring the skills and values needed to thrive in a given culture – take place in the peer group rather than the family.

25 Rowe, *The Limits of Family Influence*; Harris, *The Nurture Assumption*; Turkheimer, "Three Laws of Behavior Genetics"; Robert Plomin and Denise Daniels, "Why Are Children in the Same Family So Different from One Another?" *Behavioral and Brain Sciences* 10 (1987): 1 – 60.

26 Harris, *The Nurture Assumption*.

27 Ibid.; Judith Rich Harris, "Context-Specific Learning, Personality, and Birth Order," *Current Directions in Psychological Science* 9 (2000): 174 – 177; Jeremy Freese, Brian Powell, and Lala Carr Steelman, "Rebel Without a Cause or Effect: Birth Order and Social Attitudes," *American Sociological Review* 64 (1999): 207 – 231.

28 David Reiss, Jenae M. Neiderhiser, E. Mavis Hetherington, and Robert Plomin, *The Relationship Code: Deciphering Genetic and Social Influences on Adolescent Development* (Cambridge, Mass.: Harvard University Press, 2000).

Though children are not prewired with cultural skills, they also are not indiscriminately shaped by their environment. One aspect of human nature directs children to figure out what is valued in their peer group – the social milieu in which they will eventually compete for status and mates – rather than to surrender to their parents' attempts to shape them.

Acknowledging this feature of human nature in turn raises questions about how the relevant environments, in this case peer cultures, arise and perpetuate themselves. Does a peer culture trickle down from adult culture? Does it originate from high-status individuals or groups and then proliferate along peer networks? Does it emerge haphazardly in different forms, some of which entrench themselves when they reach a tipping point of popularity?

A revised understanding of how children socialize themselves has practical implications as well. Teen alcoholism and smoking might be better addressed by understanding how these activities become status symbols in peer groups than by urging parents to talk more to their adolescents (as current advertisements, sponsored by beer and tobacco companies, insist). A major determinant of success in school might be whether classes fission into peer groups with different status criteria, in particular whether success in school is treated as admirable or as a sign of selling out.[29]

The development of personality – a person's emotional and behavioral idiosyncrasies – poses a set of puzzles distinct from those raised by the process of socialization. Identical twins growing up in the same home share their genes, their parents, their siblings, their peer groups, and their culture. Though they are highly similar, they are far from indistinguishable: by most measures, correlations in their traits are in the neighborhood of 0.5. Peer influence cannot explain the differences, because identical twins largely share their peer groups. Instead, the unexplained variance in personality throws a spotlight on the role of sheer chance in development: random differences in prenatal blood supply and exposure to toxins, pathogens, hormones, and antibodies; random differences in the growth or adhesion of axons in the developing brain; random events in experience; random differences in how a stochastically functioning brain reacts to the same events in experience. Both popular and scientific explanations of behavior, accustomed to invoking genes, parents, and society, seldom acknowledge the enormous role that unpredictable factors must play in the development of an individual.

If chance in development is to explain the less-than-perfect similarity of identical twins, it also highlights an interesting property of development in general. One can imagine a developmental process in which millions of small chance events cancel one another out, leaving no difference in the resulting organism. One can imagine a different process in which a chance event could disrupt development entirely. Neither of these happens to identical twins. Their differences are detectable both in psychological testing and in everyday life, yet both are (usually) healthy human beings. The development of organisms must use complex feedback loops rather than prespecified blueprints. Random events can divert the trajectories of growth, but the trajectories are confined within an envelope of functioning designs for the species.

These profound questions are not about nature versus nurture. They are about nurture versus nurture: about

29 Harris, *The Nurture Assumption*.

what, precisely, are the nongenetic causes of personality and intelligence. But the puzzles would never have come to light if researchers had not first taken measures to factor out the influence of nature, by showing that correlations between parents and children cannot glibly be attributed to parenting but might be attributable to shared genes. That was the first step that led them to measure the possible effects of parenting empirically, rather than simply assuming that parents had to be all-powerful. The everything-affects-everything diagram turns out to be not sophisticated but dogmatic. The arrows emanating from 'parents,' 'siblings,' and 'the home' are testable hypotheses, not obvious truisms, and the tests might surprise us both by the arrows that shouldn't be there and by the labels and arrows we may have forgotten.

The human brain has been called the most complex object in the known universe. No doubt hypotheses that pit nature against nurture as a dichotomy or that correlate genes or environment with behavior without looking at the intervening brain will turn out to be simplistic or wrong. But that complexity does not mean we should fuzz up the issues by saying that it's all just too complicated to think about, or that some hypotheses should be treated a priori as obviously true, obviously false, or too dangerous to mention. As with inflation, cancer, and global warming, we have no choice but to try to disentangle the multiple causes.[30]

30 The writing of this paper was supported by NIH Grant HD-18381. I thank Helena Cronin, Jonathan Haidt, Judith Rich Harris, and Matt Ridley for comments on an earlier draft.

Richard Rorty

Philosophy-envy

When philosophers like Ortega y Gasset say that we humans have a history rather than a nature, they are not suggesting that we are blank slates. They do not doubt that biologists will eventually pin down the genetic factor in autism, homosexuality, perfect pitch, lightning calculation, and many other traits and abilities that differentiate some humans from others. Nor do they doubt that, back in the days when our species was evolving its way into existence on the African savannas, certain genes were weeded out and others preserved. They can cheerfully agree with scientists like Steven Pinker that the latter genes account for various sorts of behavior common to all human beings, regardless of acculturation.

What these philosophers doubt is that either factoring out the role of genes in making us different from one another, or tracing what we have in common back to the evolutionary needs of our ancestors, will give us anything appropriately labeled 'a theory of human nature.' For such theories are supposed to be normative – to provide guidance. They should tell us what to do with ourselves. They should explain why some lives are better for human beings than other lives, and why some societies are superior to others. A theory of human nature should tell us what sort of people we ought to become.

Philosophical and religious theories of human nature flourished because they stayed clear of empirical details. They took no chances of being disconfirmed by events. Plato's and Aristotle's theories about the parts of the soul were of this sort, and so were Christianity's theory that we are all children of a loving God, Kant's theory that we are phenomenal creatures under noumenal command, and Hobbes's and Freud's naturalizing stories about the origins of sociality and of morality. Despite their lack of predictive power and empirical disconfirmability, such theories were very useful – not because they were accurate accounts of what human beings, deep down, really and truly are, but because they suggested perils to avoid and ideals to serve. They marketed helpful moral

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and political advice in fancy, disposable, packaging.

Steven Pinker is trying to recycle this packaging, wrapping it around a miscellany of empirical facts rather than around a vision of the good life or of the good society. But it is hard to see how a composite, or a synthesis, of the various empirical disciplines that now call themselves cognitive sciences could serve the purposes that religion and philosophy once served. The claim that what the philosophers did a priori and badly can now be done a posteriori and well by cognitive scientists will remain empty rhetoric until its adherents are willing to stick their necks out. To make good on the promise of the term 'a scientific theory of human nature' they would have to start offering advice about how we might become, individually or collectively, better people. Then they would have to spell out the inferences that had led them from particular empirical discoveries about our genes or our brains to these particular practical recommendations.

E. O. Wilson, Pinker, and others who think that biology and cognitive science can take over at least part of the cultural role of philosophy are reluctant to start down this path. They remember the fate of the eugenics movement – of claims to have 'proved scientifically' that interracial marriage, or increased immigration, would produce cultural degeneration. Recalling this obnoxious predecessor makes them leery of betting the prestige of their disciplines on the outcome of practical recommendations. Instead, they just repeat over and over again that as we learn more and more about our genes and our brains, we shall gain a better understanding of what we essentially are.

But for historicist philosophers like Ortega there is nothing we essentially are. There are many lessons to be learned from history, but no superlesson to be learned from science, or religion, or philosophy. The unfortunate idea that philosophy could detect the difference between nature and convention – between what is essential to being a human being and what is merely a product of historical circumstance – was passed on from Greek philosophy to the Enlightenment. There it reappeared, in a version that would have disgusted Plato, in Rousseau. But in the last two centuries the notion that beneath all cultural overlays there lurks something called human nature, and that knowledge of this thing will provide valuable moral or political guidance, has fallen into deserved disrepute.

Dewey was right to mock Plato's and Aristotle's claims that the contemplative life was the one that best utilized our distinctively human abilities. Such claims, he said, were merely ways in which these philosophers patted themselves on the back. Ever since Herder, the Rousseauvian claim that the aim of sociopolitical change should be to bring us back to uncorrupted nature has been rejected by thinkers impressed by the extent, and the value, of cultural variation. The idea, shared by Plato and Rousseau, that there is such a thing as *the* good life for man has gradually been replaced by the conviction that there are *many* equally valuable human lives. This change has resulted in our present conviction that the best sociopolitical setup is one in which individuals are free to live whichever of these lives they choose – to make themselves up as they go along, without asking what they were somehow 'meant' to become. It has also resulted in religion and philosophy being nudged aside by history, literature, and the arts as sources of edification and of ideals.

Carl Degler's *In Search of Human Nature: The Decline and Revival of Darwinism in American Social Thought* tells the story of the biologists' attempts to move onto some of the turf from which the philosophers have been withdrawing. Darwinism revealed previously unsuspected continuities between humans and brutes, and these made it seem plausible that further biological research could tell us something morally significant. In a chapter called "Why Did Culture Triumph?" Degler explains how the overweening pretensions of the eugenicists, and the futile attempt to stem the tide of feminism by appeals to biological facts about the differing 'natures' of men and women, helped to discredit this suggestion. Then, in a chapter called "Biology Redivivus," he describes how sociobiologists and their allies have been trying to push the pendulum back in the other direction.

Degler ends his book on an ecumenical note, endorsing what Pinker calls holistic interactionism. But many of his readers will conclude that the moral of the story he tells is that "nature or nurture?" was never a very good question. Darwin did make a tremendous difference to the way we think about ourselves, because he discredited religious and philosophical accounts of a gap between the truly human and immaterial part of us and the merely animal and material part. But nothing Darwin taught us blurs the distinction between what we can learn from the results of biological and psychological experiments and what we can only learn from history – the record of past intellectual and social experiments.

Pinker is right that the nature vs. nurture debate will not go away as long as the question is raised in respect to some very particular type of human behavior – autism, for example. But at more abstract levels, such debates are vacuous. They are rhetorical exchanges occasioned by academic turf wars. The question "Is our humanity a biological or a cultural matter?" is as sterile as "Are our actions determined or do we have free will?" No concrete result in genetics, or physics, or any other empirical discipline will help us answer either bad question. We will go right on deliberating about what to do, and holding each other responsible for actions, even if we become convinced that every thought we have, and every move we make, will have been predicted by an omniscient neurologist. We will go right on experimenting with new lifestyles, new ideas, and new social institutions, even if we become convinced that, deep down, everything somehow depends on our genetic makeup. Discussion of the nature-nurture question, like discussion of the problem of free will, has no pragmatic import.

Pinker says, correctly, that there is a "widespread desire that the whole [nature-nurture] issue would somehow just go away" and an equally widespread suspicion that to refute a belief in the blank slate is "to tip over a straw man." Readers of Degler will be disposed to share both that desire and that suspicion. Pinker hopes to change their minds by tipping over other straw men: "postmodernism and social constructionism, which dominate many of the humanities." But it is hard to think of any humanist – even the most far-out Foucauldian – who would endorse the view, implausibly attributed by Pinker to Louis Menand, that "biology can provide no insight into human mind and behavior." What Foucault, Menand, and Ortega doubt is that insights provided by biology will ever help us decide which individual and social ideals to strive for.

Pinker thinks that science may succeed where philosophy has failed. To make his case, however, he has to treat platitudes as gee-whiz scientific discoveries. He says, for example, that "cognitive science has shown that there must be complex innate mechanisms for learning and culture to be possible." Who ever doubted there were? We already knew, before cognitive science came along, that you cannot teach young nonhuman animals to do things that you can teach young humans to do. We figured out a long time ago that if an organism had one kind of brain we could teach it to talk, and that if it had another kind we could not. Yet Pinker writes as if people like Menand were committed to denying evident facts such as these.

Again, Pinker cites recent suggestions that the circle of organisms that are objects of our moral concern "may be expanded to include people to whom one is bound by networks of reciprocal trade and interdependence, and . . . contracted to exclude people who are seen in degrading circumstances." But we did not need recent scientific research to tell us about these "possible levers for humane social change." The relevance of interdependence to the way we treat foreign traders, and of degradation to the way we treat prisoners of war, is hardly news. People have been recommending trade and intermarriage as a way of achieving wider community for a long time now. For an equally long time, they have been suggesting that we stop degrading people in order to have an excuse for oppressing them. But Pinker describes facts familiar to Homer and Herodotus as exhibiting "nonobvious aspects of human nature."

It is likely that further discoveries about how our brains work will give us a lot of useful ideas about how to change human behavior. But suppose that nanotechnology eventually enables us to trace the transmission of electrical charges from axon to axon within the living brain, and to correlate such processes with minute variations in behavior. Suppose that we become able to modify a person's behavioral dispositions, in pretty much any way we like, just by tweaking her brain cells. How will this ability help us figure out what sort of behavior to encourage and what sort to discourage – to know how human beings should live? Yet that sort of help is just what philosophical theories of human nature claimed to provide.

Pinker says at various places in *The Blank Slate* that everybody has and needs a theory of human nature, and that empirical scientific inquiry is likely to give us a better theory than either uninformed common sense or a priori philosophizing. But it is not clear that we have or need anything of the sort. Every human being has convictions about what matters more and what matters less, and thus about what counts as a good human life. But such convictions need not – and should not – take the form of a theory of human nature, or a theory of anything else. Our convictions about what really matters are constantly modified by new experiences – moving from a village to a city or from one country to another, meeting new people, and reading new books. The idea that we deduce them, or should deduce them, from a theory is a Platonist fantasy that the West has gradually outgrown.

The books that change our moral and political convictions include sacred scriptures, philosophical treatises, intellectual and sociopolitical histories, epic poems, novels, political manifestoes, and writings of many other sorts. But scientific treatises have become increasingly irrelevant to this process of change.

This is because, ever since Galileo, natural science has won its autonomy and its richly deserved prestige by telling us how things work, rather than, as Aristotle hoped to do, telling us about their intrinsic natures.

Post-Galilean science does not tell us what is really real or really important. It has no metaphysical or moral implications. Instead, it enables us to do things that we had not previously been able to do. When it became empirical and experimental, it lost both its metaphysical pretensions and the ability to set new ends for human beings to strive for. It gained the ability to provide new means. Most scientists are content with this trade-off. But every so often a scientist like Pinker tries to have it both ways, and to suggest that science can provide empirical evidence to show that some ends are preferable to others.

Whereas physics-envy is a neurosis found among those whose disciplines are accused of being soft, philosophy-envy is found among those who pride themselves on the hardness of their disciplines. The latter think that their superior rigor qualifies them to take over the roles previously played by philosophers and other sorts of humanists – roles such as critic of culture, moral guide, guardian of rationality, and prophet of the new utopia. Humanists, such scientists argue, only have opinions, but scientists have knowledge. Why not, they ask us, stop your ears against culture-babble (which is all you are going to get from those frivolous postmodernists and irresponsible social constructionists) and get your self-image from the people who know what human beings really, truly, objectively, enduringly, transculturally are?

Those who succumb to such urgings are subjected to bait-and-switch tactics. They think they will learn whether to be more like Antigone than like Ismene, or more like Martha than like Mary, or more like Spinoza than like Baudelaire, or more like Lenin than like FDR, or more like Ivan Karamazov than like Alyosha. They want to know whether they should throw themselves into campaigns for world government, or against gay marriage, or for a global minimum wage, or against the inheritance tax. They hope for the sort of guidance that idealistic freshmen still think their teachers may be able to provide. When they take courses in cognitive science, however, this is not what they get. They get a better understanding of how their brains work, but no help in figuring out what sort of people to be or what causes to fight for.

This sense that they have been subjected to bait-and-switch tactics often also afflicts freshmen who sign up for philosophy courses because they have been turned on by Marx, Camus, Kierkegaard, Nietzsche, or Heidegger. They imagine that if they take a course in what are advertised as 'the core areas of philosophy' – metaphysics and epistemology – they will be better able to answer the questions these authors raised. But what they get in such courses is, typically, a discussion of the place of such things as knowledge, meaning, and value in a world made up of elementary particles. Many would-be students of philosophy are unable to see why they need have views on that topic – why they need a metaphysics.

It was because Ortega found such topics profitless that he wrote polemical essays like the one from which Pinker quotes ("History as a System," in Ortega's *Toward a Philosophy of History*). There he said:

> all the naturalist studies on man's body and soul put together have not been of the slightest use in throwing light on any of our most strictly human feelings, on what each individual calls his own life, that life which, intermingling with others, forms societies, that in their turn, persisting, make up human destiny. The prodigious achievement of natural science in the direction of the knowledge of things contrasts brutally with the collapse of this same natural science when faced with the strictly human element.

Ortega insisted that increasing knowledge of how things such as the human brain and the human genome work will never help us figure out how to envisage ourselves and what to do with ourselves. Pinker thinks that he was wrong. But only a few pages of *The Blank Slate* grapple directly with this issue. Among those that do, the most salient are the ones in which Pinker argues that scientific discoveries give us reason to adopt what he calls "The Tragic Vision" rather than "The Utopian Vision" of human life – to take a dim view of the capacity of human beings to change themselves into new and better sorts of people.

In order to show that our choice between these two visions should be made by reference to science rather than to history, Pinker has to claim, cryptically, that "parts of these visions" consist of "general claims about how the mind works." But that is just what historicist philosophers like Ortega doubt. They think that the contest between these two visions will be unaffected even if the brain turns out to work in some weird way that contemporary science has not yet envisaged, or if new fossil evidence shows that the current story about the evolution of our species is all wrong. Debates about what to do with ourselves, they say, swing as free from disagreements about the nature of neurons or about where we came from as they do from controversies about the nature of quarks or about the timing of the big bang.[1]

The issue Pinker has with Ortega, and with most philosophers outside the so-called analytic tradition, has nothing to do with blank slates. It is about whether the conversations among humanists about alternative self-images and alternative ideals would be improved if the participants knew more about what is going on in biology and cognitive science. Pinker argues that men and women with moral and political concerns have always relied upon theories of human nature, and that empirically based theories are now available. But Ortega would reply that for the last few hundred years we have learned to substitute historical narrative and utopian speculation for such theories.

This historicist turn does, however, owe a great deal to one particular scientist: Darwin. Darwin helped us stop thinking of ourselves as an animal body in which something extra, and specifically human, has been inserted – a mysterious ingredient whose nature poses philosophical problems. His critics said that he had reduced us to the level of the beasts, but in fact he let us see imaginative daring as a causal force comparable to genetic mutation. He reinforced the historicism of Herder and Hegel by letting us see cultural evolution as on a par with biological evolution – as equally capable of creating something radically new and better. He helped poets like Tennyson and Whitman, and thinkers like Nietzsche, H. G. Wells, George Bernard Shaw, and John Dewey, to dream of

1 For more on this point, see my "The Brain as Hardware, Culture as Software," *Inquiry* 47 (3) (June 2004): 219 – 235.

Richard Rorty on human nature

utopias in which human beings had become as wonderfully different from us as we are from the Neanderthals. The dreams of socialists, feminists, and others have produced profound changes in Western social life, and may lead to vast changes in the life of the species as a whole. Nothing that natural science tells us should discourage us from dreaming further dreams.

Richard Wrangham

Killer species

Human social behavior varies so much that our plasticity can sometimes seem infinite. But human variation has obvious limits when we compare ourselves with our primate relatives. Napoleon may have claimed that he always had to give in to his wife, the Empress Josephine, but there are no human societies that follow the lemur pattern of all males invariably subordinating themselves to all females. Nor do women anywhere entice all their male counterparts in their community to mate with them every month, as female chimpanzees do. Just as other species have their particular social tendencies, in other words, so does ours. Features characteristic of human society include social communities composed of individuals who associate at will, multilevel ties among communities, mothers forming mating bonds, coalitions of males fighting over territory, and so on.

That all humans share some characteristic social tendencies may be unremarkable in comparison with other species, but it provides valuable insight into behavioral evolution. In this essay I will focus on a few features we share with our closest ape relatives, but that are otherwise found rarely. In particular, we share the tendency for coalitions of related males to cooperate in defending a shared territory; and we kill our enemies. These are unusual patterns in other primates, so the question is why they should be prominent in humans and our close kin.

One hypothesis is phylogenetic inertia, the nonadaptive retention of an ancestral trait. Phylogenetic inertia is a possibility whenever closely related species behave alike. For example, horses and zebras both live in groups of unrelated females and single stallions within larger herds. Breeding wolves and coyotes live as isolated monogamous pairs aided by nonbreeding helpers. Male hornbills of many different species imprison their mating partners in a secluded breeding hole. There are many such examples of social systems corre-

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lated with phylogeny, and in theory these could result from species failing to adapt their behavior to new circumstance.

However attractive the notion of phylogenetic inertia might seem, it suffers from the problem of explaining why adaptive changes in social behavior should be constrained. The hypothesis of adaptive socioecology is therefore a strong a priori alternative to phylogenetic inertia. Adaptive socioecology posits that a similar lifestyle is the key to similar behavior among closely related species, whether it be grass-eating for horses and zebras, den-living for wolves and coyotes, or a shortage of suitable nesting holes for different species of hornbills. Adaptive socioecology rests on the notion that social systems can change rapidly in response to a novel ecology.

Baboons offer a particularly tidy example of adaptive socioecology, because even within a single species genetically based differences in psychology have evolved in apparent response to a specific ecological change. East Africa's olive baboons live in lush grasslands where the abundance of food permits large, cooperative groups of female kin that aid each other in competition against other females. Too large to be monopolized by a single male, a group generally includes ten or more unrelated males that join as adolescents. Female olive baboons respond to the plethora of males by mating widely within the group, thereby garnering protection for their offspring from the numerous possible fathers. A rich food supply thus promotes large, multimale groups of promiscuous and kin-bonded females.

Hamadryas baboons, by contrast, occupy semideserts in northeast Africa and Arabia. They resemble olive baboons closely, being only marginally smaller, with somewhat more colorful males. In their dry habitat, food is so sparse that in bad seasons the large groups fragment by day in search of forage. But females can't survive without a defending male, so each stays in a small subgroup with a single male, to whom she becomes faithfully bonded and whom she allows to herd her when other males are near. To prevent other males from stealing their females when the subgroups reunite at sleeping sites, males form defensive alliances with each other. A poor food supply thus leads to small families of acquiescent female hamadryas attached to a network of bonded males.

The contrasting baboon social patterns conform to the respective ecological pressures. These differences could in theory emerge merely as the baboons' developmental response to their immediate environments, but there is evidence of strong genetic influence. Thus even after many generations in captivity, baboons of the two subspecies form the same kinds of social groups as their wild ancestors. The same differentiation is dramatically echoed among naturally occurring hybrids in Ethiopia, for which physical features and behavior are correlated. Females that look more like olive baboons, for example, strongly resist male efforts to herd them. By contrast, those that look more like hamadryas readily accept a male's herding. Differences in serotonin levels between males of the two subspecies of baboons conform to the different patterns of aggression.

Olive and hamadryas baboons differentiated from each other around three hundred thousand years ago. Even without any notable anatomical evolution, therefore, three hundred thousand years and a changed ecology are enough for radical adaptation in social behavior, including patterns of grouping, kin relations, and feeding competition.

Why, then, should humans be in the least similar to our cousin apes? Chimpanzees and bonobos are separated from humans not only by five to six million years, but by enormous changes in ecology and ability, including raw biological differences in diet, locomotion, and sexuality, as well as by the refined influences of language and culture. Against this background, significant social similarities with our cousin apes are puzzling. While phylogenetic inertia is an explanation of last resort, adaptive socioecology is at first glance improbable. As we will see, however, hidden ecological similarities suggest that contrary to the apparent differences between humans and other apes, our shared social features derive from parallel ecological pressures.

Though human hunter-gatherers (also called foragers) offer the most appropriate comparison with other species, their lifestyle and social relations differ about as much from those of our cousin apes as any other people's. Foragers dig for roots and collect fruits, hunt large game, cook their food, construct simple housing, and defend themselves with spears or other weapons. They tend to occupy temporary camps for several weeks at a time, housing a group of perhaps twenty to forty people, and they relocate these camps when the women find it hard to get enough food within a reasonable day's walk. The members of a camp are part of a larger social community that might include a few hundred or even a thousand or more people. At certain times of the year this community gathers for a few days, when feasts and ceremonies allow social relationships to be re-formed across the wider network of the tribe. And as is true for every other human society, cultural rules pervade life among such communities. None of this is very ape-like.

Killer species

Chimpanzees and bonobos are the species of apes that are closest to humans. Both are quadrupedal, forest-living fruit-eaters that climb for most of their food, sleep in trees exposed to the rain, and use only the simplest tools (some populations use none). Their communities are limited to the set of individuals that live sufficiently close that they might meet by chance. These communities are formed around a core of related males, and there are no bonds among mates.

Yet different as humans and these apes are, all three species live in social communities with no fixed associations of individuals other than those between mothers and their dependent offspring – a rare trait in the context of most other primates. Accordingly, during the day, individuals of these species can decide for themselves where to go. In practice, among hunter-gatherers most women forage every day in the company of other women from their temporary camp, much as most male chimpanzees spend the day in the company of chosen allies. But in both cases, there are options. A woman might choose to make a tryst, stay in the camp, or walk alone. A male chimpanzee might equally well opt to travel alone for hours or days at a time.

Such individual choice within a defined social network occurs in only one other group of primates: the atelines, South American monkeys distantly related to apes. In addition to community organization, those species share a second rare similarity with humans, chimpanzees, and bonobos: their males form coalitions to defend territory.

There are other ways in which the atelines (spider monkeys, woolly monkeys, and muriqui) are the most ape-like group of monkeys: their large size relative to other South American monkeys, relatively efficient travel, mobile shoulders, and diet of ripe fruit and soft

leaves. It has therefore been suggested that resemblances between the social behavior of atelines and that of the apes have resulted from parallel adaptations for harvesting ripe fruit, a resource that induces intense feeding competition, independent travel, and territorial defense.[1] In line with this suggestion, the protean grouping patterns of humans may be similarly derived from an evolutionary commitment to high-quality foods.

Whatever its precise cause, the combination of social communities with small and frequently changing subgroups appears to be an important precondition for one of the most striking similarities between humans and any other primates: the territorial aggression observed in humans and chimpanzees alike.

Warfare is often defined in a way that suggests it is unique to humans, for instance, as an interaction involving culturally sanctioned plans or weapons or organized fighting between large groups. But of course the behavior that underlies human warfare is not unique, as the chimpanzee case makes clear.

Most encounters between chimpanzee communities involve males. There can be as many as thirty-five males in a community, but the average is ten to twelve, and most parties (temporary subgroups) have about half that number. Interactions with neighboring communities are never friendly and are often dangerous.

But even so, males sometimes seek out opportunities to engage with neighbors. They routinely conduct border patrols and may penetrate beyond the zone of relative safety, looking carefully as they go. Sometimes they climb a tree and face the neighboring range, as if listening for rivals. Occasionally they make deep invasions.

Most encounters that result from these behaviors happen by chance when nearby parties surprise each other at close range – a few hundred yards, say. Calls from strangers prompt immediate tension. Sometimes the listeners briefly freeze, but more often they let out a volley of shouts and quickly move. If they are numerous, they advance. If not, they retreat toward the heart of their territory.[2]

But when they meet at close range and the numbers of males on each side are similar they're more likely to stand their ground. Typically, chimpanzees in the battleground hurtle unpredictably through the brush, pausing after each rush to look and listen tensely around, often standing bipedal with one hand on a small tree. For them one decision might be a matter of success or death. Their pauses allow them to gauge who's where, to find an ally, or to see uncertainty in the enemy. After a stop, alone or in a small tight group of two or three, they charge off on a new run across the battle area. Occasionally one of them gets hit by a passing rusher, but mostly the chimpanzees from each community charge backwards and forwards from safe spots as each side tries to frighten the other into retreat. The air is thick

1 Colin A. Chapman, Richard Wrangham, and Lauren J. Chapman, "Ecological Constraints on Group Size: An Analysis of Spider Monkey and Chimpanzee Subgroups," *Behavioral Ecology and Sociobiology* 36 (1995): 59 – 70.

2 Michael L. Wilson, Marc D. Hauser, and Richard W. Wrangham, "Does Participation in Intergroup Conflict Depend on Numerical Assessment, Range Location, or Rank for Wild Chimpanzees?" *Animal Behaviour* 61 (2001): 1203 – 1216, describe playback experiments showing that when a call is heard from a single stranger, chimpanzees move forward only if there are at least three males in the listening party, and that otherwise they retreat.

with screams and emotion. It's hard to tell exactly what's happening; it's difficult even to identify the males in the melee of speed and power and fully erected hair. Their screams and barks can go on with hardly a pause for forty-five minutes.

In the end, the party with fewer males generally retreats. The result can be important. For several weeks, the losing community tends to avoid an area that would otherwise have provided access to a preferred food; this could mean the difference between a few weeks of eating from a rich fruit crop, and being forced onto a poor diet that causes delayed response and threatens infant survival.

Of more immediate importance, these battles sometimes lead to a lone participant being caught by several of his rivals. The result tends to be remarkably lopsided. While the aggressors are unlikely even to be scratched, the victim may be killed on the spot, or bruised, bitten, and torn so badly that he survives for only a few days or weeks. The same result can follow from border patrols or deep invasions. Overwhelming numbers mean the attackers are safe. Several males each hold a hand or foot of the rival. The immobilized victim can then be damaged at will.

Observations from five study sites now allow the first rough estimates of death rates from intergroup killing among chimpanzees. Between 1963 (when we have Jane Goodall's first demographic data from Gombe) and 2002, a total of about 145 data-years of observation were logged across the five long-term sites. During that time, forty-six intercommunity kills were observed or suspected. Thirty-one involved members of the study communities (twenty-four adult males, one adult female, six infants). When the number of chimpanzees in each community is taken into account, these figures yield a median death rate from intergroup aggression of 140 per 100,000, which rises to 356 per 100,000 if we include suspected cases in addition to those observed or confidently inferred.[3]

The chimpanzee data resemble death rates from war among traditional subsistence societies. Thus, based on a worldwide compilation by Lawrence Keeley, Michael Wilson and I have assembled demographic data for thirty-two politically independent peoples. These include twelve hunter-gatherer and twenty gardening or farming cultures. For hunter-gatherers, annual war death rates averaged 165 per 100,000, about the same as the intergroup killing rate for chimpanzees. For the subsistence farmers, the toll rose to a startling 595 per 100,000, somewhat above the upper estimate for chimpanzees (356 per 100,000).[4] The sampled cultures range from relatively peaceful people such as the Semai of Malaysia to the famously dangerous Dani of New Guinea, among whom at least 28 percent of men's deaths, and 2 percent of women's, occurred in war.[5] Understanding why there is such a range is an important challenge for the future. For the moment, however, we can conclude that

3 Rates are calculated from data presented in Michael L. Wilson and Richard W. Wrangham, "Intergroup Relations in Chimpanzees," *Annual Review of Anthropology* 32 (2003): 363–392. For adult males as a separate class, the equivalent rates are between 0.38 and 1.30 percent per year.

4 Lawrence H. Keeley, *War Before Civilization* (New York: Oxford University Press, 1996).

5 Karl G. Heider, *The Dugum Dani: A Papuan Culture in the Highlands of West New Guinea* (Chicago: Aldine Publishing Company, 1970), 128, recorded for Dani living in the Grand Valley of Balim River in the central highlands of western New Guinea.

death rates from intergroup aggression among small independent communities are broadly similar for humans and chimpanzees.

Shockingly, death rates in the modern era tend to be lower even when periods of major war are included. During the twentieth century, for example, Germany, Russia, and Japan each experienced rates of war deaths that were less than half the average hunter-gatherer rate. The contrast reflects a difference in the practice of war between prestate and state societies. In prestate societies all men are warriors, and all women are vulnerable. In state societies, by contrast, fewer people are directly exposed to violence (even though civilians and children often suffer worse casualties than the military) because armies fight on behalf of the larger group.[6]

There's only one other mammal whose intergroup killing has been observed frequently enough to have been calculated. The discovery would have been a surprise to Konrad Lorenz, a founding father of ethology. Lorenz thought wolves would not kill wolves, because he saw captive dominants treating helpless subordinates in a kindly manner. So he argued that wolves must have been selected for inhibition. He was right in one sense: within social groups, wolves normally control their emotions well. But Lorenz didn't know about wolves in the wild, where food is scarce and every group is surrounded by its neighbors.

Wolves of neighboring groups don't hold back. David Mech and his colleagues studied packs in the glacial uplands of Alaska's Denali National Park, an area they considered to be free of human influences. Based on twenty-two killings in at least seventeen packs, they estimated that 39 to 65 percent of adult wolves were killed by other packs. We can expect variation in such rates across populations, but at least in Minnesota a similar figure emerged: 43 percent of wolves not killed by humans were killed by other wolves.[7]

These data were presented as percentages of deaths from violence, rather than as an annual death rate. Human data have sometimes been compiled in the same way, and show that only the most extreme of human cultures match the killing rate of wolves. The highest human death rate from violence has been recorded in eastern Ecuador, where anthropologist James Yost and colleagues collected data on causes of death for Waorani horticulturalists living in dispersed villages of less than a hundred people. Based on 551 deaths, they found that homicide took the lives of 49 percent of women and 64 percent of men, close to the figure for Denali wolves.[8]

Other prestate societies show slightly lower figures. More such data have been collected from highland New Guinea than from any other part of the world, because many of the people living there continued to practice local war until recently. These people include the Tauna

6 Death rates in the twentieth century were presented by Keeley, *War Before Civilization*. Carolyn Nordstrom, "Deadly Myths of Aggression," *Aggressive Behavior* 24 (1998): 147–159.

7 L. David Mech, Layne G. Adams, Thomas J. Meier, John W. Burch, and Bruce W. Dale, *The Wolves of Denali* (Minneapolis: University of Minnesota Press, 1998).

8 James A. Yost and Patricia M. Kelley, "Shotguns, Blowguns, and Spears: The Analysis of Technological Efficiency," in Raymond B. Hames and William T. Vickers, eds., *Adaptive Responses of Native Amazonians* (New York: Academic Press, 1983), 189–224. The recorded deaths include an unrecorded proportion of killings within villages, so these figures do not correspond exactly to the wolf data.

Awa, with 16 percent of women and 30 percent of men (of 206 deaths) dying from homicide; the Usurufa, with 12 percent of women and 32 percent of men (of 514 deaths); the Mae Enga, with maybe 2 to 3 percent of women and 35 percent of men (of 261 deaths); and the Huli, with 1 percent of women and 20 percent of men (of 769 deaths).

For hunter-gatherers, fewer data are available, but the picture is as expected from the annual kill rate. Homicides occur, but at lower rates than among horticultural farmers.[9] There are the Aché of Paraguay, among whom homicide has been responsible for the deaths of 14 percent of women and 15 percent of men (of 115 deaths); the Hiwi of Venezuela, with 17 percent of women and 14 percent of men (of 124 deaths); and the Agta of the Philippines, with 3 percent of women and 14 percent of men (of 78 deaths).

The point about these figures isn't to claim any particular numerical averages. It's merely to say that with chimpanzees, wolves, and humans the big picture is consistent: in typical populations of these three species, it can be mortally dangerous to meet the neighbors.

That's why they all have war zones.

War zones are the border areas where territories abut, danger lurks, and parties rarely go. Low rates of foraging mean that war zones can become lands of plenty – rich in tempting resources.

The Upper Missouri War Zone, a corridor five hundred kilometers long and two hundred forty kilometers wide, was a focal area for the intertribal aggression of numerous indigenous groups, including the Nez Perce, Crow, and Shoshone. Lewis and Clark described the presence there of "immence [sic] quantities of buffalo in every direction";[10] the herbivores benefited from the low human predation pressure resulting from the dangers of hunting in these contested ranges. So the feared war zone became a game sink. Territorial tension sometimes works the same way today. The Demilitarized Zone (DMZ) separating North and South Korea is so empty of people that it has particularly high biodiversity, and supports large populations of rare and endangered species extinct on the rest of the Korean peninsula. (Conservationists should be worried about the prospect of peace. When peace came to the Upper Missouri War Zone, prey animals were hunted to extinction.)

War zones occurred among hunter-gatherers also. Anthropologist Bion Griffin reports, for example, that the Agta of the Philippines knew where the danger lay. "Hunters are especially aware of the chance of illegal trespassers and assume that they may be bent on raiding," Griffin writes. "In the remotest forest hunting zones, where hunters from more than one dialect group may range, precautions are taken and one would seldom hunt alone."[11]

In Australia, expeditions outside the core of the territory were likewise viewed as dangerous: "The red ochre gathering expeditions . . . were normally all-male parties, and although cordial relationships between groups were

9 Bruce M. Knauft, "Violence and Sociality in Human Evolution," *Current Anthropology* 32 (1991): 391 – 428, has stressed the evidence that rates of war are higher among horticulturalists than among hunter-gatherers.

10 Paul S. Martin and Christine R. Szuter, "War Zones and Game Sinks in Lewis and Clark's West," *Conservation Biology* 13 (1999): 36 – 45.

11 P. Bion Griffin, "Forager Resource and Land Use in the Humid Tropics: The Agta of Northeastern Luzon, the Philippines," in Carmel Schrire, ed., *Past and Present in Hunter-Gatherer Studies* (New York: Academic Press, 1984), 106.

sought, fighting appears to have been a common hazard faced by traveling parties. One entire party, with the exception of one man, is recorded as having been ambushed and killed in about 1870, whilst in about 1874 all but one of a group of 30 men were 'entombed in the excavations.'"[12]

Among chimpanzees, evidence of a game sink in war zones comes from the group size of their favorite prey species, red colobus monkeys. Groups averaged 46 percent smaller in the core of the territory than in the border area, according to primatologist Craig Stanford. He attributed the difference to the lower hunting pressure in the border areas, where chimpanzees feared to go.

Meanwhile, David Mech describes how except during periods of extreme food shortage, the threat of encountering hostile neighbors keeps packs of wolves out of border areas. White-tailed deer therefore occur at particularly high density in the zones of wolf-pack territorial overlap. Mech believes that these war-zone populations of deer are critical for the long-term relationship between predator and prey, since they provide the stock for recolonizing the over-hunted areas in the core of the wolf territories. Wolf war zones, in other words, provide conservation areas rather in the style of the Korean DMZ.

It's not the abutment of territories that makes a war zone. Redtail monkeys in Kibale also live within territories, but they do not kill members of neighboring communities and they do not avoid the territorial borders. They use the territory fully, right up to the border, and merely defend their ranges with chases when they meet neighbors. What makes a war zone is not a territory, but the risk of being victimized at its edge.

War zones also aren't known among bonobos, or, for that matter, among most primates or most mammals or most animals. In the great majority of species, territorial encounters involve display, chases, and occasional grappling, but not outright killing. There are only a select few species whose territorial boundaries are places of death and avoidance. The question is why this selection should include chimpanzees, wolves, and humans.

A strong evolutionary rationale for killing derives from the harsh logic of natural selection. Every homicide shifts the power balance in favor of the killers. So the killers have an increased chance of outnumbering their opponents in future territorial battles, and therefore of winning them. Bigger territories mean more food, and therefore more babies.

This unpleasant formula implies that killing is favored by two conditions. It pays whenever resource competition is intense, and whenever killing can be carried out at low risk to the aggressors.

All animals face resource competition. In the wild, for example, female chimpanzees lose weight during poor seasons and are often so short of food that they must wait for an abundant fruiting season before they can conceive. All hunter-gatherer populations show similar evidence of intermittent food scarcity, such as reduced growth during poor seasons.

Persistent food shortages suggest that a larger territory will always pay, and long-term data from Gombe confirm it. During two decades the territory of the Kasekela chimpanzee community varied in size. Shifts in the balance of power with neighboring communities may

12 The quotation is from R. G. Kimber, "Hunter-Gatherer Demography: The Recent Past in Central Australia," in Betty Meehan and Neville White, eds., *Hunter-Gatherer Demography Past and Present* (Sydney: University of Sydney Press, 1990), 160–170.

have been responsible for these oscillations. When the territory was small, the chimpanzees had inadequate food. Individuals lost body weight and tended to travel in the small parties typical of periods of low food supply. Females then had long intervals between births, and offspring survival was low. When the territory was larger, everything changed. Male efforts at expanding the territory led to gains for both sexes. With a better food supply, all adults gained weight, females reproduced faster, and the young survived better.[13]

The Gombe study nicely shows the importance of a larger territory. But it doesn't show anything special about the killer species. Any territory-holding group can be expected to fare better if its neighbors' power declines, allowing its territory to expand. By the same process seen in Gombe, a group of any species that gets a larger territory can be expected to have improved food and better reproduction. This principle should apply as much to bonobos and redtail monkeys as to chimpanzees, wolves, and humans. But bonobos and monkeys don't kill.

So resource competition is a necessary condition for war-zone killing, but it's not enough on its own. The second condition is the sufficient one. Killing must be cheap.

The special feature of the killer species is that when parties from neighboring territories meet, there is sometimes an imbalance of power so great that one party can kill a victim without any significant risk of any of them getting hurt themselves. For chimpanzees and wolves, the imbalances of power come entirely from their protean grouping patterns. For hunter-gatherers, the same applies, but there is an extra twist from human inventiveness. For modern humans, imbalances of power come not only from being able to form a larger subgroup than the enemy's, but also from striking the first lethal blow – such as by throwing a spear, flaming a hut, or flying an airplane into a building.

Among chimpanzees, the most likely victims of homicide are adults found alone or immediately abandoned by their friends after being cornered by members of a hostile community. Among wolves, the evidence is less direct, but 90 percent of kills in Denali occurred in winter. At that time, the probability of a lone individual meeting a party of at least three other wolves is forty times higher than in the summer.

Support for the supposed importance of power imbalances comes from the species that don't kill. Bonobos and monkeys live in relatively stable groups, with individuals rarely in parties so small that they might be overwhelmed by neighbors. Those species have diets that allow parties the luxury of permanent association.

But among humans, power imbalances are routine in intercommunity conflict, and the predominant tactic of war for small-scale societies is unambiguous. It's hit-and-run or ambush. Anthropologist A. R. Radcliffe-Brown recorded the attitude of the Andaman Islanders, hunter-gatherers living east of India. "The whole art of fighting," he wrote, "was to come upon your enemies by surprise, kill one or two of them and then retreat . . . . They would not venture to attack the enemy's camp unless they were certain of taking it by surprise . . . . If they met with any serious resistance or lost one of their own number, they

13 Jennifer M. Williams, Anne E. Pusey, John V. Carlis, B. P. Farm, and Jane Goodall, "Female Competition and Male Territorial Behavior Influence Female Chimpanzees' Ranging Patterns," *Animal Behaviour* 63 (2002): 347 – 360.

would immediately retire. Though the aim of the attacking party was to kill the men, it often happened that women or children were killed."[14]

Similar tactics have been described for hunter-gatherers around the world. In Australia, Walbiri men who surprised enemy camps were said to have killed or driven off the enemy males, and to have carried away any women they could find. In the Arctic, by contrast, raiders would normally kill everyone, though they might spare young girls. Raids typically involved fifteen to twenty men, and could take ten days to complete.[15]

That hunter-gatherers would have raided each other may seem surprising in view of the reputation of forager societies like the Kalahari Bushmen for living peacefully. Scrutiny of early records of contact with hunter-gatherers, however, shows widespread evidence of primitive violence, even in the Kalahari. And material culture supports the picture. Archaeologist Steven LeBlanc has recently drawn attention to the shields of Eskimos that attest to the occurrence of battles. Australian Aborigines also had shields as well as weapons used exclusively for warfare, such as a hooked boomerang and a heavy spear. Both in the Arctic and in Australia there is clear historical evidence for a combination of raids and battles.[16]

The principle that underlies the mayhem is simple, then. When the killing is cheap, kill. In any particular instance it may or may not lead to a bigger territory, but from the perspective of natural selection, the specific case is less important than the average benefit. The integrating effect of selective pressures on emotional systems requires only that killing should lead to benefits sufficiently often. Just as the first male fig wasp that emerges from pupation will immediately attempt to kill any other males he finds in the same fig, so the defenders of territory benefit by taking advantage of opportunity. The killers don't have to think through the logic. They may think of their action as revenge, or placating the gods, or a rite of manhood – or they may not think about it at all. They may do it because it's exciting, as seems the case for chimpanzees. The rationale doesn't matter to natural selection.[17]

What matters, it seems, is that in future battles the neighbors will have one less warrior. So those who killed will become a little more powerful as a result.

Why, then, do humans, chimpanzees, and wolves share the unusual practice of deliberately and frequently killing neighbors? In each species the violence makes sense. Protean grouping patterns allow individuals to attack only when they have overwhelming power. Such tactical success allows them to kill safely and cheaply, and thereby win a likely increase in resources over the succeeding months or years. Killing thus emerges as a consequence of having territories, dispersed groups, and unpredictable power relations. These driving variables, in turn, appear to result from ecological adaptations, whether to a scattered fruit supply or to the challenges of hunting

14 A. R. Radcliffe-Brown, *The Andaman Islanders: A Study in Social Anthropology* (Cambridge: Cambridge University Press, 1948), 85.

15 Azar Gat, "The Human Motivational Complex: Evolutionary Theory and the Causes of Hunter-Gatherer Fighting, Part I: Primary Somatic and Reproductive Causes," *Anthropological Quarterly* 73 (2000): 20 – 34.

16 Steven A. LeBlanc, *Constant Battles* (New York: St. Martin's Press, 2003).

17 Klaus Reinhold, "Influence of Male Relatedness on Lethal Combat in Fig Wasps: A Theoretical Analysis," *Proceedings of the Royal Society of London* B 270 (2003): 1171 – 1175.

vertebrate prey. The implication is that because of our particular evolutionary ecology, natural selection has favored in the brains of humans, chimpanzees, and wolves a tendency to take advantage of opportunities to kill enemies.

This doesn't condemn us to be violent in general. Indeed, within our communities humans are markedly less violent than most other primates, and in some ways humans are specially peaceful. Nor does it mean that intergroup aggression is inevitable: rather, it predicts little violence when power is balanced between neighboring communities. Nor, again, does it mean that gang attacks on members of other tribes or religions or clubs or countries are necessarily adaptive: in evolutionary terms, they may or may not be. Nor does it mean that women are incapable of violence, or are inherently less aggressive than men: it suggests instead why the circumstances that favor aggression are not identical for men and women.

What it does imply, however, is that selection has favored a human tendency to identify enemies, draw moral divides, and exploit weaknesses pitilessly across boundaries. As a result, our species remains specially predisposed to certain types of violent emotion. That selection operated in the context of a hunter-gatherer world that has all but disappeared. But if its legacy is that we are biologically prepared by natural selection to be killers, an understanding of the neural basis of intergroup violence should be a research priority.

Patrick Bateson

The origins of human differences

With increasing frequency the media report the discovery of genes *for* distinct human characteristics, such as athletic prowess or male promiscuity. Yet it is obvious that experience, education, and culture make a big difference in how people behave, whatever their genetic inheritance. Why is it that behavioral and psychological development are so often explained in terms of the exclusive importance of one set of factors, either genetic or environmental?

Oversimplified opinions may derive from a style of advocacy that is common in many academic debates. If Dr. Jones has overstated her case, then Professor Smith feels bound to redress the balance by overstating the counterargument. The way scientists analyze complex processes further amplifies the confusion. When somebody has conducted a clever experiment demonstrating an important long-term influence on behavior, that person has good reason to feel pleased. It is easy to forget, however, about all those other influences that a competent scientist contrives to keep constant or to play no systematic role.

Even if the debates are seen for what they are – irritating examples of advocacy – is it not the case that complex human behaviors have come from somewhere? In some instances, surely, they will be inborn and in other instances they will be acquired by experience. But the apparent good sense of this view leaves out of account the ways in which the inborn can be changed by experience and the ways in which the gathering of experience is itself inborn. Even so, it is worth looking at some straightforward examples.

Studies of animal behavior do, indeed, tell us that much complex behavior can develop without opportunities for practice. The European garden warblers that have been hand-reared in cages nevertheless become restless and attempt to fly south in the autumn, the time when their wild counterparts migrate in that direction. The warblers continue to be restless in their cages for about a couple of months, the time it would take them to fly from Europe to their species' wintering grounds in Africa. A similar restlessness during the following spring sim-

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ulates their return flight north. This migratory response occurs despite the birds' rearing in social isolation, with no opportunities to learn when to fly, where to fly, or for how long. Cases like these are marvels of developmental biology. They involve the construction of a nervous system that can express the full complexity of the behavior. But the principles involved are no more difficult to understand than those involved in the construction of, say, a kidney.

Continuing with this general line of argument, many aspects of human behavioral development recur in everybody's life despite the shifting sands of cultural change and the unique contingencies of any one person's life. Individual differences among humans seem small when any human is compared with any chimpanzee. All humans have the capacity to acquire language, and the vast majority do. With few exceptions, humans pass the same developmental milestones as they grow up. Most children have started to walk by about eighteen months after birth, have started to talk by two years, and have reached sexual maturity by their late teens.

Similarly, human facial expressions have characteristics that are widely distributed across cultures. The emotions of disgust, fear, anger, and pleasure can be easily deciphered in facial expressions in any part of the world. Toward the end of his life, Charles Darwin wrote *The Expression of the Emotions in Man and Animals*, a book that provided the stimulus for observational studies of animal and human behavior that have continued into modern times. Darwin would show his friends and colleagues pictures of people expressing various emotions and ask them, without further prompting, to describe the emotions. In one case he showed a picture of an old man with raised eyebrows and an open mouth to twenty-four people, only one of whom did not understand what emotion that expression indicated. Such research as well as his extensive correspondence with travellers and missionaries convinced Darwin that humans from all round the globe express the same emotion in the same way. Darwin concluded: "That the chief expressive actions, exhibited by man and by the lower animals, are now innate or inherited – that is, have not been learnt by the individual, – is admitted by every one."

Subsequently, an enormous photographic archive of human expressions from different cultures at different stages of economic development was formed. The similarities in the appearance of the smile or the raised eyebrows, for example, are striking. The cross-cultural agreement in the interpretation of complex facial expressions is also remarkable. People agree not only about which emotions are being expressed, but also about which expression of a particular emotion is the more intense.

All of this might seem straightforward; the argument that some human behavior is instinctive seems to be correct. However, the concept of instinct is riddled with confusion. For some, it means a distinctly organized system of behavioral patterns, such as those involved in searching for and consuming food. For others, 'instinct' simply refers to behavior that is not learned, that is present at birth (the strict meaning of 'innate'), or that emerges at a particular stage in the life cycle. Another suggestion is that 'instinct' refers to behavior that, once developed, does not change, or to behavior that develops before it serves any biological function, like some aspects of sexuality. At the same time, some define 'instinct' as those behavioral patterns shared by all members of the species (or at least by members of

the same sex and age), while others define it as the behavioral difference between individuals caused by a genetic difference. None of this would matter if it were always the case that all examples of supposed instinct had all the characteristics variously attributed to it. That, unfortunately, is not the case; many examples have some of the characteristics but not others.

One aspect of the unitary concept of instinct that has unravelled on further inspection is the belief that learning does not influence instincts once they have developed. Learning modifies many cases of apparently unlearned behavioral patterns after they have been used for the first time. Human babies who have been born blind, and consequently never see a human face, nevertheless start to smile at around five weeks – the same age as sighted babies. But while sighted children learn to modify their smiles according to their experience, producing subtly different smiles that are characteristic of their particular culture, blind children become less responsive and less varied in their facial expressions. Experience can and does modify what started out as apparently unlearned behavior.

Conversely, some learned behavioral patterns are developmentally stable and virtually immune to subsequent modification. The songs some birds learn early in life may be extremely resistant to change once they have been acquired. Similarly, modes in humans of perceiving language and articulating particular sounds, once acquired, are extremely difficult to change in adulthood.

The idea that one meaning of instinct, 'unlearned,' is synonymous with another, namely, 'adapted through evolution,' also fails to stand up to scrutiny. The development of a behavioral pattern that has been adapted for a particular biological function during the course of a species' evolutionary history may nonetheless involve learning during the individual's life span. For example, the strong social attachment that young birds and mammals form to their mothers is clearly adaptive and has presumably developed through evolution. And yet the attachment process requires the young animal to learn the distinguishing features of its mother. An important point is that Darwinian selection, by acting on mechanisms that regulate changes in behavior in response to challenges from the environment, can increase plasticity and behavioral diversity.

In short, many behavioral patterns have some, but not all, of the defining characteristics of instinct, and the unitary concept breaks down under closer scrutiny. The various theoretical connotations of instinct – namely, that it is unlearned, caused by a genetic difference, adapted over the course of evolution, unchanged throughout the life span, shared by all members of a species, and so on – are not merely different ways of describing the same thing. Even if a behavioral pattern is found to have one diagnostic feature of instinct, it is certainly not safe to assume that it will have all the other features as well. Perhaps for that reason Darwin wisely refused to define 'instinct.' In *The Origin of Species* he wrote:

> An action, which we ourselves require experience to enable us to perform, when performed by an animal, more especially by a very young one, without experience, and when performed by many individuals in the same way, without their knowing for what purpose it is performed, is usually said to be instinctive. But I could show that none of these characters are universal. A little dose of judgment or reason . . . often comes into play, even with animals low in the scale of nature.

Should we be worried about the confusion with how terms are used? Only if we suppose that we can easily divide behavior into the two categories 'innate' and 'learnt.'

One of the triumphs of behavioral biology in the latter part of the twentieth century was to relate differences in mating systems, parental behavior, foraging, and many other aspects of adult behavior to differences in ecology. A comparable coherence can be brought to the great variation in the ways in which adult behavior can develop. In particular, the role of experience is likely to vary considerably from one behavioral system to another. In predatory species, the successful capturing of fast-moving prey requires considerable learning and practice. The osprey does not learn to snatch trout from water overnight. Such animals that rely upon highly sophisticated predatory skills suffer high mortality rates among their young, and those that survive are often unable to breed for years. This is because they have to acquire and hone their skills before they can capture enough prey to feed offspring in addition to themselves. In such cases, a combination of different developmental processes generates the highly tuned skills seen in the adult.

The developmental processes that make learning, like behavioral imprinting, easier at the beginning of a sensitive period are timed to correspond with changes that the individual will encounter as it develops under natural conditions. The processes that bring the sensitive period to an end are often related to the gathering of crucial information, such as the physical appearance of the individual's mother or close kin. In the unpredictable real world, the age when the individual can acquire crucial knowledge is variable; the design of the developmental process reflects that uncertainty.

In contrast to those processes fine-tuned by experience, cleaning the body is not generally something that requires special skills tailored to local conditions. Indeed, grooming among mammals has almost all the various defining characteristics of the old-fashioned notion of instinct. Rodent grooming is, for example, a species-typical, stereotyped system of behavior that develops before it is of any use to the individual.

In other words, biologists expect variation in the way behavioral patterns and their underlying structure develop. Attempts to shoehorn each example into one of the two categories are ridiculous.

The muddled use of 'instinct' (and with it, 'innate' and 'inborn') does not mean that the expression of each behavioral characteristic is, what Salman Rushdie called in another context, a P2C2E – a process too complicated to explain. Nor does it mean that such expressions cannot be subject to evolution when critical environmental conditions are stable from one generation to the next. And it certainly does not mean that all adult behavior is totally dependent on the environment. What we must conclude is that if we want to understand developmental processes then we have no alternative but to study them.

Plant and animal breeders know well that many of the characteristics that matter to them are inherited. Long before genes were postulated and DNA was discovered, breeders took this as a bountiful fact of life, even though they had no idea how inheritance worked. To take just one example, dogs have for many centuries been bred for their behavioral characteristics as well as their appearance. The sheepdog is especially sensitive to the commands of humans, waiting until the shepherd gives it a signal to start herding the sheep. The pointer is especially attentive to the presence of

certain game, stopping in its tracks when it detects the smell of a species such as grouse. Valued behavioral characteristics such as these are clearly inherited and are quickly lost if breeds are crossed with others.

Humans may also reveal through their children how particular characteristics are inherited. Two healthy parents from a part of the world where malaria is rife may have a child who develops severe anaemia. Both parents carry a gene that has some effect on red blood cells, protecting them against the malarial parasite that enters those cells during part of its life cycle. However, a double dose of this recessive gene leads to the red blood cells collapsing from their normal disc shape into strange sickle-like shapes. The child who receives this genetic legacy has sickle-cell anaemia.

Few behavioral characteristics are inherited in as simple a fashion as sickle-cell anaemia, and when they are, the effects are usually damaging and pervasive. A well-known case is the disabling disease phenylketonuria (PKU). If a child inherits two copies of a particular recessive gene from both parents, the child cannot produce a crucial enzyme required to break down phenylalanine, an amino acid that is a normal component of the average diet. The resulting accumulation of phenylalanine in the body poisons the child's developing brain and causes severe mental retardation – unless the condition is diagnosed and the child is given a special diet.

Evidence for genetic influences on human behavior is usually indirect. It is bound to be so, because naturally occurring breeding experiments are rare, and deliberate breeding experiments in the interest of genetic research would obviously be prohibited in most societies. However, the study of twins has cast some light on the links between genes and behavior.

Research into the inheritance of human behavior has been greatly helped by comparing genetically identical twins with nonidentical twins. Identical (or monozygotic) twins are genetically identical because they develop from the splitting of a single fertilized egg; they are naturally occurring clones. Nonidentical (or dizygotic) twins, in contrast, develop from two fertilized eggs. Consequently, they are no more similar to each other genetically than any two siblings born at different times. If identical twins are no more alike than nonidentical twins in a given behavioral characteristic, then the genetic influence on that characteristic is presumably weak. Conversely, when identical twins are substantially more alike than nonidentical twins (or siblings) in a behavioral characteristic, then the mechanism of inheritance is likely genetic.

Another way of exploring how genes influence behavior is to compare twins who have been reared apart with twins who have been reared together. The thought behind this approach is that separation in early infancy removes the influence of the shared environment, leaving only the inherited factors. The thought is not wholly correct, however, because even twins who are separated immediately after birth will have shared a common environment for the first crucial nine months after conception, while they are together in their mother's womb. This obvious truth can add to the difficulties of sorting out the sources of individual distinctiveness. Moreover, being separated at birth does not preclude the possibility that the different environments in which the twins are raised may in fact have many important features in common.

Nevertheless, the appearance, behavior, and personality of identical twins who have been reared apart are often startlingly similar. In one documented

case, for example, a pair of twins had been separated early in life, one growing up in California, the other in Germany. Yet when they met for the first time in thirty-five years, they both arrived wearing virtually identical clothes and with similarly clipped moustaches; both had a habit of wrapping elastic bands around their wrists; and both had the idiosyncratic habit of flushing lavatories before as well as after using them.

Accounts such as these are sometimes greeted with skepticism, because it is suspected that in the interest of a good story only the startling matches have been reported while the discrepant twins have been ignored. Nevertheless, some properly conducted statistical surveys have revealed that, on a range of measures of personality, identical twins who have been reared apart are more like each other than nonidentical twins also reared apart. When making such comparisons, it does not matter whether, as has often been argued, the measures of behavioral characteristics are crude and relatively insensitive. The inescapable conclusion is that some observable aspects of individual behavior are influenced by inherited factors.

Even the most cursory glance at humanity reveals the enormous importance of each person's experience, upbringing, and culture. Look at the astonishing variation among humans in language, dietary habits, marriage customs, child-care practices, clothing, religion, architecture, art, and much else besides. Nobody could seriously doubt the remarkable human capacity for learning from personal experience and learning from others.

Early intervention can benefit the disadvantaged child, but in ways that had not been fully anticipated. In the 1960s, great efforts were made in the United States to help people living in difficult and impoverished conditions. The government program known as Head Start was designed to boost children's intelligence by giving them educational experience before starting school. But the program did not seem to have the substantial and much hoped-for effects on intelligence, as measured by IQ. Children who had received the Head Start experience displayed an initial modest boost in their IQ scores, but these differences soon evaporated after a few years. The fashionable response was to disparage such well-meaning efforts to help the disadvantaged young.

Later research, however, has revealed that some of the other effects of the Head Start experience were long-lasting and of great social significance – greater, in fact, than boosting IQ scores. Several long-term follow-up studies of people who had received preschool training under Head Start found they were distinctive in a variety of ways, perhaps the most important being that they were much more community-minded and less likely to enter a life of crime. Head Start produced lasting benefits for its participants and for society more generally, but not by raising raw IQ scores. Evidence for the long-term benefits of early educational intervention has continued to accumulate. Studies like these raise many questions about how early experiences exert their effects, but they do at least show how important such experiences can be.

Even relatively subtle differences in the way children are treated at an early age can have lasting effects on how they behave years later. One study compared the long-term effects of three different types of preschool teaching. In the first type, three- and four-year-olds were given direct instruction, with the teachers initiating the children's activities in

a strict order; in the second, the teachers responded to activities initiated by the children; and in the third, known as High/Scope, the teachers involved the children in planning the activities, but arranged the classroom and the daily routine so the children could do things that were appropriate to their stage of development. Striking differences were found between the children as they grew up. When followed up at the age of twenty-three, the individuals who had been in the direct instruction group were worse off in a variety of ways than those in the other two groups. In particular, they were more likely to have been arrested on a criminal charge and more likely to have received special help for emotional impairment. In comparison, the individuals who had received the more relaxed type of preschooling were more likely to be living with spouses and much more likely to have developed a community spirit.

The importance of both genes and environment to the development of all animals, including humans, is obvious. This is true even for apparently simple physical characteristics – take myopia, or shortsightedness, for example. Myopia runs in families, suggesting that it is inherited, but it is also affected by individual experience. Both a parental history of myopia and, to a lesser extent, the experience of spending prolonged periods studying close-up objects will predispose a child to become shortsighted.

A more interesting case is musical ability, about which strong and contradictory views are held. Dissociation between general intellectual ability and musical ability is strongly suggested by the phenomenon of the musical idiot savant – an individual with low intelligence but a single, outstanding talent for music. Such individuals are usually male and often autistic, and their unusual gift (whether it be for music, drawing, or mental arithmetic) becomes apparent at an early age and is seldom improved by practice. One typical individual could recall and perform pieces of music with outstanding skill and almost perfect pitch; he had poor verbal reasoning, but that was to some degree offset by high levels of concentration and memory.

Children who are good at music, on the other hand, also tend to be good at reading and to have a good sense of spatial relations. The main factors fostering the development of musical ability form a predictable cast: a family background of music, practice (the more the better), practical and emotional support from parents and other adults, and a good relationship with the first music teachers. Practice is especially important, and attainment is strongly correlated with effort. A rewarding encounter with an inspirational teacher may lock the child into years of effort, while an unpleasant early experience may cause the child to reject music, perhaps forever. Here, as elsewhere, chance plays a role in shaping the individual's development.

Research on identical and nonidentical twins has shown that the shared family environment has a substantial influence on the development of musical ability, whereas inherited factors exert only a modest effect. Genetically identical twins are only slightly more alike in their musical ability than nonidentical twins or siblings. A study of more than six hundred trainee and professional musicians analyzed the origins of perfect pitch, the ability to hear a tone and immediately identify the musical note without reference to any external comparison. Heritable factors appeared to play a role, as musicians with perfect pitch were four times more likely than other musicians to report having a rela-

tive with that skill. But the same study also found that virtually all the musicians with perfect pitch had started learning music by the age of six. Of those who had started musical training before the age of four, 40 percent had developed perfect pitch, whereas only 3 percent of those who had started training after the age of nine possessed the ability. So early experience is also important.

Like many other complex skills, musical ability develops over a prolonged period; and the developmental process does not suddenly stop at the end of childhood. Expert pianists manage to maintain their high levels of musical skill into old age despite the general decline in their other faculties. They achieve this through copious practice throughout their adult life; the more frequent the practice, the smaller the age-related decline in musical skill. Practice not only makes perfect, it maintains perfect.

Is it possible to calculate the relative contributions of genes and environment to the development of behavioral patterns or psychological characteristics such as musical ability? Given the passion with which clever people have argued over the years that either the genes or the environment are of crucial importance in development, it is not altogether surprising that the outcome of the nature-nurture dispute has tended to look like an insipid compromise between the two extreme positions. Instead of asking whether behavior is caused by genes or the environment, the question became: How much is due to each? Within a single individual this question cannot be answered, but it can be posed for a population of individuals as follows: How much of the variation between individuals in a given characteristic is due to differences in their genes, and how much is due to differences in their environments?

The nature-nurture controversy appeared at one time to have been resolved by what seemed like a neat solution to this question about where behavior comes from. The suggested solution was provided by a measure called heritability. The concept of heritability is best illustrated with an uncontroversial characteristic such as height, which clearly is influenced by both the individual's family background (genetic influences) and nutrition (environmental influences). The variation between individuals in height that is attributable to variation in their genes may be expressed as a proportion of the total variation within the population sampled. This index is known as the heritability ratio. If people differed in height solely because they differed genetically, the heritability of height would be 1.0; if, on the other hand, variation in height arose entirely from individual differences in environmental factors such as nutrition, then the heritability would be 0.

Calculating a single number to describe the relative contributions of genes and environment has obvious attractions. Estimates of heritability are of undoubted value to animal breeders, for example. Given a standard set of environmental conditions, the genetic strain to which a pig belongs will predict its adult body size better than other variables such as the number of piglets in a sow's litter. If the animal in question is a cow and the breeder is interested in maximizing its milk yield, then knowing that milk yield is highly heritable in a particular strain of cows under standard rearing conditions is important.

Behind the deceptively plausible ratios lurk some fundamental problems. For a start, the heritability of any given char-

acteristic is not a fixed and absolute quantity – tempted though many scientists have been to believe otherwise. Its value depends on a number of variable factors, such as the particular population of individuals that has been sampled. For instance, if heights are measured only among people from affluent backgrounds, then the total variation in height will be much smaller than if the sample also includes people who are small because they have been undernourished. The heritability of height will consequently be larger in a population of exclusively well-nourished people than it would be among people drawn from a wider range of environments. Conversely, if the heritability of height is based on a population with relatively similar genes – say, native Icelanders – then the figure will be lower than if the population is genetically more heterogeneous; for example, if it includes both Icelanders and African Pygmies. Thus, attempts to measure the relative contributions of genes and environment to a particular characteristic are highly dependent on who is measured and under what conditions.

Another problem with the heritability ratio is that it says nothing about the ways in which genes and environment contribute to the biological and psychological processes involved in an individual's development. This point becomes obvious when considering the heritability of a characteristic such as 'walking on two legs.' Humans walk on less than two legs only as a result of environmental influences such as war wounds, car accidents, disease, or exposure to teratogenic toxins before birth. In other words, all the variation within the human population results from environmental influences, and consequently the heritability of walking on two legs is zero. And yet walking on two legs is clearly a fundamental property of being human, and is one of the more obvious biological differences between humans and other great apes such as chimpanzees or gorillas. It obviously depends heavily on genes, despite having a heritability of zero. A low heritability clearly does not mean that development is unaffected by genes.

If a population of individuals is sampled and the results show that one behavioral pattern has a higher heritability than another, this merely indicates that the two behavioral patterns have developed in different ways. It does not mean that genes play a more important role in the development of the behavioral pattern with the higher heritability. Important environmental influences might have been relatively constant at the stage in development when the more heritable pattern would have been most strongly affected by experience.

The most serious shortcoming of heritability estimates is that they rest on the spurious assumption that genetic and environmental influences are independent of one another and do not interact. The calculation of heritability assumes that the genetic and environmental contributions can simply be added together to obtain the total variation. In many cases this assumption is clearly wrong.

One surprising conclusion to emerge from studies of identical twins is that twins reared apart are sometimes more like each other than those reared together. To put it another way, rearing two genetically identical individuals in the same environment can make them less similar rather than more similar because one of the twins is dominant to the other, entering the room first and speaking for them both. This fact pleases neither the extreme environmental determinist nor the extreme genetic determinist.

The environmental determinist supposes that twins reared apart must have different experiences and should therefore be more dissimilar in their behavior than twins who grew up together in the same environment. The genetic determinist does not expect to find any behavioral differences between genetically identical twins who have been reared together. If they have had the same genes and the same environment, how can they be different?

Siblings are less like each other than would be expected just by chance. The child picks a niche for him or herself, not on the basis of his own characteristics but on what his siblings have done. Individual differences emerge because children are active agents in their own development; children seek out their own space. When Mary did well at art, her younger sister Susan would not have anything to do with drawing or painting, even though she would probably have been good at both. When Henry developed a flair for history and languages, George inclined toward math and science. Most parents with more than one child can tell such stories.

Such interplay between siblings probably accounts for some of the influences of birth order. Other things are also at work, of course. Parents treat their successive children differently – sometimes deliberately, sometimes unwittingly. They often have a more taut relationship with their first child than with their later-born children; they are usually more relaxed, positive, and confident with their subsequent children, and their preoccupation with every detail of their children's behavior and appearance lessens. These examples emphasize how important it is that we look carefully at the transactions between the developing child and the social and physical worlds in which he or she lives.

Any scientific investigation of the origins of human behavioral differences eventually arrives at a conclusion that most nonscientists would probably have reached after only a few seconds' thought: genes and the environment both matter. How much each of them matters defies an easy answer, and we have to accept that no simple formula can solve that conundrum. We also have to wean ourselves away from the confused and utterly false idea that genes give rise to instincts and experience gives rise to acquired behavior. The answer to the question of where knowledge comes from will not emerge from the conventional opposition between nature and nurture. The answer requires understanding of the biological and psychological processes that build a unique adult from a fertilized egg.

As attention is focused on development of behavior, more and more will be learned about the underlying processes. My own view is that many of these have regularities that will be amenable to analysis. But it does not follow that as these regularities are uncovered human behavior will become more predictable. To understand why, consider a rule-governed game like chess. It is impossible to predict the course of a particular chess game from a knowledge of the game's rules. Chess players are constrained by the rules and the positions of the pieces, but they are also instrumental in generating the positions to which they must subsequently respond. The range of possible games is enormous. The rules may be simple but the outcomes can be extremely complex.

The adult human brain, on which its owner's behavior depends, has around one hundred thousand million (10^{11}) neurons, each with hundreds or thousands of connections to other neurons. A diagram of even a tiny part of the brain's

connections would look like an enormously complex version of a map of the New York subway system. The brain is organized into subsystems, many of which are dedicated to different functions that may run separately but, if the behavior of the individual is not to be a mess, must be integrated with each other. The products of genes, the impact of experience, and the resulting activities of neurons are all embedded in elaborate networks.

The idea that genes might be likened to the blueprint of a building is hopelessly misleading because the correspondences between plan and product are not to be found. In a blueprint, the mapping works both ways. In a finished house, the position of each room can be found on the blueprint, and the blueprint indicates where every room will be. This straightforward mapping is not true for genes and behavior, in either direction. The language of a gene *for* a particular behavior pattern, so often used by scientists, is exceedingly muddling to the nonscientist (and, if the truth be told, to many scientists as well). This is because the phraseology seems to imply that the gene determines the characteristic of the behavior without anything else being important. What the scientists mean (or should mean) is that a genetic difference between two groups is associated with a difference in behavior. They know perfectly well that other things are important and that, even in constant environmental conditions, the developmental outcome depends on the whole 'gene team.'

Nevertheless, it is likely that order underlies even those learning processes that make people different from each other. Knowing something of the underlying regularities in development does bring an understanding of what happens to the child as he or she grows up. The rules influence the course of a life, but they do not determine it. Like chess players, children are active agents. They influence their environment and are in turn affected by what they have done. Furthermore, children's responses to new conditions will, like chess players' responses, be refined or embellished as children gather experience. Sometimes normal development of a particular ability requires input from the environment at a particular time; what happens next depends on the character of that input.

The upshot is that, despite their underlying regularities, developmental processes seldom proceed in straight lines. Big changes in the environment may have no effect whatsoever, whereas some small changes have big effects. The only way to unravel this is to study what happens.

Donald E. Brown

Human universals, human nature & human culture

Human universals – of which hundreds have been identified – consist of those features of culture, society, language, behavior, and mind that, so far as the record has been examined, are found among all peoples known to ethnography and history. After presenting some of the basic conceptions and problems concerning such universals per se – their kinds and causes and the methodological and disciplinary considerations that have shaped their study – I will explore some of the issues in how human universals relate to human nature and human culture.

I will begin with some examples. In the cultural realm, human universals include myths, legends, daily routines, rules, concepts of luck and precedent, body adornment, and the use and production of tools; in the realm of language, universals include grammar, phonemes, polysemy, metonymy, antonyms, and an inverse ratio between the frequency of use and the length of words; in the social realm, universals include a division of labor, social groups, age grading, the family, kinship systems, ethnocentrism, play, exchange, cooperation, and reciprocity; in the behavioral realm, universals include aggression, gestures, gossip, and facial expressions; in the realm of the mind, universals include emotions, dichotomous thinking, wariness around or fear of snakes, empathy, and psychological defense mechanisms.

Many universals do not fall neatly into one or another of these conventional realms, but cut across them. Kinship terminologies (in English, the set of terms that includes 'father,' 'mother,' 'brother,' 'sister,' 'cousin,' etc.) are simultaneously social, cultural, and linguistic. The concept of property is social and cultural. Revenge is both behavioral and social. Lying and conversational turn-taking are simultaneously behavioral, social, and linguistic. Many behavioral universals almost certainly have distinctive, even dedicated, neural underpinnings, and thus are universals of mind too.

A distinction among universals that figures large in anthropological thought is that between 'emic' and 'etic.' These words (derived from the linguistic terms 'phonemic' and 'phonetic') distinguish

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features that are overtly or consciously represented in a people's own cultural conceptions from features that are present but not a part of the overt or conscious local cultural conceptions. Thus every people has a language with grammar, but not all peoples have an overt cultural representation of the idea of grammar. Merely having grammar is an etic fact. If it is culturally represented as well, then it is an emic fact too. Etically, everyone has a blood type, but the cultural practice of distinguishing between blood types (as in the case of those Japanese beliefs that link blood type with marital compatibility) is far from universal. Emic universals are probably much rarer than etic universals.

Many universals subdivide into yet others. Thus tools are a universal, and so too are some general kinds of tools (pounders, cutters, containers, etc.). The facial expression of emotion is a universal, and so too are smiles, frowns, and other particular expressions.

While some universals are or seem to be relatively simple, others are complex. Ethnocentrism and romantic love are examples: both are best understood as complexes or syndromes rather than simple traits or behaviors.

Many universals have a collective rather than individual referent. Thus music and dance are found in all societies, but not all individuals dance or make music. Yet other universals are found in all (normal) individuals, although sometimes only in one sex or the other or in particular age ranges. Thus women everywhere predominate in child-care and on average are younger than their mates. Children everywhere acquire language with prodigious skill, but adults do not. On the other hand, above the age of infancy everyone employs gestures and such elementary logical concepts as 'not,' 'and,' 'or,' 'kind of,' 'greater/lesser,' 'part/whole,' etc.; everyone classifies; everyone has likes and dislikes.

It is important to distinguish between kinds of universals. The formally distinct kinds include absolute universals, near universals, conditional universals, statistical universals, and universal pools.

The universals I listed at the start of this essay are absolute universals – they are found among *all* peoples known to ethnography and history. A near universal, by contrast, is one for which there are some few known exceptions or for which there is reason to think there might be some exceptions. Fire making and keeping domestic dogs are near universals, as there are good reports of a very few peoples who used fire but did not know how to make it, or who did not possess dogs. Many traits are described as 'universal or nearly universal' to express a note of caution (given the sampling problems to be described below). Thus the emphasis of percussion or deep-noted instruments and of the colors red, white, and black in rituals around the world should probably be described as 'universal or nearly universal.'

A conditional universal (also called an implicational universal) is an if-then universal: if a particular condition is met, then the trait in question always accompanies it. Such universals are analogous to the facultative adaptations of evolutionary biology, of which callusing is an example: not all individuals have calluses, but if there is sustained friction on particular locations of the hand, say, then calluses develop. An example from culture of a conditional universal is that if there is a cultural preference for one hand over the other, then it will be the right hand that is preferred (as in Western culture, where the right hand is used

in greetings and taking oaths). It is the rule or underlying causal mechanism that is the real universal in such cases.

A statistical universal is one that may be far from absolutely universal but that occurs in unrelated societies at a rate that seems well above chance. An example is the name different peoples give to the pupil of the eye. In a surprisingly large number of unrelated languages, it is a term that refers to a little person; the apparent explanation for this is the common experience of seeing a small reflection of oneself in other people's eyes. Although it is something of a stretch to think of such phenomena as universals, the explanation for them is drawn not from cultural particularities but from universal experience.

A universal pool refers to those situations in which a limited set of options exhausts the possible variations from one society to another. The international phonetic alphabet, which does not really cover all the possibilities, nonetheless serves to express the idea: it consists of a finite possible set of speech sounds or sound contrasts, from which a selection is found in each distinct language. An early-twentieth-century analysis of kinship terminologies showed that a quite small set of semantic contrasts accounts for the differences in kin terms in all or nearly all societies (a few further contrasts have been added since).[1] Examples of the semantic contrasts are sex, which distinguishes 'brother' from 'sister,' 'father' from 'mother,' etc.; and generation, which distinguishes 'son' from 'father,' 'father' from 'grandfather,' etc.

There are severe methodological limitations on what can be known about universals in general. No one can really know the conditions in all societies, so any statement about universality is based on some sort of sampling. In most cases this sampling has not been rigorous. Furthermore, the precision with which a real or alleged universal has been described often leaves much to be desired, in part because the original reports or descriptions were provided by different observers, sometimes at widely spaced intervals in time. Thus the confidence one can have in particular claims of universality is quite variable. Given the costs involved in studying even a single society, this range of problems will persist.

However, it should be noted that a sample as small as two societies – so long as they are very different – can be highly suggestive. Thus one can view the documentary film *First Contact* and make observations about what is common to two highly diverse societies: one's own modern society and a previously uncontacted highland New Guinean society. Australian prospectors took the footage for this documentary in the 1930s, when they were the first outsiders to enter a high and isolated valley.[2] The differences between the Australians and the isolated New Guineans are striking, and yet the two groups also have a lot in common, much of which would be difficult to trace to cultural borrowing.

In spite of anthropology's professional charge to study all cultures, which uniquely qualifies the discipline to both identify and verify universals, some anthropological practices have not been congenial to the study of universals. Notably, anthropological attention has been riveted more surely by differences between societies than by their com-

1 Alfred L. Kroeber, "Classificatory Systems of Relationship," *Journal of the Royal Anthropological Institute* 39 (1909): 77 – 84.

2 The making of this documentary is described in Bob Connolly and Robin Anderson, *First Contact: New Guinea Highlanders Encounter the Outside World* (New York: Penguin, 1987).

monalities. Moreover, that attention has tended to be limited to surface or manifest universals, those readily available to observation or readily expressed by their informants. Innate universals have tended to be neglected (in extreme cases, their existence was even denied). This neglect was to a large extent overt and principled, seeming to follow logically from the view of culture that anthropologists held throughout much of the twentieth century, a view that seemed to be supported by exaggerated (and in some cases false) reports of the extraordinary extent to which cultures both differ from one another and yet decisively shape human behavior, a view that was construed to indicate that there must be few, if any, universal features of the human mind. As a result, the anthropological study of universals has been spotty at best, unified neither by theory nor by sustained inquiry. There is thus ample reason to suspect that a great many universals have yet to be identified.

In contrast to anthropologists, psychologists have been much more open to the discovery of presumably universal features of the human mind. But only rarely have psychologists conducted their research outside the modernized Western world, so the cross-cultural validity of the numerous mental processes and traits they have identified has often been in doubt. Some cross-cultural research has indeed shown that psychological phenomena that one might think are unaffected by cultural differences – the perception of certain optical illusions, for example – are in fact not universal.

A relatively small number of causal processes or conditions appears to account for most if not all universals. These processes or conditions are: 1) the diffusion of ancient, and generally very useful, cultural traits; 2) the cultural reflection of physical facts; and 3) the operation, structure, and evolution of the human mind.

Some universals (the well-authenticated examples are tool making, the use of fire, and cooking food) seem to have existed in the very earliest human populations and to have spread with humans to all their subsequent habitats.[3]

As for the cultural reflection of physical facts, I have already mentioned the case of terms for the pupil of the eye, as well as the cultural preference for the right hand, which probably reflects the observation that in all societies most people are right-handed. I have also mentioned kin terms, which everywhere reflect the relationships created through sexual reproduction – parent-child, sibling, and marital/mate relationships, as well as the various compounds of these relationships. Kin terms often include more than, or sometimes partially omit, what such relationships entail, but in every language there is a substantial mapping of the locally named (emic) relationships onto the actual (etic) kin relationships. In all these cases, the 'world out there,' so to say, is reflected in the cultural conceptions of each people – even though the reflections vary in many ways from one society to another.

Finally, there are those universals whose causes lie more or less directly in the nature of the human mind, or that are features of the human mind. The latter in turn trace causally to the evolutionary past of humanity as a species. These universals of mind require a more extended discussion.

3 It is sometimes suggested that there are some beliefs that have been with humans from the earliest times not because they are obviously useful, but because there was little or nothing to expose their falsity and thus to hinder their spread.

Recalling what was said earlier about disciplinary differences, it should be noted that those sociocultural anthropologists who are most qualified to document universals are not as a rule well qualified to explain them. By training, most sociocultural anthropologists are neither psychologists nor biologists. But psychobiology and evolutionary psychology surely are crucial in explaining many innate universals (and in providing guidance in the search for further such universals). The reasoning is simple: whatever is constant through all human societies must be due to something that goes with people wherever they go; that would certainly include human nature – and psychobiology and evolutionary psychology are the tools for understanding human nature.

Examples of universals of psyche or mind that have been identified through broad cross-cultural studies are dichotomization or binary discriminations, emotions, classification, elementary logical concepts, psychological defense mechanisms, ethnocentrism or in-group bias, and reciprocity as a mechanism for bonding individuals to one another.

Among the universals formulated more recently (and more tentatively) in the light of psychological-evolutionary propositions are a social-cheater-detecting mechanism, a mental mechanism for thinking about 'human kinds,' and a facial-template-constructing mechanism that averages the facial features in the observable population as a baseline calibration from which optimums of attractiveness for each sex and age are calculated. Among the apparent projections from the latter mechanism is a preference in males for skin colors in females that are lighter than the observable average (because in the past relative lightness of skin correlated with female fecundity).

The concept of incest *avoidance* – a phenomenon now shown to be present in many animal species as well as humans – is an evolution-minded rethinking of what had long been one of the most frequently discussed and prototypically cultural human universals: the incest *taboo*. Similarly, most anthropologists long recognized the sentiments generated by kinship and reciprocity as universal, but they only received a sound theoretical understanding when evolutionary biologists illuminated their crucial role in providing solutions to the Darwinian puzzle of how altruism could evolve.

The determination and causal explanation of innate universals, predicted or illuminated by evolutionary theory, is probably the most active area in the study of universals at present. But a pursuit of causation in the other direction is vigorously underway too: since it follows that features of human nature must provide a continuous and pervasive structuring of human thought and activity – and hence of society, culture, and history, however much variation they exhibit – the findings of psychobiology and evolutionary psychology have clear implications for sociocultural particulars too. In the next section I will discuss analysis that involves partitioning or breaking down sociocultural particulars into the universal elements of which they are compounds.

In turning now to culture in relation to universals, I will ignore those universals that presumably *are* cultural (such as the ancient and useful inventions and the cultural reflections) and will focus instead on those that are or may be innate universals. Hereinafter, 'universals' will refer to those only.

Anthropologists usually define culture in terms that distinguish it from nature,

often in radical contrast: culture *versus* nature. Definitions of culture generally stress patterns of behavior, thought, feeling, and artifact that are passed on extrasomatically from individual to individual, group to group, generation to generation – meaning patterns that are not in our genes, patterns that must be learned. In this vein, culture has often been associated with variability, indeterminacy, arbitrariness – all in contrast to the fixity of nature. In extreme views, there is virtually no human nature: culture is the overwhelming determinant of human behavior, and can be studied with little or no attention to the human mind.

Other definitions of culture correctly acknowledge a continuous intermixing of culture *with* nature. The philosopher-anthropologist David Bidney, for example, argued that culture should, at least in part, be understood "as the dynamic process and product of the self-cultivation of human nature."[4] Others speak of culture *within* nature – that is, as a product of human nature. Some see culture as a control or correction of certain features of human nature. Yet others see culture as an extension of the human mind and body.

There is good reason to distinguish the cultural in human affairs – but in almost everything that humans do it is as useful to insist on *either* culture *or* nature as the source as it is to insist that water is either hydrogen or oxygen.

But how can the constants of human nature be reconciled with the manifest variability of cultures or, for that matter, with the manifest variability of human behavior? Let me give five answers.

First, in any discussion of human nature a particularly crucial distinction must be made between functions and effects. The set of mental mechanisms that comprise the human mind, and that are thus fundamental to human nature, were designed by natural selection to solve particular problems that were recurrent in our evolutionary past and that are presumably finite in number. However, a mechanism designed to discharge a particular function may have side effects or by-products. Thus, the shape of the outer ear was designed to gather sound waves but may also be used to support glasses or pencils. The anthropologist Lawrence Hirschfeld has proposed, on the basis of experimental evidence, that there is a mechanism in the human mind dedicated to processing information on human types, such as kin types, the sexes, and occupational types.[5] While this mechanism must have evolved in conditions where racial differentiation was rarely if ever perceived (due to the short distances our Stone Age ancestors could have traveled), it has left the human mind effectively 'prepared' to think about races in particular ways. Thus racial thinking has flourished in recent times because it 'parasitizes' a mechanism that was designed for other purposes.

Human mental mechanisms are numerous and their effects – which presumably include a great many emergent properties stemming from the interaction of the various individual mechanisms – are either potentially infinite or infinitely divisible. In spite of the infinity of possible behavioral effects, the mechanisms leave traces of their existence: some are relatively obvious (as in the uniformity of smiles and frowns), some possess enough observable irregularity to fuel the nature-nurture debates (as with many sex differences), and some

4 David Bidney, "Human Nature and the Cultural Process," *American Anthropologist* 49 (1947): 387.

5 Lawrence A. Hirschfeld, *Race in the Making: Cognition, Culture, and the Child's Construction of Human Kinds* (Cambridge, Mass.: MIT Press, 1996).

reveal themselves only through unusual observational situations (as in extensive cross-cultural comparison or in psychological experimentation). At any rate, the range of effects that may become culturally patterned is thus large.

Second, many mental mechanisms motivate us toward goals (mating, ingesting food, etc.), which we may meet through a potentially infinite variety of means. While the many means are observable, the few goals must be inferred. The range of means that may become culturally patterned is, again, large.

Third, some mental mechanisms involve calibration to environing conditions. The resulting behaviors are variable by design, though the underlying mechanism is unitary. These variable responses may well appear to be cultural. For example, as mentioned earlier, there is evidence to suggest that humans have an evolved mechanism for detecting and preferring faces that are projections from the average of what one sees. Since that average may vary from one population to another, the resulting standards of beauty would vary too, and this could easily be interpreted as cultural difference.

Fourth, many adaptations may in some circumstances conflict with each other, so that the resulting behaviors are compromises. Purely local conditions may favor compromises in one direction rather than another. Various peoples thus ignore the pangs of hunger and thirst for a time, in order to maintain the approval of their fasting fellows.

Fifth, as wondrously precise as genetic replication is, the genes that program the structure and operation of our minds and bodies do so in interaction with the genes' environment, which can and does vary. This, in turn, results in structures and operations that differ in varying degrees from one individual to another and from one population to another. In this context it is important to note that recent human environments, in almost all parts of the world, present many conditions that are quite unlike those that prevailed over the long period in which human nature evolved. Many modern behaviors – epidemic obesity in environments rich in processed foods comes to mind as an example – may have their analogues more in the bizarre behaviors of animals in zoos than in what the same animals do in their natural habitats. Clearly, local environments account for many of what are seen as cultural distinctions between one society and another.

In sum, observable variation in behavior or culture is entirely compatible with a panhuman design of the mind (barring, of course, sex and age differences that are equally likely to reflect evolutionary design).

Finally, let us return to the notion that innate human universals continuously and pervasively structure human culture. To the extent that this is so, we should be able to do a sort of back engineering on features of society or culture that allows us to break them down into their component elements and to trace their roots back to the aspects of human nature that gave rise to them. What is the alternative, for example, to concluding that writing, the printing press, the telegraph, the telephone, and the word processor are extensions or augmentations of speech?

And what would be the alternative explanation for literally millions of songs, poems, stories, and works of art, from many parts of the world and over long periods of time, that celebrate the attractions between men and women – except the mind's preoccupation with the topic? Perhaps the entire cosmetics

industry flows from the same cause. Ronald Hyam, a historian of colonialism, has even argued that the sexual drive was as potent a motivator of colonialism as was economics.[6] The virulent nationalisms and racisms of modern times may well be 'hypertrophies' of an ethnocentrism that for many millennia played itself out on a much smaller scale.

What I believe was one of anthropology's great achievements – an assembly of information about where and when cultural inventions arose around the world – appeared in Ralph Linton's mid-century book on culture history, *The Tree of Culture*.[7] Missing there, however, were the roots of that tree in human nature. The task of tracing those roots – in literature, the arts, history, and human affairs in general – is now well begun. We can look forward to the time when a great many cultural features are traced beyond the time and place of their invention to the specific features of human nature that gave rise to them. The study of human universals will be an important component of that task.[8]

6 Ronald Hyam, *Britain's Imperial Century, 1815 – 1914 : A Study of Empire and Expansion* (London : B. T. Batsford, 1976). See also Hyam, *Empire and Sexuality : The British Experience* (Manchester : University of Manchester Press, 1990).

7 Ralph Linton, *The Tree of Culture* (New York : Alfred A. Knopf, 1955).

8 This paper has benefited from comments by Donald Symons. References for the assertions made here may be found in Donald E. Brown, *Human Universals* (New York : McGraw-Hill, 1991) ; Brown, "Human Nature and History," *History and Theory* 38 (4) (1999) : 138 – 157 ; Brown, "Human Universals and Their Implications," in Neil Roughley, ed., *Being Humans : Anthropological Universality and Particularity in Transdisciplinary Perspectives* (Berlin : Walter de Gruyter, 2000), 156 – 174.

Jonathan Haidt & Craig Joseph

Intuitive ethics: how innately prepared intuitions generate culturally variable virtues

Strangeness is fascinating. Medieval maps embellished with fantastical beasts, sixteenth-century wonder chambers filled with natural and technological marvels, even late-twentieth-century supermarket tabloids – all attest to the human fascination with things that violate our basic ideas about reality. The study of morality and culture is therefore an intrinsically fascinating topic. People have created moralities as divergent as those of Nazis and Quakers, headhunters and Jains. And yet, when we look closely at the daily lives of people in divergent cultures, we can find elements that arise in nearly all of them – for example, reciprocity, loyalty, respect for (some) authority, limits on physical harm, and regulation of eating and sexuality. What are we to make of this pattern of similarity within profound difference? Social scientists have traditionally taken two approaches.

The empiricist approach posits that moral knowledge, moral beliefs, moral action, and all the other stuff of morality are learned in childhood. There is no moral faculty or moral anything else built into the human mind, although there may be some innate learning mechanisms that enable the acquisition of later knowledge. To the extent that there are similarities across cultures, they arise because all cultures face similar problems (e.g., how to divide power and resources, care for children, and resolve disputes) for which they have often developed similar solutions.

The nativist approach, on the other hand, holds that knowledge about such issues as fairness, harm, and respect for authority has been built into the human mind by evolution. All children who are raised in a reasonable environment will come to develop these ideas, even if they are not taught by adults. To the extent that there are differences across cultures, they arise because of local variation in the implementation of universal moral

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knowledge (e.g., should relations among siblings be guided by rank and respect for elders, or by equality and reciprocity?).

We would like to take the opportunity afforded by this *Dædalus* issue on human nature to work through one aspect of the idea that morality is both innate and learned. We are not going to offer a wishy-washy, split-the-difference approach. Rather, we will present a modified nativist view that we believe fully respects the depth and importance of cultural variation in morality. We will do this by focusing attention on a heretofore ignored link: the link between *intuitions*, especially a subset of intuitions that we argue are innate in important respects, and *virtues*, which by and large are social constructions.

We propose that human beings come equipped with an *intuitive ethics*, an innate preparedness to feel flashes of approval or disapproval toward certain patterns of events involving other human beings. The four patterns for which we believe the evidence is best are those surrounding suffering, hierarchy, reciprocity, and purity. These intuitions undergird the moral systems that cultures develop, including their understandings of virtues and character. By recognizing that cultures build incommensurable moralities on top of a foundation of shared intuitions, we can develop new approaches to moral education and to the moral conflicts that divide our diverse society.

Anthropologists often begin with sociological facts and then try to work down one level of analysis to psychology. Laws, customs, rituals, and norms obviously vary, and from that variation it is reasonable to conclude that many psychological facts, such as beliefs, values, feelings, and habits, vary too. Evolutionary psychologists, in contrast, work mostly in the space between psychological and biological levels of analysis. Human brains are obviously products of natural selection, adapted to solve problems that faced our hominid ancestors for millions of years. Since infant brains hardly vary across cultures and races, it is reasonable to suppose that many psychological facts (e.g., emotions, motivations, and ways of processing social information) are part of the factory-installed equipment that evolution built into us to solve those recurrent problems.

So how can we get those working down from sociological facts to connect with those working up from biological facts? Where exactly should we drive the golden spike to link the two approaches? The meeting point must be somewhere in the territory of psychology, and we suggest that the exact spot is the intuitions. Intuitions are the judgments, solutions, and ideas that pop into consciousness without our being aware of the mental processes that led to them. When you suddenly know the answer to a problem you've been mulling, or when you know that you like someone but can't tell why, your knowledge is intuitive. Moral intuitions are a subclass of intuitions, in which feelings of approval or disapproval pop into awareness as we see or hear about something someone did, or as we consider choices for ourselves.[1]

Intuitions arise because the mind is composed of two distinct processing systems. Most of cognition can be referred to as the intuitive, or automatic,

1 For more on moral intuition, see Jonathan Haidt, "The Emotional Dog and Its Rational Tail: A Social Intuitionist Approach to Moral Judgment," *Psychological Review* 108 (2001): 814–834; James Q. Wilson, *The Moral Sense* (New York: Free Press, 1993).

system. The human mind, like animal minds, does most of its work by automatic pattern matching and distributed processing. Our visual system, for example, makes thousands of interpretations each second, without any conscious effort or even awareness. It does this by relying in part on built-in processing shortcuts, or heuristics (e.g., the assumption that lines continue behind obstacles that block parts of them), which are integrated with learned knowledge about the things in one's visible world. Analogously, many psychologists now believe that most social cognition occurs rapidly, automatically, and effortlessly – in a word, intuitively – as our minds appraise the people we encounter on such features as attractiveness, threat, gender, and status. The mind accomplishes this by relying in part on heuristics, which are then integrated with learned facts about the social world.

But human minds are unlike other animal minds in having a well-developed second system in which processing occurs slowly, deliberately, and fully within conscious awareness. When you think in words or reason through a problem or work backward from a goal to your present position, you are using the reasoning, or controlled, system. Most psychological research on morality has looked at deliberative moral reasoning, in part because it is so accessible. All you have to do is ask someone, as Lawrence Kohlberg did, "Do you think that Heinz should break into the pharmacy to steal the drug to save his wife's life?"[2] Kohlberg developed a comprehensive account of moral development by looking at how people's answers to these sorts of dilemmas changed over the years of childhood and adolescence.

Yet recent research in social psychology suggests that the responses to such dilemmas mostly emerge from the intuitive system: people have quick gut feelings that come into consciousness as soon as a situation is presented to them. Most decide within a second or two whether Heinz should steal the drug. Then when asked to explain their judgments, people search for supporting arguments and justifications using the reasoning system.[3] As with the visual system, we can't know *how* we came to see something; we can only know *that* we see it. If you focus on the reasons people give for their judgments, you are studying the rational tail that got wagged by the emotional dog.

We propose that intuition is a fertile but under-studied construct for research on morality. It is here that we can find a small number of basic units that might underlie a great diversity of cultural products. Analogous units comprise our perceptual systems. Three kinds of receptors in the skin (for pressure, temperature, and pain) work together to give us our varied experiences of touch. Five kinds of receptors on the tongue (for salt, sweet, bitter, sour, and, oddly, glutamate) work together with our sense of smell to give us a great variety of gustatory experiences. Might there be a few different kinds of social receptors that form the foundation of our highly elaborated and culturally diverse moral sense?

Intuitive ethics: how innately prepared intuitions generate culturally variable virtues

What can evolution put into a mind, and how does it put it there? Some have

2 Lawrence Kohlberg, "Stage and Sequence: The Cognitive-Developmental Approach to Socialization," in David A. Goslin, ed., *Handbook of Socialization Theory and Research* (Chicago: Rand McNally, 1969).

3 See Haidt, "The Emotional Dog"; Richard E. Nisbett and Timothy DeCamp Wilson, "Telling More Than We Can Know: Verbal Reports on Mental Processes," *Psychological Review* 84 (1977): 231 – 259.

argued that the evolutionary process has created innate knowledge of various kinds.[4] For example, infants appear to have hard-wired knowledge of faces and sweet tastes, because their brains come equipped with cells and circuits that recognize them. But our more complex abilities are often better described as a 'preparedness' to learn something. For example, humans are born with few hard-wired fears, but we come prepared to acquire certain fears easily (e.g., of snakes, spiders, mice, open spaces), and cultures vary in the degree to which they reinforce or oppose such fears. On the other hand, it is very difficult to create a fear of flowers, or even of such dangerous things as knives and fire, because evolution did not 'prepare' our minds to learn such associations.

So what moral intuitions might the mind be prepared to develop? What are the patterns in the social world to which human beings might easily come to react with approval or disapproval? There is more than one way to answer these questions; in this essay we take what might be called a meta-empirical approach, surveying works by a variety of social scientists to locate a common core of moral values, concerns, and issues.

We focused on five works – two that aim to describe what is universal,[5] two that describe what is culturally variable,[6] and one that describes the building blocks of morality that are visible in other primates.[7] We began by simply listing the major kinds of social situations these five authors said people (or chimpanzees) react to with a clear evaluation as positive or negative. We then tallied the number of 'votes' each item got, that is, the number of authors, out of the five, who referred to it directly.

The winners, showing up in all five works, were suffering/compassion, reciprocity/fairness, and hierarchy/respect. It seems that in all human cultures, individuals often react with flashes of feeling linked to moral intuitions when they perceive certain events in their social worlds: when they see others (particularly young others) suffering, and others causing that suffering; when they see others cheat or fail to repay favors; and when they see others who are disrespectful or who do not behave in a manner befitting their status in the group. With chimpanzees, these reactions occur mostly in the individual that is directly harmed. The hallmark of human morality is third-party concern: person A can get angry at person B for what she did to person C. In fact, people love to exercise their third-party moral intuitions so much that they pay money to see and hear stories about fictional strangers who do bad things to each other.

The best way to understand our argument is to begin with the notion of long-

4 For reviews see Steven Pinker, *The Blank Slate* (New York: Viking, 2002); Jerome Barkow, Leda Cosmides, and John Tooby, eds., *The Adapted Mind: Evolutionary Psychology and the Generation of Culture* (New York: Oxford, 1992).

5 Donald E. Brown, *Human Universals* (Philadelphia: Temple University Press, 1991); Alan P. Fiske, *Structures of Social Life* (New York: Free Press, 1991).

6 Shalom H. Schwartz and Wolfgang Bilsky, "Toward a Theory of the Universal Content and Structure of Values: Extensions and Cross-Cultural Replications," *Journal of Personality and Social Psychology* 58 (1990): 878 – 891; Richard A. Shweder et al., "The 'Big Three' of Morality (Autonomy, Community, and Divinity) and the 'Big Three' Explanations of Suffering," in Allan M. Brandt and Paul Rozin, eds., *Morality and Health* (New York: Routledge, 1997), 119 – 169.

7 Frans de Waal, *Good Natured: The Origins of Right and Wrong in Humans and Other Animals* (Cambridge, Mass.: Harvard University Press, 1996).

Table 1
Four moral modules and the emotions and virtues associated with them

	Suffering	Hierarchy	Reciprocity	Purity
Proper domain (original triggers)	*Suffering and vulnerability of one's children*	*Physical size and strength, domination, and protection*	*Cheating vs. cooperation in joint ventures, food sharing*	*People with diseases or parasites, waste products*
Actual domain (modern examples)	*Baby seals, cartoon characters*	*Bosses, gods*	*Marital fidelity, broken vending machines*	*Taboo ideas (communism, racism)*
Characteristic emotions	*Compassion*	*Resentment vs. respect/awe*	*Anger/guilt vs. gratitude*	*Disgust*
Relevant virtues	*Kindness, compassion*	*Obedience, deference, loyalty*	*Fairness, justice, trustworthiness*	*Cleanliness, purity, chastity*

standing adaptive challenges, and then to scan down each of the columns in table 1. For example, the prolonged dependence characteristic of primates, especially humans, made it necessary, or at least beneficial, for mothers to detect signs of suffering and distress in their offspring. Mothers who were good at detecting such signals went on to rear more surviving offspring, and over time a communication system developed in which children's stylized distress signals triggered maternal aid. Psychological preparation for hierarchy evolved to help animals living in social groups make the most of their relative abilities to dominate others. Given the unequal distribution of strength, skill, and luck, those individuals who had the right emotional reactions to play along successfully and work their way up through the ranks did better than those who refused to play a subordinate role or who failed to handle the perks of power gracefully.[8] Similarly, a readiness for reciprocity evolved to help animals, particularly primates, reap the benefits of cooperating with non-kin. Individuals who felt bad when they cheated, and who were motivated to get revenge when they were cheated, were able to engage successfully in more non-zero-sum games with others.[9]

A useful set of terms for analyzing the ways in which such abilities get built into minds comes from recent research into the *modularity* of mental functioning.[10] An evolved cognitive module is a

8 Frans de Waal, *Chimpanzee Politics* (New York: Harper & Row, 1982).

9 See Robert L. Trivers, "The Evolution of Reciprocal Altruism," *Quarterly Review of Biology* 46 (1971): 35–57; Robert Wright, *NonZero: The Logic of Human Destiny* (New York: Vintage, 2000).

10 Modularity was first proposed for perceptual processes by Jerry Fodor, *Modularity of Mind* (Cambridge, Mass.: MIT Press, 1983). However, more recent modularity theorists argue that more flexible and only partially modularized cognitive systems play a role in most areas of higher cognition. See Dan Sperber and Lawrence A. Hirschfeld, "The Cognitive Foundations of Cultural Stability and Diversity," *Trends in Cognitive Sciences* 8 (2004): 40–46; Gerd Gigerenzer, *Adaptive Thinking: Rationality in the Real World* (Oxford: Oxford University Press, 2002).

processing system that was designed to handle problems or opportunities that presented themselves for many generations in the ancestral environment of a species. Modules are little bits of input-output programming, ways of enabling fast and automatic responses to specific environmental triggers. In this respect, modules behave very much like what cognitive psychologists call heuristics, shortcuts or rules of thumb that we often apply to get an approximate solution quickly (and usually intuitively).

One useful distinction in the modularity literature is that between the *proper* and *actual* domains of a module. The proper domain is the set of specific scenarios or stimuli that the module was evolved to handle. In the case of a suffering/compassion module, the proper domain is the sight of one's own child showing the stereotypical signs of distress or fear. The proper domain may have extended to distress shown by all kin as well. The actual domain, in contrast, is the set of all things in the world that now happen to trigger the module. This includes the suffering of other people's children, starving adults seen on television, images of baby seals being clubbed to death, and our pet dogs that droop, mope, whine, and break our hearts as we prepare to go off to work each morning.

The concept of modules is helpful for thinking about moral intuitions. One possibility is that moral intuitions are the output of a small set of modules. When a module takes the conduct or character of another person as its input and then emits a feeling of approval or disapproval, that output is a moral intuition. In strong cases, each of these moral modules triggers a full-fledged emotion: suffering triggers compassion; arrogant behavior by subordinates triggers contempt; cheating triggers anger. But in most cases our moral modules are triggered by minor events, by gossip, by things we read in the newspaper, and we do not truly get angry, or feel compassion; we just feel small flashes of approval or disapproval.

For the three sets of moral intuitions we have examined so far, the persistent adaptive challenge is a social challenge. But there is an odd corner of moral life, odd at least for modern Westerners, who tend to think of morality as strictly concerned with how we treat other people. That corner is the profound moralization of the body and bodily activities, such as menstruation, eating, bathing, sex, and the handling of corpses. A great deal of the moral law of Judaism, Hinduism, Islam, and many traditional societies is explicitly concerned with regulating purity and pollution.

Based on our research and that of others, we propose that culturally widespread concerns with purity and pollution can be traced to a purity module evolved to deal with the adaptive challenges of life in a world full of dangerous microbes and parasites. The proper domain of the purity module is the set of things that were associated with these dangers in our evolutionary history, things like rotting corpses, excrement, and scavenger animals. Such things, and people who come into contact with them, trigger a fast, automatic feeling of disgust. Over time, this purity module and its affective output have been elaborated by many cultures into sets of rules, sometimes quite elaborate, regulating a great many bodily functions and practices, including diet and hygiene. Once norms were in place for such practices, violations of those norms produced negative affective flashes, that is, moral intuitions.[11]

11 For the complete story of how the actual domain of disgust expanded into the social world,

Purity and pollution were important ideas in Europe from antiquity through the Victorian age, but they began to fade as the twentieth century replaced them with an increasingly medical and utilitarian understanding of hygiene and an increasing emphasis on personal liberty and privacy in regard to bodily matters. However, even contemporary American college students, when we interview them in our studies of moral judgment, will confess to feeling flashes of disgust and disapproval when asked about violations of purity taboos. Stories about eating one's dead pet dog, about harmless cases of cannibalism, or even about homosexuality may elicit feelings of disgust, which the students attempt, often comically, to justify afterward. The intuition is produced by the module, but the culture does not support a purity-based morality anymore (at least for liberal college students), so the students are left to struggle with the reasoning system to explain a judgment produced by the intuitive system.

Thus far, we have argued two points: that much of mature moral functioning is intuitive rather than deliberative; and that among our moral intuitions are a small number that are primitive and innate, or at least innately prepared. In addition to reflecting persistent adaptive tasks in the human evolutionary past, these prepared intuitions influence moral development and functioning by constraining our moral attention and laying the foundation for the development of other moral concepts. We will now link these observations to another area of philosophical and psychological thinking about morality, namely, the area of virtue theory.

Intuitive ethics: how innately prepared intuitions generate culturally variable virtues

Virtue theorists are a contentious lot, but most would agree at least that virtues are characteristics of a person that are morally praiseworthy. Virtues are therefore traits as John Dewey conceived them – as dynamic patternings of perception, emotion, judgment, and action.[12] Virtues are social skills. To possess a virtue is to have disciplined one's faculties so they are fully and properly responsive to one's local sociomoral context. To be kind, for example, is to have a perceptual sensitivity to certain features of situations, including those having to do with the well-being of others, and to be sensitive such that those features have an appropriate impact on one's motivations and other responses. To be courageous is to have a different kind of sensitivity and well-formedness of response; to be patient, still another.

Virtues, on this understanding, are closely connected to the intuitive system. A virtuous person is one who has the proper automatic reactions to ethically relevant events and states of affairs, for example, another person's suffering, an unfair distribution of a good, a dangerous but necessary mission. Part of the appeal of virtue theory has always been that it sees morality as embodied in the very structure of the self, not merely as one of the activities of the self. Even Aristotle supposed that in developing the virtues we acquire a second nature, a refinement of our basic nature, an alteration of our automatic responses.

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see Paul Rozin, Jonathan Haidt, and Clark R. McCauley, "Disgust," in Michael Lewis and Jeanette M. Haviland-Jones, eds., *Handbook of Emotions*, 2nd ed. (New York: Guilford Press, 2000), 637 – 653.

12 John Dewey, *Human Nature and Conduct: An Introduction to Social Psychology* (New York: Holt, 1922). See also Paul M. Churchland, "Toward a Cognitive Neurobiology of the Moral Virtues," *Topoi* 17 (1998): 83 – 96.

One of the crucial tenets of virtue theory is that the virtues are acquired inductively, that is, through the acquisition, mostly in childhood but also throughout the life course, of many examples of a virtue in practice. Often these examples come from the child's everyday experience of construing, responding, and getting feedback, but they also come from the stories that permeate the culture. Each of these examples contains information about a number of aspects of the situation, including the the protagonists' motivations, the protagonists' state of being (suffering, disabled, hostile, rich, etc.), the categorization of the situation, and the evaluation of the outcome offered by more experienced others. Only over time will the moral learner recognize what information is important to retain and what can be safely disregarded.

As philosophers and cognitive scientists have recently been arguing, with respect both to morality and to cognition more generally, this kind of learning cannot be replaced with top-down learning, such as the acceptance of a rule or principle and the deduction of specific responses from it. Interestingly, this aspect of virtue theory shows Aristotle to have been a forerunner of the current application of the neural network theory of morality that is being developed by Paul Churchland, Andy Clark, and others.[13] In this model, the mind, like the brain itself, is a network that gets tuned up gradually by experience. With training, the mind does a progressively better job of recognizing important patterns of input and of responding with the appropriate patterns of output.

For those who emphasize the importance of virtues in moral functioning, then, moral maturity is a matter of achieving a comprehensive attunement to the world, a set of highly sophisticated sensitivities embodied in the individual virtues. Of course, reasoning and deliberation play important roles in this conception as well; indeed, part of being a virtuous person is being able to reason in the right way about difficult situations. But virtue theory is nevertheless a departure from theories of morality that see deliberation as the basic moral psychological activity.

We believe that virtue theories are the most psychologically sound approach to morality. Such theories fit more neatly with what we know about moral development, judgment, and behavior than do theories that focus on moral reasoning or on the acceptance of high-level moral principles such as justice. But a fundamental problem with many virtue theories is they assume that virtues are learned exclusively from environmental inputs. They implicitly endorse the old behaviorist notion that if we could just set up our environment properly, we could inculcate any virtue imaginable, even virtues such as 'love all people equally' and 'be deferential to those who are smaller, younger, or weaker than you.' Yet one of the deathblows to behaviorism was the demonstration that animals have constraints on learning: some pairings of stimuli and responses are so heavily prepared that the animal can learn them on a single training trial, while other associations go against the animal's nature and cannot be learned in thousands of trials. Virtue theories would thus be improved if they took account of the kinds of virtues that 'fit' with the human mind and of the kinds that do not. Virtues are indeed cultural achievements, but they are cultural achievements built on and partly con-

13 See Larry May, Marilyn Friedman, and Andy Clark, eds., *Mind and Morals* (Cambridge, Mass.: MIT Press, 1997).

strained by deeply rooted preparednesses to construe and respond to the social world in particular ways.

Aristotle himself recognized the constraining effect of human beings' embodied and situated nature on ethical experience. As Martha Nussbaum points out, Aristotle defined virtues by reference to universal features of human beings and their environments that combine to define spheres of human experience in which we make normative appraisals of our own and others' conduct[14] – not unlike what above we called persistent adaptive challenges. Aristotle's and Nussbaum's approach is also a nativist one, albeit one that locates the innate moral content in both the organism and the environment. Our four modules of intuitive ethics are in a sense a pursuit of this Aristotelian project. Like Aristotle, we are seeking a deeper structure to our moral functioning, though in the form of a smaller number of phenomena that are located more in the organism than in the environment.

Let us now link our account of moral intuitions with this account of virtues. Briefly, we propose that the human mind comes equipped with at least the four modules we describe above.[15] These modules provide little more than flashes of affect when certain patterns are encountered in the social world. A great deal of cultural learning is required to respond to the actual domain that a particular culture has created, but it may take little or no learning to recognize cases at the heart of the proper domain for each module (e.g., seeing the facial and bodily signals of distress in a child or seeing a large male display signs of dominance and threat while staring down at you).

Intuitive ethics: how innately prepared intuitions generate culturally variable virtues

These flashes are the building blocks that make it easy for children to develop certain virtues and virtue concepts. For example, when we try to teach our children virtues of kindness and compassion, we commonly use stories about mean people who lack those virtues. While hearing such stories children feel sympathy for the victim and condemnation for the perpetrator. Adults cannot create such flashes out of thin air; they can only put children into situations in which these flashes are likely to happen. We should emphasize that a flash of intuition is not a virtue. But it is an essential tool in the construction of a virtue.

Of course, it is possible to teach children to be cruel to certain classes of people, but how would adults accomplish such training? Most likely by exploiting other moral modules. Racism, for example, can be taught by invoking the purity module and triggering flashes of disgust at the 'dirtiness' of certain groups, or by invoking the reciprocity module and triggering flashes of anger at the cheating ways of a particular group (Hitler used both strategies against Jews). In this way, cultures can create variable actual domains that are much broader than the universal proper domains for each module.

A second way in which cultures vary is in their relative use of the four modules.

14 Martha C. Nussbaum, "Non-Relative Virtues: An Aristotelian Approach," in Martha C. Nussbaum and Amartya Sen, eds., *The Quality of Life* (New York: Oxford University Press, 1993).

15 There are probably many others. The best candidate for a fifth might be an 'ingroup' module whose proper domain is the boundaries of a co-residing kin group, and whose actual domain now includes all the ethnic groups, teams, and hobbyist gatherings that contribute to modern identities. To the extent that people feel a bond of trust or loyalty toward strangers, the operation of a such an ingroup module seems likely.

In our own research we have found that American Muslims and American political conservatives value virtues of kindness, respect for authority, fairness, and spiritual purity. American liberals, however, rely more heavily on virtues rooted in the suffering module (liberals have a much keener ability to detect victimization) and the reciprocity module (virtues of equality, rights, and fairness). For liberals, the conservative virtues of hierarchy and order seem too closely related to oppression, and the conservative virtues of purity seem to have too often been used to exclude or morally taint whole groups (e.g., blacks, homosexuals, sexually active women).[16]

A third way in which cultures diverge is in their assignment of very different meanings and intuitive underpinnings to particular virtues. Take, for example, the virtue of loyalty. Certainly there is a difference between loyalty to peers and friends on the one hand (that is, loyalty grounded in reciprocity intuitions), and loyalty to chiefs, generals, and other superiors (that is, loyalty in the context of hierarchy), even though both have much in common. Similarly, the virtue of honor can be incarnated as integrity (in reciprocity), as chivalry or masculine honor more generally (in hierarchy), or as chastity or feminine honor (in purity). And temperance is one thing in the context of reciprocity, where it may be essential for the flourishing of the group in conditions of scarcity, and something quite different in the context of purity, where it is often construed as a means of enlightenment or spiritual development. In each of these cases, different moral underpinnings provide the virtue with different eliciting conditions and different appropriate behaviors and responses.

A fourth source of cultural variation is the complex interactions that virtues can generate, forming what one might call virtue complexes, which express a great deal of a society's conception of human nature and moral character. One excellent example comes from Reynold A. Nicholson's *Literary History of the Arabs*, a masterful survey of pre-Islamic and Islamic Arab culture. One of the moral concepts elucidated by Nicholson is that of *hamasa*, which is often glossed simply as 'valor.' Nicholson, however, defines it this way: "'Hamasa' denotes the virtues most highly prized by the Arabs – bravery in battle, patience in misfortune, persistence in revenge, protection of the weak and defiance of the strong."[17] There is no necessary connection between these qualities; one could imagine someone brave in battle and protective of the weak, but impatient in misfortune and inclined to bide his time when challenged by someone stronger. But the point is that the Arabs do not imagine this set of traits, or at least they do not award it their ultimate praise. Even if some virtues tend to go together across cultures, the virtue complexes that each culture generates are likely to be unique.

On the account we have sketched, morality is innate (as a small set of modules) and socially constructed (as sets of interlocking virtues). It is cognitive (intuitions are pattern-recognition systems) and it is emotional (intuitions often launch moral emotions). But above all, morality is important to people in their daily lives, and to societies that seem forever to lament the declining morals of today's youth. We will

16 For a compatible and much more comprehensive treatment see George Lakoff, *Moral Politics: What Conservatives Know That Liberals Don't* (Chicago: University of Chicago Press, 1996).

17 Reynold A. Nicholson, *A Literary History of the Arabs* (Cambridge: Cambridge University Press, 1930), 79.

therefore close with suggestions for using intuitive ethics in moral education and in dealing with moral diversity.

Moral education, on our account, is a matter of linking up the innate intuitions and virtues already learned with a skill that one wants to encourage. Parents and educators should therefore recognize the limits of the 'direct route' to moral education. It is helpful to espouse rules and principles, but only as an adjunct to more indirect approaches, which include immersing children in environments that are rich in stories and examples that adults interpret with emotion. Those stories and examples should trigger the innate moral modules, if possible, and link them to broader virtues and principles. Another indirect approach involves arranging environments so that messages about what is good and bad are consistent across sources (parents, teachers, television, movies, afterschool activities, etc.). Conservative parents who homeschool their children, limit what they can watch on television, and read to them from William Bennett's *Book of Virtues* are therefore likely to be successful in tuning up their children's moral-perceptual systems in the desired ways. Liberal parents who try not to 'impose their morality' on their children, by contrast, may well be disappointed by the results. Depriving children of frequent moral feedback, including displays of the parent's moral emotions, or exposing them to many conflicting messages, may deprive the intuitive system of the experiences it needs to properly tune up. If virtues are social skills, then moral education should be a comprehensive and sustained training regimen with regular feedback.

Moral diversity, on our account, results from differences in moral education and enculturation. As we suggested above, one of the main sources of moral diversity originates in political diversity. On such currently divisive issues as gay marriage, therapeutic cloning, and stem cell research, liberals focus on promoting individual welfare and individual rights. Conservatives understand these arguments, but they have a more multivocal moral life, drawing on a wider set of moral intuitions.[18] They also have to integrate their deeply intuitive aversion to 'playing God' and their more finely honed and valued sense of disgust. Leon Kass, President Bush's bioethics advisor, for instance, bases his critique of human cloning in part on the fact that it offends and repulses many people. He grants that disgust is not by itself an argument, but he suggests that there is a form of wisdom in repugnance. "Shallow are the souls that have forgotten how to shudder," he wrote.[19]

So how can we all get along in a morally diverse society? The first step is simply to recognize that all sides in the debate are morally motivated. We tend to assume the worst about our opponents, to regard them as perfectly villainous. But when liberals assume that conservatives are motivated by little more than hatred and bigotry, they show about as much psychological insight as President Bush's statement that the 9/11 hijackers did what they did because they "hate our freedom." Only when moral motives are acknowledged can intelligent discourse begin.

The second step is to try to frame appeals in language that may trigger new intuitions on the other side. For example, conservatives tend to value social order and stability; a concerted effort to show that gay marriage is about order and stability, that it's about helping peo-

18 Lakoff, *Moral Politics*.

19 Leon Kass, "The Wisdom of Repugnance," *New Republic*, 2 June 1997, 17–26.

ple to form life-long commitments that will often create stability for children, may be more effective in changing hearts and minds than the familiar arguments about rights and fairness.

It is our hope that a fuller understanding of the links between virtues and intuitions will lead to greater tolerance and respect – between liberals and conservatives, between people of different nations, and, perhaps in the far distant future, between nativists and empiricists.

Vernon L. Smith

Human nature: an economic perspective

> Fruitful social science must be very largely a study of what is not.
>
> – F. A. Hayek, *Rules and Order*

An economist writing on the topic of human nature is surely expected to talk about decision making by narrowly self-interested rational agents. These agents are assumed to choose among all possible options the one that maximizes their expected gain, defined variously as utility, profit, income, wealth, and so on, depending upon the standard model invoked. Moreover, *ceteris paribus*, the particular context of the decision is irrelevant in the standard model.

But I will not be fulfilling such a simplistic expectation; neither am I going to claim that people are not motivated by self-interest. In fact, on balance, I believe we have more to learn about what constitutes self-interest by observing humans in a variety of contexts than we have to teach using models based on traditional assumptions about self-interest. This is because my half-century involvement in the development of experimental economics long ago revolutionized the way I think about economics. Market and other group decision-making experiments have deepened my understanding and respect for the power of human beings to create institutions that enable them to discover ingenious new ways to pursue and satisfy their interests. This creative process is neither deliberate nor consciously visible to the participants.

From an economist's point of view, the most compelling feature of human nature is sociality. It has been our species' capacity for social exchange that has enabled task specialization and the production above bare subsistence that has supported investment in the creation and utilization of knowledge. As can be seen in the ethnographic record, in daily life, and in laboratory experiments, whether it is goods or favors that are exchanged, exchange promises gains that humans seek relentlessly in all social interactions. Focusing on narrow, easily modeled, a priori conceptions of self-interest distracts us from this underlying truth.

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Intellectually we economists have in many ways outgrown our roots in the Scottish Enlightenment. We have far more technical knowledge of the economy than Adam Smith did. But while our understanding of economics has grown more sophisticated, we have abandoned, forgotten, and failed to build upon some of Smith's most significant insights. As I shall endeavor to explain, this failure has been costly in diluting and blunting our understanding of the foundations of our sociality.

The good news, however, is that the insights of the Scottish intellectual tradition have reemerged in the study of motivated human behavior using the methods of experimental economics, and in a wide variety of applications of this technology to the design of new resource-management problems in the field. This renaissance in research has enabled the earlier traditions to be explored and extended with contemporary tools of inquiry, and promises to deepen our understanding of human sociality.

Adam Smith did not champion the standard socioeconomic science model (SSSM) based on the self-interest assumption as it is used today by most economists. In Smith's view, each individual defined and pursued his own interest in his own way. Indeed, Smith has been badly and repeatedly mischaracterized with the title 'economic man.'[1] This label ignores his overriding moral concerns; it may prevent us from appreciating the nuances of the key proposition articulated by Smith and almost all the other Scottish philosophers: to do good for others does not require individuals to take *deliberate* action to do good for others.

As Mandeville so efficiently stated it, "The worst of all the multitude did something for the common good."[2] Many contemporary scholars have mistakenly reversed Mandeville's proposition, arguing that the SSSM requires, justifies, and promotes selfish behavior. That exclusively selfish behavior can yield benefits to others through exchange in no sense allows us to conclude that the existence of social exchange and its key role in increasing welfare necessitates such selfish behavior. That A (selfish behavior in exchange) implies B (wealth benefits via specialization and markets) says nothing about whether or not B implies A.

Cultures with evolved markets have enormously expanded resource specialization and have created commensurate gains from exchange, and are wealthier than those that have not.[3] This supports Smith's fundamental two-part theorem that wealth is derived from specialization – the division of labor – which in turn is limited by the extent of the market. Thus, we have:

exchange → specialization → wealth.

By Smith's account, "This division of labor . . . is not originally the effect of any human wisdom, which foresees and intends that general opulence to which it gives occasion. It is the necessary, though very slow and gradual, consequence of a certain propensity in human nature which has in view no such extensive utility; the propensity to truck,

1 Cf F. A. Hayek, "Adam Smith (1723 – 1790): His Message in Today's Language," in *The Trend of Economic Thinking: Essays on Political Economists and Economic History* (Chicago: University of Chicago Press, 1991), 120.

2 See Bernard Mandeville's poem, "The Grumbling Hive: or Knaves Turned Honest" (1705), quoted in Hayek, "Adam Smith," 82.

3 Gerald W. Scully, "The Institutional Framework and Economic Development," *Journal of Political Economy* 96 (3) (1988): 652 – 662.

barter, and exchange one thing for another."[4]

Individuals can use their increased wealth for consumption, investment, or gifts to the poor, the symphony, or the Smithsonian. Markets economize on the need for virtue, but they do not eliminate it – indeed, markets depend on a modicum of virtuous behavior, if they are to avoid heavy monitoring and enforcement costs. If monitored and externally enforced rights can never cover every margin of decision, then – contrary to the notion that markets depend on selfishness – opportunism in all relational contracting and exchange across time is a *cost*, not a benefit, in achieving long-term value from trade. An ideology of honesty means that people choose to play the game of trade rather than steal, although property crimes may well pay the rational lawbreaker.[5] Nor does people's altruistic behavior in dispersing the gains they enjoy from ordinary market transactions prevent market exchange from promoting specialization and creating wealth.

David Hume, Adam Smith's Scottish neighbor, was concerned with the limits of reason, the bounds on human understanding, and with moderating the exaggerated claims of Cartesian rationalists. As F. A. Hayek has put it, "Descartes contended that all the useful human institutions were and ought to be [a] deliberate creation of conscious reason . . . a capacity of the mind to arrive at the truth by a deductive process."[6] To Hume, by contrast, rationality was a phenomenon that reason discovers in emergent institutions: "the rules of morality . . . are not conclusions of reason."[7] Smith developed this concept of emergent self-organizing order for economics. In this methodology, truth is discovered in the form of the intelligence embodied in rules and traditions that have formed, inscrutably, out of the ancient history of human social interactions. This is the antithesis of the anthropocentric belief that if an observed social mechanism like reciprocity or language is functional, then somebody, somewhere, somehow must have invented it.

I am not saying, however, that we can do without a constructive sense of rationality. Indeed, we employ rational tools to formulate the hypotheses used to interpret observations alleged to arise from an emergent order. For example: individual families initially providing for all their own consumption discover that they can gain by trading some of their bumper corn crop for hogs to add to

4 Adam Smith, *An Inquiry into the Nature and Causes of the Wealth of Nations*, ed. R. H. Campbell and A. S. Skinner (Indianapolis: Liberty Fund, 1981), 20. Thus, when Smith uses the metaphor of the invisible hand, he is referring to the essential insight that people in markets achieve ends that are not part of their intention; i.e., people achieve more efficient arrangements induced by the specialization-exchange nexus than is possible without that nexus. The more common, inappropriate, interpretation is illustrated in the following quotation from Joseph Stiglitz ("Information and the Change in the Paradigm in Economics," in *Les Prix Nobel, The Nobel Prizes 2001* [Stockholm: The Nobel Foundation, 2002], 472): "The argument of Adam Smith . . . that free markets led to efficient outcomes, 'as if by an invisible hand,' has played a central role in these [information economics] debates . . . . The set of ideas that I will present here undermines Smith's theory and view of government that rested on it. They have suggested that the reason that the hand may be invisible is that it is simply not there – or at least that it is palsied."

5 Douglass C. North, *Structure and Change in Economic History* (New York: Norton, 1981).

6 F. A. Hayek, *Studies in Philosophy, Politics and Economics* (Chicago: University of Chicago Press, 1967), 85.

7 David Hume, *A Treatise of Human Nature* (London: Penguin Classics, 1985), vol. 2, 235.

their herd; from this experience they learn that they can transform corn into hogs more cheaply through trade than through home production. As more and more people specialize either in corn or hogs and trade in this manner, the community becomes wealthier through greater individual wealth. This dynamic could be a form of Smith's "very slow and gradual" process through which people create unintended opulence and then choose how to utilize that opulence.

The durability of ancient Judeo-Christian norms of social stability and the rule of common law in England are difficult to fathom without the concept of an emergent evolutionary cultural order. The early lawgivers did not make the law they presumed to give; they observed social traditions, norms, and informal rules and gave voice to them, as God's, or natural, law:

> all early "law-giving" consisted in efforts to record and make known a law that was conceived as unalterably given. A "legislator" might endeavor to purge the law of supposed corruptions, or to restore it to its pristine purity, but it was not thought that he could make new law . . . . But if nobody had the power or intention to change the law . . . this does not mean that law did not continue to develop.[8]

I believe that Hayek's interpretation applies well to what one finds in the first written law, Ur-Nammur's Code. The Sumerian clay tablets containing laws inscribed in cuneiform script that appeared by 2050 B.C. reflected the social norms and practices already described in Sumerian proverbs and fables.[9]

The common lawyer Sir Edward Coke championed seventeenth-century social norms as law commanding higher authority than the king. Remarkably, these forces prevailed, paving the way for the rule of law in England, which would become so essential to the development of the American liberal social order. What allowed the rule of 'natural' or 'found' law to prevail in England "was the deeply entrenched tradition of a common law that was not conceived as the product of anyone's will but rather as a barrier to all power, including that of the king – a tradition which Edward Coke was to defend against King James I and Francis Bacon."[10]

According to David Hume, there are just "three fundamental laws of human nature, *that of the stability of possession, of its transference by consent, and of the performance of promises*. 'Tis on the strict observance of those three laws, that the peace and security of human society entirely depend; nor is there any possibility of establishing a good correspondence among men, where these are neglected." If only we could have had a more widely distributed appreciation of these principles, and some operating knowledge of how to implement them, in the rush to liberalize the former Soviet Union.

Hume's insight is the foundation for both *personal exchange*, based on small-group reciprocity, and *impersonal exchange*, through markets. Central to both kinds of exchange is what economic the-

8 F. A. Hayek, *Law, Legislation and Liberty*, vol. 1, *Rules and Order* (Chicago: University of Chicago Press, 1973), 81.

9 Samuel Noah Kramer, *History Begins at Sumer: Thirty-Nine Firsts in Man's Recorded History* (Philadelphia: University of Pennsylvania Press, 1981), 51 – 59, 116 – 131.

10 Hayek, *Law, Legislation and Liberty*, 85, 167, 173 – 174. For a thoughtful examination and critique of Hayek's arguments, see Ronald Hamowy, "F. A. Hayek and the Common Law," *Cato Journal* 23 (2) (Fall 2003): 241 – 264.

orists have traditionally called property rights. As I use the term, a property right is a guarantee allowing actions to occur within the opportunities and constraints defined by the right. Such human rights need have nothing to do with property in the sense of land or physical assets. We automatically look to the state as the guarantor against reprisal when rights are exercised, but we also know that the state can often be as much a part of the problem as of its solution.

In any case, property rights predate nation-states. This is because social exchange within stateless tribes, and trade between such tribes, predates the agricultural revolution. Both social exchange and trade implicitly recognize mutual consensual rights to act when engaged in voluntarily and spontaneously. But how is it possible for property rights to emerge without an external enforcement authority? Repeated exchange: if you gather or grow grain, I husband goats, and we trade our surpluses, then we each have a stake in the other's rights to territory and in a common emergent incentive to band together in defending those rights.

Some political activists juxtapose property rights and human rights as if they were mutually exclusive phenomena. Those activists are sadly confused. Property is that over which an individual human, or association of humans, exercises some recognized and sanctioned specific priority of action with respect to other humans. Only humans, not property, can be recognized by a community as allowed to act without reprisal from others. Moreover, such rights must have stability over time if they are to enable production.

The essence of property rights is the claim to the product of one's own labor and to the further productive yield generated by the savings from that product. Property rights mean that, one, if I plant corn, then I have the right to harvest the yield of that corn, and therefore the right to prevent an unauthorized passerby from harvesting it; and, two, if I use some of the income from the sale of that harvest to invest in more land, then I have the right to plant and harvest from that additional land. To be 'propertied' is to have accumulated. To accumulate is to *not* consume all that my labor, and previous savings-investment, has produced. This allows my accumulation to remain at work in society at large and for all others to benefit from my capital investment. This is the basis for all net wealth accumulation in society. *There can be no other basis*. If there is any abridgement of my right to so harvest and accumulate, then there is a direct abridgement of the right of all others to enjoy the benefits of my accumulation and to a corresponding reduction in their poverty.

We should all love rich people, because they consume such a small percentage of their accumulation, leaving almost all of it to work in the economy and make the rest of us better off. But rich or not, there are solid reasons why it is good economics to love thy neighbor as thyself: each of us benefits through exchange from the utilization of specialized knowledge possessed by others.

Since the pioneering work of Boas over a century ago, the study of extant hunter-gatherer tribal societies has made plain the sophistication and diversity of property rights throughout human history. Of the hundreds of examples that could be cited, I want to quote one of my favorites, from Peter Freuchen's *Book of the Eskimos*. As you read it, keep in mind Hume's laws of human nature.

Vernon L. Smith on human nature

> "A [polar] bear is so constructed that it does not like to have spears in it," say the [Inuit] Eskimos. As if to prove what they say, the bear – as they run right up to the beast with their incredible courage and hurl their puny weapons at it – takes the spears that have lodged deeply in its flesh and breaks them as if they were matchsticks.
>
> . . . According to custom, all the hunters present are to get parts in the quarry, in this case both of the meat and skin. There are three pairs of trousers in a bearskin. If there are more than three hunters present, the ones who threw their spears last will usually be generous enough to leave their parts of the skin to the others. The hunter who fixed his spear first in the bear gets the upper part. That is the finest part, for it includes the forelegs with the long mane hairs that are so much desired to border women's kamiks [boots] with.
>
> . . . So the hunter measures with his whip handle from the neck down, and marks the length of his own thighs on the skin and cuts off at that mark. The next hunter does likewise with the next piece, and the third one gets the rest.[11]

In terms of social exchange and its economic function (I do not deny, but cannot here consider, other important functions), I want to note that the Inuit 'first harpoon' property right norm is an incentive rule that rewards the greater risk and cost of being the first to harpoon this incredibly dangerous prey. It is an equal opportunity rule, not an equal outcome rule, that evolved from ancient prehistory. Any member of the hunting team is free to go first, pay the risk cost, and collect the higher revenue. All others, however, whose contributions cannot be differentiated – and this is the key condition – share equally or more flexibly in the remaining revenue.

These deep ethical principles surface in laboratory experiments showing that when there is no way to differentiate individual contributions, people support the equal outcome rule. When contributions can be differentiated, people tend to prefer a rule that rewards in proportion to individual contributions – more to those who sacrifice more for the group. The literature developing these social-psychological mainsprings of our humanity goes back at least to George C. Homans's 1967 *The Nature of Social Science*, and has been widely examined and replicated in experiments. The point that I cannot overemphasize is that we are all a collage of the norms and rules of human exchange, and that the rules – which we do not observe consciously, and of whose work in enabling social stability we are unaware – in turn depend upon context.

Imagine, now, that you have been recruited to our economics laboratory for an experiment. When you arrive, you are paid $5 for appearing at the scheduled time and place. You are escorted to a computer terminal in a large room with roughly forty terminals, each at a work desk with partially enclosed sides to facilitate privacy. Others arrive and, when all are seated, everyone reads through the instructions on the monitor. You are randomly paired with one other person whose identity you will never know.[12]

11 Peter Freuchen, *Book of the Eskimos* (Cleveland: World Publishing Company, 1961), 53 – 54.

12 Sometimes two-person interactions similar to this are conducted 'double blind,' meaning that the experimenter can never know who made what decisions. Introducing double-blind procedures is a way of changing social distance by removing the experimenter and all others from knowledge of the subjects' decisions.

A sequential move procedure for two persons is displayed on your computer screen. In the experiment you will be designated either as a person 1 or a person 2. If you are a person 1, you move first. You choose between two alternatives: $20 for yourself and $20 for person 2, or you can pass the decision on to person 2. If you do not pass, the experiment is over and you will each be paid $20. If you pass to person 2, he or she has two alternatives: $25 for each ($25, $25) or $15 for person 1 and $30 for person 2 ($15, $30). All this is done privately to protect anonymity.

If each is a narrowly self-interested 'economic man,' i.e., always chooses the larger of two amounts of money for him or herself, and each believes that the other is similarly motivated, then person 1 will look ahead in the decision sequence and see that if he passes to person 2, she will elect the outcome ($15, $30). Thus, person 1 will 'rationally' choose to opt out with ($20, $20). This is the proffered equilibrium of the formal game when it is played once between players who are strangers with no history or future.

What do we observe? Among fifty-four subjects (twenty-seven pairs) recruited from the general undergraduate population, 63 percent of persons 1 pass to their matched person 2, while 37 percent choose the predicted equilibrium ($20, $20). Of the persons 2 with the opportunity to make a choice, 65 percent elect to cooperate ($25, $25), while 35 percent choose to defect ($15, $30).[13]

We have data from many of these trust game experiments with different payoff outcomes; typically, about half or more of persons 1 pass to their matched person 2, and some two-thirds or more of persons 2 cooperate. For example, in one version, person 1 can choose ($10, $10) or pass to person 2, who chooses between ($15, $25) and ($0, $40). You might think that few will pass to person 2, since it is in their interest to take the $40. In fact, half of the undergraduate subjects pass to person 2, and 75 percent reciprocate with ($15, $25). Incidentally, the same fraction of graduate students choose to pass if they are persons 1, and nearly as many, 67 percent, reciprocate. Hence, cooperation can survive training in economics and game theory.[14]

Why do these experiments reveal so much cooperation?

Hypothesis I: people are altruistic; they like to give money even to people they do not know and will never be able to identify.

Hypothesis II: people tend to reciprocate; they like to 'return the favor' when others make choices that benefit them.

How can we test, that is, discriminate, between these two hypothetical explanations? The reciprocity argument takes into account that person 2 sees that person 1 gave up the outcome ($20, $20). Suppose therefore that we do the same experiment, except that we eliminate the option in which person 1 may choose the predicted equilibrium, and instead require him to cede the choice to person 2. Economically, this means he incurs no opportunity cost; psychologically, this means his 'trust' is now involuntary. Then the entire game task reduces simply to person 2 choosing between ($25,

13 Kevin A. McCabe, Mary Rigdon, and Vernon L. Smith, "Positive Reciprocity and Intentions in Trust Games," *Journal of Economic Behavior and Organization* 52 (October 2003): 267 – 275.

14 Kevin A. McCabe and Vernon L. Smith, "A Comparison of Naïve and Sophisticated Subject Behavior with Game Theoretic Predictions," *Proceedings of the National Academy of Sciences* 97 (7) (2000): 3777 – 3781.

$25) and ($15, $30). Hypothesis I predicts no difference between the choices made by persons 2 in the 'voluntary trust' and 'involuntary trust' games. Hypothesis II, however, predicts that more persons 2 will choose to maximize their own reward.

Hypothesis II seems to be confirmed experimentally. In twenty-seven pairs of subjects, all of whose persons 1 must involuntarily trust persons 2, we observe that only 33 percent of persons 2 choose the predicted equilibrium ($25, $25). In the voluntary trust case, person 2 implicitly sees that person 1 has performed an action that enables person 2 to make him or herself better off, but also to 'return the favor.' In the involuntary case, no such interpretation of an implicit contract is evident.

We interpret this behavior as driven by the human propensity to engage in exchange – in this context, personal exchange. What we learn from the experiments is that this propensity is so strong that it survives anonymity in half or more of the participants in single-play protocols; in repeat interaction, over 90 percent of the subjects are able to sustain cooperative outcomes.

Adam Smith would hardly have been surprised by these results:

> Of all the persons . . . whom nature points out for our peculiar beneficence, there are none to whom it seems more properly directed than to those whose beneficence we have ourselves already experienced. Nature, . . . which formed men for their mutual kindness, so necessary for their happiness, renders every man the peculiar object of kindness, to the persons to whom he himself has been kind . . . . No benevolent man ever lost altogether the fruits of his benevolence. If he does not always gather them from the persons from whom he ought to have gathered them, he seldom fails to gather them, and with a tenfold increase, from other people. Kindness is the parent of kindness.[15]

Most of my career has been devoted to the experimental study of market and other exchange mechanisms with at least four subjects. In one simple experiment there were twenty-two subjects – ten buyers and twelve sellers.[16] Privately each buyer was assigned a value, and each seller a cost. Unknown to everyone, the demand schedule, defined by the set of all buyers' values ordered from highest to lowest, ran from $3.70 to $3.10. Also unknown to all, the supply schedule, defined by the set of sellers' costs ordered from lowest to highest, ran from $0.20 to $3.80. These schedules intersected at a uniform clearing price of $3.40 and at a corresponding volume of nine units traded. Buyers earned a profit given by the difference between their value and the purchase price from some seller. Sellers earned a profit given by the difference between their unit private cost and the price received. No subject knew the defining economic environment, so each had to function entirely with only two pieces of information: the personal private value (or cost); and the public information generated by the open outcry of buyers' bids and sellers' asking prices in a version of the trading mechanism known as the double auction – a two-sided generalization of the ancient progressive buyer-bid auction, dating back to the Babylonians of 500 B.C. and still used by auction houses to

15 Adam Smith, *The Theory of Moral Sentiments* (Indianapolis: Liberty Fund, 1976), 225. Notice that Smith is talking about reciprocity, but without using this word from our time. Then he proceeds to talk about reputation formation and positive cultural responses.

16 Vernon L. Smith, *Papers in Experimental Economics* (Cambridge: Cambridge University Press, 1991).

vend collectables, tobacco, wool, and other commodities.

All subjects hear (or see, in computer-based electronic auctions) the bids and acceptances that yield the serial contract prices. The competitive equilibrium clearing price and volume of trades, and their particular realization in this example ($3.40, 9), are of course unknown to the subjects. Yet these simple markets converge across repeat trading periods to approximately the ruling equilibrium within two to five periods (depending upon the thickness of the markets, the number of participants, and the parameters of the supply/demand environment). The subjects deny, if asked, that any kind of quantitative model can predict their final price tendencies. They also deny that each could be doing as well for him or herself as possible, given the restraining effects of what all others are doing. Yet these are precisely the properties of the equilibrium to which they have just converged in repeat interaction. The results have been replicated in many hundreds of experiments with a variety of different supply and demand schedules. These equilibrium observations also have been extended to far more complex interdependent multiple-commodity markets in which the costs in one market depend upon the volume and price in the others.[17]

These laboratory experiments have established that markets efficiently aggregate the dispersed private information possessed by their participants. The results are robust to variations in the subject pool, and many cross-cultural comparisons have been made.

Although Adam Smith recognized the phenomenon that we call reciprocity, he never realized that the personal sentiments he described in his first book were a form of exchange functionally like the markets whose consequences he spelled out so eloquently in his second book. He apparently did not see the unity between the two works based on a broader universal conception of the "propensity to truck, barter, and exchange."[18]

It was Hayek who saw clearly the tension between the two orders of exchange and the cultural dangers that each posed for the other:

> we must constantly adjust our lives, our thoughts and our emotions, in order to live simultaneously within different kinds of orders according to different rules. If we were to apply the unmodified, uncurbed rules of the . . . small band or troop, or . . . our families . . . to the [extended order of cooperation through markets], as our instincts and sentimental yearnings often make us wish to do, *we would destroy it*. Yet if we were to always apply the rules of the extended order to our more intimate groupings, *we would crush them*.[19]

17 Arlington Williams, Vernon L. Smith, and John O. Ledyard, "Simultaneous Trading in Two Competitive Markets," manuscript (Bloomington: Indiana University Department of Economics, 1986); Arlington Williams, Vernon L. Smith, John O. Ledyard, and Steven Gjerstad, "Concurrent Trading in Two Experimental Markets with Demand Interdependence," *Journal of Economic Theory* 16 (2000): 511 – 528; Charles Plott, "Equilibrium, Equilibration, Information and Multiple Markets: From Basic Science to Institutional Design," Nobel Symposium, "Behavioral and Experimental Economics," Grand Hotel Saltsjobaden, December 4 – 6, 2001. The effects of using different trading institutions have also been extensively explored; see Smith, *Papers in Experimental Economics*.

18 See Vernon L. Smith, "The Two Faces of Adam Smith," Southern Economic Association Distinguished Guest Lecture, *Southern Economic Journal* 65 (1) (July 1998): 1 – 19.

19 F. A. Hayek, *The Fatal Conceit* (Chicago: University of Chicago Press, 1988), 18. The italics are Hayek's.

Vernon L. Smith on human nature

Here is my interpretation of the problem of living within two "kinds of orders according to different rules": In the world of personal social exchange, which all of us live in no matter how deeply involved we might be in specialization and markets, our experience is that good comes from deliberate acts of good – sharing, kindness, and reciprocity. "I owe you one" is a common human expression across many languages.

By contrast, the work that markets do and the unintended good we accomplish through them is completely foreign to our direct personal experience. Therefore, it seems to us that we ought always to be able to intervene, introduce controls, and make them work for a greater good. But failing proof of efficacy, any such policy can so easily not result in improvement, and can yield unintended consequences that make things worse. Thus, restrictions that keep jobs from being exported prevent domestic firms from lowering cost to meet competition; firms slip toward bankruptcy and the jobs are lost anyway, postponing the natural predilection of the economy to direct resources into new industries. Yesterday's old economy jobs are artificially retained by policy restrictions, blocking the channeling of funds into creating tomorrow's new jobs and wealth. Political lobbies emerge from those wanting to protect their past; no lobbies emerge from those who will create the new products, technologies, and jobs – for they are part of what is *not*.

If unintended outcomes are not plainly visible as part of our experience and are thus identified as the result of our constructivist interventions, we fail to learn the great harm we have done. The value of all that is must derive from that which is not, from that which could have been. Understanding what is requires understanding what might have been. Hence, the understanding that can stem from experiments that probe behavior in arrangements that do not exist.

If undeveloped economies based on personal exchange and local trade are to grow wealth, the trust that supports productivity among people well known to each other must somehow be transferred to institutions that enable exchange and specialization to be extended to vast networks of strangers. One still must give in order to receive through that extended order, exactly as in traditional societies, but through the intermediary of monetary and financial institutions that disconnect individuals from the pervasive bonds that traditionally held them in mutual trust, respect, and dignity. Taking is no longer plainly related to giving, and the rules of the market that benefit all by deepening specialization may confront, clash, and destroy the old connectedness without making visible the productively superior replacement connections.

Jerome Kagan

The uniquely human in human nature

We can describe an object by listing its features, as manufacturers do when they provide a description of the parts of an assembly-required crib; or by comparing the object with one from a related category, as parents do when they tell their child that a zebra has stripes but a horse does not. Most answers to the question What is human nature? adopt this second strategy when they nominate the features that are either uniquely human or that are quantitative enhancements on the properties of apes. I adopt such a comparative posture here and describe seven psychological features that are either restricted to or enhanced in humans compared with our closest relatives, the chimpanzees. Four are of the first category; the other three are quantitative enhancements on chimpanzee talents.

The distinct psychological qualities of Homo sapiens are traceable to genetic changes that permitted the founder cells that become mature neurons to continue to divide for an extra seventy-two hours. Those additional cell divisions significantly expanded the size of the human cortex and contributed to the novel cognitive, emotional, and motor skills that emerge in humans over the course of development.

However, some scientists remain inexplicably resistant to acknowledging that any human quality is unique. When a linguist claims that only humans have a language with a grammar, a scientist will reply that chimpanzees can be taught to communicate with pieces of plastic. Jane Goodall's discovery that chimpanzees use tools is celebrated because of its implication that my use of a hammer to hang my granddaughter's recent artwork on the wall is not fundamentally different from a chimpanzee's use of a twig to ferret out termites. But the modern syn-

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Some ideas in this essay were drawn from a forthcoming book, "A Young Mind in a Growing Brain" (written with Norbert Herschkowitz), to be published next year.

thesis in evolutionary biology does not demand that every feature that belongs to a particular family, genus, or species has a homologous structure or function in a related taxon.

Human and chimpanzee infants are very similar to each other at the end of the first year. Both species locomote, attend to unexpected or unfamiliar events, and remember where an attractive object disappeared ten seconds earlier. However, only twenty-four months later, children have diverged permanently from their primate relatives because maturational changes in the brain, informed by experience, have permitted the development of four uniquely human qualities. Children now infer varied thoughts and feelings in others; use a symbolic language with a grammar and semantic categories for events that share no physical features (for example: milk, mother, and pink rabbits); understand the concepts of good, bad, right, and wrong, as well as experience a distinct feeling when they contemplate or violate an acquired prohibition; and become consciously aware of some of their intentions and feelings.[1] I now consider these four functions in more detail.

1

The ability to infer the intentions, evaluations, and feelings of others is evident in an experiment where an adult hides a toy under one of three covers behind a barrier so that the child cannot see where the toy is hidden. If, after removing the barrier, the adult directs her gaze toward the toy's location, two-year-olds, but not one-year-olds, reach in the direction of the adult's gaze, indicating that they assume the adult is looking at the place where the toy rests. Such an inferential ability is necessary for feeling empathy with another. The two-year-old who hears her mother scream in pain as she catches her hand in a closing door associates the scream with her memory of past painful experiences, relates the latter to the perception of distress in the parent, and then announces with her face and posture an empathic concern for the victim. The child may even run to her mother to offer a reassuring embrace.

Although chimpanzees occasionally track the gaze of another animal and appear to be able to infer that another cannot see a piece of food hidden behind a barrier, they do not understand that another animal intends to share information with them. Chimpanzees watching a human adult perform simple actions with a tool and objects focus their attention on the objects rather than the adult's movements, because they fail to infer that the person's manipulations are guided by an intention and a plan. No pair of juvenile or adult chimps would throw a small ball back and forth between them, because they are incapable of appreciating that a partner intends to engage in a reciprocally cooperative act that has no implication for the gaining of food or protection. Every two-year-old child makes this simple assumption automatically.

Humans feel uncertain when they infer that another person might harbor undesirable thoughts about them; chimpanzees feel uncertain when they anticipate actions another animal might direct at them. Doubt over whether another will regard one as dumb, disloyal, or deviant is qualitatively different from doubt over whether another animal is about to attack, dominate, or seize a

1 Jerome Kagan, *The Second Year: The Emergence of Self-Awareness* (Cambridge, Mass.: Harvard University Press, 1981).

piece of fruit. A major event in human evolution was the replacement of a vigilant posture toward the potentially threatening actions of another with worry over the possible opinions of another.

2

Although apes can be taught, with considerable training, to treat pieces of plastic as symbolic of objects, no chimpanzee comes close to the linguistic ability of the average four-year-old who uses language to represent abstract ideas. One four-year-old, on noting that her dresses were closely packed in her closet, said to her mother, "My dresses are friends." The capacity to infer another's intention is exploited in the acquisition of language, for when a parent speaks to the child, the latter assumes the former intends to communicate information about the world. The acquisition of semantic networks permits the invention of symbolic similarities among very different physical events. Chimpanzees and children can detect a crescent shape shared by a slice of lemon and a new moon, but only the latter detect the symbolic features shared by a cookie, a smiling face, a pink sunset, and a curved geometric figure because of words that link these events in a semantic network for the concept 'pleasing.'

The psychologist Ellen Markman has suggested that children begin the learning of language with the advantage of three biologically based biases.[2] The first is the assumption that when an adult speaks a word in the presence of an object, the word probably applies to the whole object. Two-year-olds hearing their parent say "spider" as the latter points to an unfamiliar dark object on top of a sandpile assume that the word refers to the entire insect and not to its location, odd-looking appendages, or the sandpile. (The philosopher Willard van Orman Quine, who failed to acknowledge this bias, wondered what a visitor to a foreign land would conclude about the meaning of an unfamiliar word when he heard a native say "Gavagai" as a rabbit sprinted across the grass.)

A second bias is the assumption that a word probably refers to a category of similar objects, rather than to the specific entity that is perceived. A child who hears the parent say "Look at the squirrel" assumes that all objects with similar features have the same name. The third bias tempts young children to assume initially that each object has only one name. If three-year-olds hear an unfamiliar word (for example, 'goox') in the presence of both a cup and an unfamiliar object, they assume that the word must apply to the latter object. A student baby-sitter reported that our three-year-old daughter was puzzled when the student announced that she was planning to be a mother and a doctor. Fortunately, this third bias is tamed before children enter school.

The universal emergence of language in children with a healthy central nervous system exploits cognitive talents that serve other purposes. These talents include selective attention to adults, detection of low-level correlations between events, sensitivity to physically distinct sounds (for example, the sound 's' at the end of a word to represent the English plural), the assumption that adults speaking to them are trying to communicate information, and, finally, the ability to detect and invent similarities between the concepts that name events as different as a fly and a tree.

2 Ellen Markman, "Constraints on Word Learning," in Megan R. Gunnar and Michael P. Maratsos, eds., *Modularity and Constraints in Language and Cognition* (Hillsdale, N.J.: L. Erlbaum Associates, 1992), 59–102.

Detection of consistency, as well as inconsistency, in the semantic networks that comprise a belief system is a salient human quality. It is not obvious why detection of inconsistency among one's semantic networks evokes a subtle but nonetheless uncomfortable feeling. Members of each language community have learned the transitional probabilities between words in narratives, as well as the differential strengths of associations between and among words. Most Americans expect the word 'ago' to follow 'years,' and respond with 'moon' when asked to report the first word they think of when they hear the word 'sun.' A violation of either probability elicits a distinct brain response and a feeling that psychologists call cognitive dissonance. This may be one reason why magicians in ancient Greece used unfamiliar combinations of words in their incantations. Use of the counterfactual in sentences ("If the sun were to die tomorrow . . . ") mutes the dissonance and allows the person to consider the possible consequences of a low-probability event. It is unlikely that chimpanzees imagine improbable events, although this claim requires more proof.

Some might argue that the uncertainty created by cognitive dissonance is an inherent property of the brain, analogous to the fact that dissonant musical chords produce an evoked potential in the cochlear nucleus that is distinctly different from that produced by consonant chords. The dissonant melodies provoke four-month-old infants to turn away, often with a facial expression of disgust. A second view is that the uncertainty is built on early experiences of seeing that an object cannot be simultaneously big and small, up and down, light and dark, or inside and outside a container. However, this account does not explain why statements that do not contain antonyms also create dissonance (for example, "dogs are vegetables"). No current explanation of this phenomenon is satisfying.

Nonetheless, poets take advantage of this property of mind, for they often use semantic inconsistency to surprise readers in order to achieve an aesthetic effect. Consider, for instance, the following word pairs from the first five lines of T. S. Eliot's poem "The Waste Land": April-cruellest; Lilacs-dead; Memory-desire; Dull-spring; Winter-warm. The final verse of Dylan Thomas's poem "If I Were Tickled by the Rub of Love" contains three perfect examples: Fear-apple; Bad-Spring; Thistle-kiss.

3

Although Enlightenment commentators nominated language as the feature that best separated humans from animals, the ancients thought that morality enjoyed that function. The author(s) of the tree of knowledge allegory in Genesis understood, long before Plato and Hume, that humans are distinguished by an obsessive concern with good and bad events and spend most of each day trying to gather evidence that affirms their membership in the former category.

Every human society has semantic concepts for the ideas of good, bad, right, and wrong, and most humans experience a changed feeling when they contemplate, or commit, a behavior that violates a standard they regard as proper. The anthropologist George Murdock once composed a list of sixty-seven features present in all cultures. Almost half of the features are ethical rules describing activities that ought or ought not to be displayed. "Know thyself" and "Nothing in excess," statements inscribed at the oracle in Delphi, are examples of two of the moral imperatives included in that list.

The argument that moral standards derive from sensory pleasure and the reduction of pain cannot explain why people become angry when they see strangers violate standards they believe are morally proper. Such acts provoke observers to question the correctness of their moral commitments. Because these beliefs are central to each day's decisions, their violation, even by a stranger, threatens the rational foundation of each observer's conduct. No ape would show signs of anger upon seeing an unfamiliar animal take food from another, as long as the victim was not a genetic relative.

The primatologist Frans de Waal tries to persuade readers with anecdotes of chimpanzee behavior that these animals possess rules and punish those who break them.[3] De Waal concedes, however, that he has never seen a guilty chimpanzee. It is unlikely he will ever see one, because guilt requires an agent to know that a voluntary act that could have been suppressed has hurt another. Guilt requires the ability to reflect on a past action that injured another in some way, to realize that the behavior could have been inhibited, and to appreciate that the self was the cause of the ethical violation. Guilt is not a possible state for chimpanzees.

The extensive semantic networks for the concepts of ethical propriety and impropriety have three branches. One refers to the actions that violate community standards for appropriate behaviors that presumably apply to everyone. A second entails the ethical obligations linked to the particular social categories to which one's self belongs (for example, most grandmothers believe they should be affectionate with their grandchildren). The third branch, which emerges by the seventh or eighth year, motivates humans to attain ideal forms. The ability to imagine the perfect parent, scientist, or friend requires a brain/mind that can generate cognitive representations of what might be possible. Apes and humans create representations of experiences that are psychological averages of actual encounters. But only humans possess conceptions of the most perfect form for a particular class of experiences.

Although an understanding of right and wrong and a feeling of uncertainty over violating moral standards are present by the third year, humans require an additional ten to twelve years before they will feel morally obligated to hold a consistent set of ethical beliefs. Adolescents, but not five-year-olds, wonder about their place in society, make plans for the future, and integrate memories of childhood with their current experience in order to understand their life circumstances.

4

An acute consciousness of one's feelings, intentions, and properties is a fourth unique quality of Homo sapiens. The term 'consciousness' probably does not name a unitary phenomenon, because the specific quality of consciousness, and its biological foundations, varies with the nature of the mental activity. Moment-to-moment changes in sensation that originate, for example, in the taste of chocolate or the smell of perfume, and which need not involve language, comprise one category. A special area of prefrontal cortex that receives sensory information represents one of the material bases for this form of consciousness, which we might call sensory awareness.

A second form, awareness of properties, is a consciousness of one's physical

3 Frans de Waal, *Good Natured* (Cambridge, Mass.: Harvard University Press, 1996).

features, beliefs, talents, personality traits, moods, and social categories. The awareness of being politically conservative, Methodist, and shy, for example, requires activation of a part of the cortex different from the circuits activated by the awareness of a toothache. The awareness that one is about to implement or suppress an action, which requires still another brain circuit, is a third form of consciousness. The neuroscientist Michael Gazzaniga believes that a fourth form is the interpretation of one's feelings, perceptions, and actions through the construction of a coherent explanation of the state of consciousness at the moment.

Some might argue that even though these phenomena recruit different brain circuits, they share a common feature and therefore constitute a single process. For example, a common set of hand muscles is used to pick up a cup, brush one's teeth, or sign a check. Those who believe in multiple forms of consciousness would claim that because the profile of brain activity and the subjective state are distinct for each form, it is reasonable to reject the assertion of a single state of awareness. A consciousness of the smell of smoke from a bedroom, of a well-constructed argument, and of the finger movements while playing the piano are easily differentiated, both psychologically and neurobiologically.

Further, the four forms of consciousness may not have evolved at the same time, for they do not emerge simultaneously in the individual. The earliest signs of awareness of sensory events appear in the first year, before children are aware of their symbolic features. It is not until the second birthday that children smile following completion of a difficult task because they are aware of having attained a goal, or lower their head in embarrassment when they cannot reproduce an adult action because they are aware of having violated an adult expectation. By the third birthday, children describe what they are doing as they are doing it because they are aware of their intentions. And by the fourth birthday, children regularly integrate the present moment with their recollections of the past and begin to impose the interpretations that Gazzaniga regards as an essential function of consciousness. Chimpanzees might be aware of the taste of particular fruits, and of the patterns of light and shadow on the forest floor, but it is unlikely they possess forms of consciousness beyond the sensory. No primatologist claims that apes reflect on their age or wonder whether they will be able to control the number of offspring they will bring into the world.

The combination of semantic networks, an appreciation of right and wrong, and conscious awareness of properties of self leads inevitably to categorizations of self that have strong evaluative connotations. All adolescents have learned semantic categories for their gender, family name, and developmental stage. Some add categories for their clan, caste, religion, or region of residence. More important, all are aware of the behaviors appropriate for each of these categories, and feel obligated to maintain semantic consistency between the features that define the category, on the one hand, and their thoughts and behaviors, on the other. Adolescent boys assume they should not wear girls' clothes even if they have never done so, have never been punished for such actions, nor have seen others criticized for this behavior.

The assignment of self to class, ethnic, national, and religious semantic categories has a profound influence on human emotions and behaviors. The writer Michael MacDonald, born to a very poor

Boston family, remembers in a memoir feeling proud of his Irish heritage when his neighborhood resisted the judicial decision to bus school children from South Boston in the service of racial integration. Humans can feel shame, anxiety, or guilt if they think the community regards their family or any one of their social categories as possessing undesirable qualities. Many adults born to Holocaust victims after 1945 carry a burden of guilt or shame because of the horrible atrocities experienced by their parents. Many Americans felt a vicarious shame for their national category when they learned that American soldiers were destroying the homes of innocent Vietnamese.

The moral power of the self's social categories derives from the fact that the child's initial words are for observable objects and events that have stable, essential features. All objects called dogs should bark and have fur; if they do not, they are less than ideal dogs. Thus, when children learn the terms for social categories like 'girl,' 'boy,' 'Palestinian,' or 'Hispanic,' they are prepared to believe that these words, too, name a set of inherent psychological characteristics belonging to those in the category. Children feel obligated to be loyal to the features that define the categories to which they belong, and experience as much cognitive dissonance if they stray from those obligations as they would if they saw an animal without fur that never barked that was called a dog.

There are two types of social categories. Nominal categories, like gender and stage of development, have relatively fixed features and appear early in development. The ethical obligations attached to these categories are not linked to a specific other person and apply across a broad array of contexts. The second class of categories, acquired later, is defined by a particular social relationship between the self and another, and includes the categories 'friend,' 'son,' 'daughter,' 'parent,' 'brother,' and 'sister.' The ethical obligations linked to these categories (usually loyalty, affection, honesty, and nurture) are attached to specific others. The social category 'friend,' for example, applies to a specific peer; hence, the obligations appropriate for one friend might differ from those appropriate for a different playmate. If a friend happens to be cautious much of the time, a child will feel obligated to dominate the dyad; but the same child may feel obliged to display deference to a different friend who likes to be dominating.

Egalitarian societies try to award greater significance to the ethical directives tied to relational categories because nominal ones imply differential status and privilege. In order to derive pride from a relational category, the individual must implement the obligatory actions. Egalitarian societies want their members to feel virtuous because of their achievements or benevolent behaviors toward others, not because they are members of a particular group.

Americans complain about the obvious increase in materialism in our society over the last half century. I suspect that one important reason for the obsession with accumulating clothes, cars, homes, and winter cruises is that the human moral sense requires knowing that some actions, and the symbolic prizes they may lead to, imply that one is more virtuous than another. Meanwhile, our society's desire to honor an egalitarian ethos requires a denial of special privilege to some categories that, in earlier centuries, were more automatic sources of virtue. Nineteenth-century white Christian males whose fathers and grandfathers attended college could

reassure themselves of their virtue by simply reminding themselves of their membership in this quartet of categories. The ethic of egalitarianism, on the other hand, denies the prize of self-satisfaction to any nominal category. Every American must attain his or her daily supply of virtue through personal accomplishments, through perfecting a talent, establishing a relationship, or acquiring status or wealth. Because gaining wealth, which most believe requires effort and talent, seems to be a possibility for most citizens, it has become a primary symbol of virtue in contemporary America. If a person cannot use gender, skin color, ethnicity, family pedigree, or occupation as a sign of worth, one of the few remaining symbols is the accumulation of property. No goal as glittering as equality of dignity can be had without a price.

Humans, in addition, display three abilities that are quantitative enhancements on chimpanzee talents, rather than unique characteristics: humans have a greater capacity to recall the past and imagine the future, to seek novelty, and to separate survival from inclusive fitness.

5

Although apes can remember the past and anticipate the future, humans expand both timelines to distant horizons. Sixty-year-olds can recall their first day at school and can anticipate what might occur two decades in the future when senility is imminent. There is no evidence, at least at present, that chimps sitting quietly on the forest floor can anticipate or recollect events several decades before or after the current moment.

Human adults who hear a seven digit telephone number for the first time can hold it in awareness for as long as thirty seconds in a process called working memory. Chimps possess a working memory, but its capacity is more limited.

The ability to manipulate several ideas simultaneously on the stage of working memory often leads to the detection of novel relations among mental structures or to an insight that reorganizes current understanding. Semantic networks were reshuffled when nineteenth-century readers of Darwin's *Origin of Species* began to entertain the notion that humans probably evolved from a primate ancestor. The automatic reshuffling of old assumptions permits one to avoid the uneasiness that follows recognition of a logical inconsistency in related beliefs.

6

The human attraction to new experiences also expands a primate competence. Chimpanzees seek new fruits to eat, new places to rest, and new mating partners, but humans spend more time than any other animal looking for unfamiliar events that can be comprehended and new skills that can be mastered. No other primate would risk survival, and a curtailment of reproductive fitness, by climbing Mount Everest, parachuting from a plane, or swimming across the English Channel.

The desire for and the ability to adapt to novel conditions is due, in part, to the structure of the human brain. The amygdala, a small, almond-shaped structure with several neuronal clusters tucked inside the temporal lobe, is an important site responsive to unexpected or unfamiliar events. When such experiences occur, excited neurons in the central nucleus of the amygdala send messages to bodily targets that lead to changes in heart rate and body posture. Over the millions of years of evolution from mouse to human, the central nucleus became smaller. As a result, humans are

less likely than chimpanzees to become immobile or to experience a racing heart when they encounter an unfamiliar member of their species. When a mammalian species is domesticated, not only does the central nucleus become smaller, but the snout (nose, mouth, and mandible) becomes flatter because of the actions of genes that control the migration and final functions of a small necklace of cells, called the neural crest, that appears during the first six weeks following conception. The human face is considerably flatter than the face of a chimpanzee.

The suggestion that humans are domesticated apes may strike some readers as absurd, given the daily media announcements of murder, rape, and torture committed within our species. But these cruelties, although horrific, are statistically infrequent anomalies. If one could sit atop Mount Olympus and count the number of acts of kindness, nurture, honesty, cooperation, civility, and affection, as well as the number of hostile, rude, dishonest, aggressive, or violent behaviors that occurred across the world each day, the value of the former would always be larger than that of the latter – a fact that is not true for chimpanzees.

Still, the balance, even for human beings, may be shifting – not because our species is innately vicious, but rather because of the assumption, greatly reinforced in modern societies after the seventeenth century, that one should only pursue individual rather than collective goals.

7

This brings us to a final quality, admittedly more controversial, that distinguishes humans from apes. We are the only species that, during some historical eras, can dissociate survival to reproductive maturity from inclusive fitness. The biological concept of inclusive fitness, a relative property, is defined by the reproductive success of each agent and all her genetic relatives, compared with the success of a related strain or species in the same ecological setting.

Survival to reproductive maturity is usually positively correlated with inclusive fitness in every species. But the invention of inexpensive, effective contraceptives has allowed many human couples to limit the size of their family or, in some cases, to have no children at all. Increasing numbers of European, North American, and Japanese couples are restricting the size of their families in order to gain signs of virtue through personal accomplishment, education, enhanced social status, and new sensory delights. This decision is inconsistent with the biological demand to maximize inclusive fitness. The historical events of the past twenty thousand years created social conditions in economically developed societies that placed the almost conscious desire to regard oneself as virtuous in competition with the silent, unconscious biological urge for inclusive fitness.

The genome of contemporary humans is essentially the same as that of our founding ancestors. But the first modern humans, who appeared between one hundred and one hundred fifty thousand years ago in a warm ecology, and whose social organization consisted of foraging bands of thirty to fifty individuals, many of whom were genetically related, were cooperative with and loyal to their group.[4] Successful adaptation demanded the suppression of excessive competition, selfishness, and self-aggrandizement.

Even though the first humans were perfectly capable of self-interest, un-

4 Peter Bogucki, *The Origins of Human Society* (Walden, Mass.: Blackwell, 1999).

checked displays of this intention would have provoked rejection, exile, or, in some cases, murder. The gradual replacement of resource sharing and suppression of an exuberant celebration of the self with their opposites over the past twenty thousand years required a number of events, but, especially, the receding of the glaciers, which enabled the establishment of agriculture and the growth of cities; and, more recently, distant communication through books, radio, television, and the Internet; inexpensive and efficient forms of transportation and contraception; and the belief, partially a product of science, that an ethic demanding kindness, honesty, and loyalty to non-kin could not be defended, on biological grounds, as having an a priori validity.

In many parts of the industrialized world these events have created a social ambience characterized by geographical and psychological isolation from parents and siblings; awareness of the economic circumstances of millions of strangers in distant places; a larger status differential within and among populations and, therefore, greater uncertainty over one's relative status; decreased likelihood of punishment for disloyalty to one's primary groups; control of fertility; and the legal protection of infants, children, and the elderly with serious physical impediments. These characteristics are inconsistent with the original human tendency to place the vitality and potency of the group ahead of the psychological satisfactions of the individual.

Celebrated novelists, poets, and playwrights are able to articulate the dominant moods within their societies. Contemporary Western writers who enjoy the respect of discerning readers regularly depict loneliness, sadness, cynicism, and lack of loyalty to lover, spouse, child, employer, aging parent, or nation – compare Brontë with Bellow or Beckett. A short story in *The New Yorker* in 2003 describes a loving husband who, having reluctantly agreed to his wife's request to perform euthanasia because of her painful cancer, leaves her bedroom after the act, goes downstairs, and has sex with her best friend. The editors of the magazine would not have published this story if they thought their readers would have found it offensive. I suspect that the editors of a comparable publication in Beijing or Cairo would not have accepted this story.

Even though improved nutrition, potable water, efficient disposal of sewage, and modern medicine have permitted a longevity twice as long as the life span enjoyed by the foragers, survival is only one component of inclusive fitness; the number of healthy offspring is the more important feature. History exploited the competences of self-awareness and a moral sense to allow some humans to dissociate survival from inclusive fitness. Although Adam Smith believed that society would prosper if each individual pursued his own interests first, he was equally certain that each person's natural concern for the opinions of others would effectively restrain unbridled self-interest. Smith could not have imagined, two hundred years after he wrote *The Wealth of Nations*, that large numbers of humans would live in cities with millions of strangers to whom they were indifferent. Few chimpanzees could survive under such conditions.

Most adults must bend their ethics a little to permit the behaviors that the shape of their social structure requires. If they resist, they can become vulnerable to corrosive tensions. A majority of North Americans and Europeans, and especially those who live and work in metropolitan areas, deal with strangers whom they suspect will lie, exploit them,

block access at crowded intersections, and push ahead in long queues. Each individual must rationalize a ready access to anger in order to resist exploitation and to protect property and dignity. Television plays dramatize how easily rage can well up to force otherwise reasonable people to behave in ways they will regret, even though the characters are usually forgiven if their intentions were not irredeemably evil. In order to rationalize the blizzard of cruelty, greed, rudeness, and dishonesty, many have come to believe that it is not always possible, and probably not adaptive, to exert continuous control over anger, cupidity, rivalry, and jealousy. Belief in this rationalization mutes guilt and dilutes a sense of personal responsibility for harshly competitive attitudes that might hurt another. I suspect that the television series *The Sopranos* owes its popularity to the fact that most viewers will feel morally arrogant because they are less mean than the members of the Soprano family.

The belief that anger, self-interest, and competitiveness should not be suppressed because they are natural emotions has advantages in a society where a large number of strangers must compete for a small number of positions of dignity, status, and economic security. Under these conditions, it seems rational to be self-interested, and irrational to be too cooperative, too loyal, or too altruistic.

A rash of books published over the last twenty years claims that unconflicted selfishness is to be expected given our evolutionary history.[5] After pointing to examples of self-interest in many animal species, these books imply that because this motive is present throughout nature, humans need not feel ashamed of their narcissism. However, anyone with a modest knowledge of animal behavior and minimal inferential skill could find examples of animal behavior that support almost any ethical message. Those who wish to sanctify marriage can point to the pair-bonding of gibbons; those who think infidelity is more natural can nominate chimpanzees. If one believes that people are naturally sociable, cite baboons; if one thinks humans are solitary, focus on orangutans. If one wants mothers to care for their infants, rhesus monkeys are the model; if one prefers the father to be the primary caretaker, point to titi monkeys. If one is certain that men should dominate harems of beautiful women, cite elephant seals; if one believes women should be in positions of dominance, describe elephants. Nature has enough diversity to fit almost any ethical taste.

Humans are selfish and generous, aloof and empathic, hateful and loving, dishonest and honest, disloyal and loyal, cruel and kind, arrogant and humble; but most feel a little guilt over an excessive display of the first member of each of these seven pairs. This feeling is uncomfortable, and we are eager to have it ameliorated. Confession or psychotherapy is effective for some, and it is likely that many adults feel better when they read that their less social urges are natural consequences of their phylogenetic history. The currently high status of the biological sciences has made it possible for students of evolution to serve as therapists to the community.

The psychological differences between the first humans and contemporary members of our species are sufficiently dramatic to motivate a curiosity over whether the current motive hierarchy of the latter group is a biologically prepared propensity that has a natural

5 David P. Barash, *Whisperings Within* (London: Penguin, 1979).

priority, or one demanded by the special conditions history has created.

Most young monkeys in natural settings play with other monkeys. But rhesus monkey infants that have been taken from their mother early in life and placed with an inanimate wire object will sit crouched in a corner of a cage away from their peers.[6] The capacity to crouch alone in a corner is inherent in the rhesus monkey genome, but actualization of that profile requires very unusual and unnatural conditions. Thus, it is relevant to wonder whether the current prevalence of unconflicted self-interest in many industrialized societies, like the rhesus monkey's solitary crouched posture, must overcome a biologically stronger urge to be a loyal, cooperative, and trusting member of a stable group that provides protection from external threat.

Most species that violate their salient natural propensities risk a loss in inclusive fitness. A warning may be hiding in this biological fact.

6 Harry F. Harlow and Margaret K. Harlow, "Social Deprivation in Monkeys," *Scientific American* 207 (1962): 136 – 146.

Matt Ridley

The DNA behind human nature: gene expression and the role of experience

The idiosyncrasies of one person cannot be human nature, nor can a feature of human behavior that is merely typical of many animals, such as hunger. Human nature must be the product of a uniquely human, but near species-universal, combination of DNA sequences suitably refracted through typically human environmental experiences.

Those sequences do not have to be only genes. Indeed, recent evidence suggests that regulatory sequences, rather than coding sequences, may be the best place to search for 'human nature DNA.' As Steven Pinker has pointed out, it is a historical accident, and the source of much confusion, that genes are equated with the genome by lay people but strictly defined as protein-coding regions by molecular biologists.

Right up until the sequencing of the human genome, a piece of conventional wisdom was confidently repeated as truth by scientists, journalists, and commentators: there were a hundred thousand genes in the human genome, about half of which were unique to the brain. So widely was this 'fact' disseminated that it is hard now to discern its original source.[1] But it was about as wrong as a scientific assertion can be. We now know that human beings have approximately twenty-five thousand genes (humiliatingly, that is fifteen thousand less than a rice plant has); that most are expressed in both the brain and the body; and that very few indeed, perhaps none, are unique to the human species. Not only do mice also have twenty-five thousand genes, but they have essentially the same twenty-five thousand.

Yet mice are not men. Something must be different. The sequencing of genomes has suggested a new hypothesis: that animal evolution usually works not by inventing new protein-coding genes (this appears to be commoner in plants), but by altering the timing, intensity, and location of the expression of preexisting

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1 See, for example, J. Madeleine Nash, "Fertile Minds," *Time* 149 (5) (3 February 1997): "There are only 100,000 genes in human DNA. Even though half these genes – some 50,000 – appear to be dedicated to constructing and maintaining the nervous system."

genes.[2] For instance, the Hoxc8 gene essentially tells a developing fetus where to grow a thorax with ribs. Hoxc8 is turned on farther back in a chicken than in a mouse, giving a chicken a longer neck. It is turned on throughout the body of a python, which is almost all thorax. Yet it is essentially the same gene: equivalent Hox genes can be swapped between animal species and still work. Somewhere in each species' DNA are sequences that cause slightly different tissue-specific expression of Hoxc8.[3]

A literary analogy is helpful. Any two novels, say, *David Copperfield* and *The Catcher in the Rye*, are written using roughly the same set of words. Some words appear in one but not the other – 'caul' and 'pettish' appear in Dickens; 'crap' and 'elevator' appear in Salinger – but they are very few. The difference between the books' plots lies in the order and pattern of the words, not in the words themselves. The difference between a man and a mouse lies in the order and pattern of gene expression. And that difference is achieved by variations in the regulatory sequences of the genome (hereafter referred to as promoters), of which more shortly.

In this context, the genes that lie behind human nature are universal to mammals, possibly to all animals, but the pattern and timing of their expression during normal development results in typical human behavior. This has an unexpected bonus for scientists interested in human nature. It means that the discovery of a gene's function in an animal will almost certainly lead directly to the discovery of the same gene's function in a human being. As our knowledge of the genes that affect behavior is deepened by experiments in mice, as well as in dogs and other species with behaviorally distinct breeds, that knowledge will quickly and inevitably improve our understanding of human behavior, too. Of course, there will be differences, but discovering these differences will itself be both easy and instructive.

Likewise, the source of genetic variability in human nature among individual people will be found mainly in sequence differences that affect gene expression. It has been known since the work of Jacques Monod and François Jacob in the late 1950s that a gene is expressed, or transcribed into messenger RNA, by the binding of a protein called a transcription factor to a promoter, a special sequence of bases usually found immediately upstream of the gene itself. Furthermore, a gene may be switched off by the binding of another protein to another sequence nearby. In some cases, more than one protein must bind to the DNA before a gene is expressed, and the regulatory sequences may be spread out over long stretches of DNA – even longer than the gene itself. For example, the 'eve' gene in fruit flies, whose job is to control other genes during development, is switched on at least ten separate times during development, and it has eight separate regulatory sequences attached to it, three upstream of the gene and five downstream. Each of these sequences requires ten to fifteen proteins to attach to it to switch on expression of the eve gene, and together they cover thousands of letters of DNA text. In different tis-

2 Sean B. Carroll, "Endless Forms: The Evolution of Gene Regulation and Morphological Diversity," *Cell* 101 (6) (2000): 577 – 580.

3 Heinz-Georg Belting, Cooduvalli S. Shashikant, and Frank H. Ruddle, "Modification of Expression and Cis-Regulation of Hoxc8 in the Evolution of Diverged Axial Morphology," *Proceedings of the National Academy of Sciences* 95 (5) (1998): 2355 – 2360; Martin J. Cohn and Cheryll Tickle, "Developmental Basis of Limblessness and Axial Patterning in Snakes," *Nature* 399 (1999): 474 – 479.

sues, different promoters and enhancers (distant or downstream switches) are often used to express the gene.[4]

This implies that many, perhaps most, of the interesting differences between a human being and a mouse, or between one human being and another, will be found in the sequence of bases in promoters, rather than in protein-coding genes. Intriguingly, this hypothesis opens the door for cultural and environmental influence, because the efficient binding of transcription factors, and therefore the expression of genes, can in some cases be altered by factors extrinsic to the organism – by, in a word, experience. Steroid hormones, for example, once they have formed a complex with their receptors, act as transcription factors, activating or suppressing the expression of genes. So elevation of cortisol – following the sensory detection of a stressful experience – can alter gene expression, particularly in the immune system. It indirectly reduces expression of Interleukin-2 and turns down the activity, number, and life span of lymphocytes.[5]

Even more strikingly, it is now clear that a genetic mechanism underlies the very un-hereditary process of forming new memories by associative learning. Such learning in flies, mice, and people consists mainly of changes in the expression of CREB genes in response to experience. These changes result in shifts in the strength of particular synaptic connections between neurons – and these shifts are the manifestation of new memories. It is clearly misleading to call the CREB gene a determinant of human nature, because what it determines depends on what the organism experiences, and yet it is human nature to have a responsive CREB gene that enables us to learn.[6]

The twenty-five thousand genes in a mammalian genome, played like a great piano by their many thousand promoters, and probably able to express at least three times as many proteins through alternative splicing, are amply capable of encoding a subtle and complex human nature throughout the tissues of a hundred-trillion-cell body, even without supposing a role for experience. There is no reason to assume that the 'higher' and more peculiarly human faculties such as intelligence, language, and social empathy are less influenced by genes than are features we normally think of as more primitive, such as aggression or hunger.

Here follow three genes that distinguish human beings from other animals, not by their existence, but by their sequence – in either the coding or the regulatory region – and by their pattern of expression. The first bears on intelligence, the second on language learning, the third on pair-bond formation – all 'higher' human faculties.

The first gene concerns the place where human anatomy meets human nature: brain structure. Having an unusually large brain for its body size is characteristic of the human being. If the gene expression theory is correct, this feature should result from the differential expression or activity of a gene or genes in human beings. One candidate gene is already known, thanks to the study by Geoffrey Woods and colleagues

4 Mark Ptashne and Alexander Gann, *Genes and Signals* (Cold Spring Harbor, N.Y.: Cold Spring Harbor Laboratory Press, 2002).

5 Paul R. Martin, *The Sickening Mind: Brain, Behaviour, Immunity and Disease* (London: HarperCollins, 1997).

6 Josh Dubnau and Tim Tully, "Gene Discovery in Drosophila: New Insights for Learning and Memory," *Annual Review of Neuroscience* 21 (1998): 407 – 444.

of inherited microcephaly in a group of inbreeding Kashmiri immigrants in Bradford, England. Microcephaly is the development of a small but otherwise normal brain.

Four separate mutations in the same gene were found to be one cause of the condition. The gene, first isolated in drosophila, is called ASPM, for abnormal spindle protein. Found on chromosome 1, it is a gene that varies considerably in length between species, producing a protein that is 1,186 amino acids long in nematode worms; 1,861 in fruit flies; 3,123 in mice; and 3,477 in human beings. This elongation is caused mainly by extra repetitions of a 75-base-pair calmodulin-binding motif, which is repeated seventy-four times in human beings, sixty-one in mice, twenty-four in flies, and twice in nematodes. (The motif, by a happy accident, is called the IQ motif, after the first two letters of its amino acid sequence, isoleucine and glutamine.) It appears that the longer the protein, the more effective it is at assisting mitosis in neuronal stem cells in the developing brain. Since stem cells multiply only for a set period during development, faster mitosis will yield more neurons and a bigger brain.[7]

ASPM is not in itself sufficient to explain the expansion in human brain size over the past five million years, because all higher primates have approximately the same number of IQ repeats in the gene.[8] The gene may have altered to make primates brainier than other mammals, but not to make human beings brainier than other primates. The search for the source of that difference has now turned to other genes affecting brain size. Yet the ASPM story serves as a strong reminder of just how simple it might be for a species to acquire an increased brain size merely by lengthening one gene with extra copies of a motif. In this case, the change is not in a promoter but in the gene itself, resulting in a more active protein from a longer gene.

The second gene affecting higher human function concerns language. Human beings are not just chimpanzees with bigger brains; they also have qualitatively different natures. Some differences of degree between human beings and all other mammals are so wide that they qualify as differences in kind. One such is language. The human capacity for learning languages shows all the hallmarks of an instinct underpinned by genes: it emerges unbidden and shows universal similarities in all people.

Once again, the study of people with linguistic defects has led to insights into which genes are especially important in differentiating human language skills from other primates' communication talents. By examining an extended family in which speech and language deficits are plainly inherited as a dominant allele, Simon Fisher and Cecilia Lai found a candidate gene, called FOXP2, on chromosome 7.[9] Other cases now confirm that lack of a functional form of FOXP2 seems to impair learning that uses sensory feedback to alter the circuitry in the brain to lay down new sequences of

7 Jacquelyn Bond, Emma Roberts, Ganesh H. Mochida, Daniel J. Hampshire, Sheila Scott, Jonathan M. Askham, Kelly Springell, Meera Mahadevan, Yanick J. Crow, Alexander F. Markham, Christopher A. Walsh, and C. Geoffrey Woods, "ASPM Is a Major Determinant of Cerebral Cortical Size," *Nature Genetics* 32 (2) (2002): 316–320.

8 C. Geoffrey Woods, personal communication, March 2004.

9 Cecilia S. L. Lai, Simon E. Fisher, et al., "A Forkhead-Domain Gene is Mutated in a Severe Speech and Language Disorder," *Nature* 413 (2001): 519–523.

orofacial gestures and new memories thereof.

How might FOXP2 do this? Fox, or forkhead box, genes are transcription factors whose job seems to be to activate or repress transcription of other genes. They are universal to animals and fungi. In mammals, which have at least forty Fox genes, FOXP2 shows remarkably little variation between species. Of 136 nucleotide substitutions in the gene between chimpanzee and mouse, only one alters the amino acid sequence of the protein; the rest are synonymous. Since the common human-chimp ancestor, however, there have been two amino-acid-altering changes, making the human FOXP2 protein stand out from all other mammal versions so far studied. And all but a very few human beings have identical versions of FOXP2.[10]

Moreover, a study by Svante Pääbo and colleagues of the number and pattern of silent substitutions in noncoding DNA nearby seems to show that the two mutations were involved in a selective sweep about two hundred thousand years ago, during which they elbowed aside all other versions of the gene, presumably as a result of natural selection. This date is intriguing because it does not predate by much the Upper Paleolithic Revolution in Africa and, therefore, possibly the beginning of symbolic communication and modern language, according to physical anthropologists. After a million years of technological stasis, there was sudden and cumulative cultural change – new tools, artifacts, pigments, trade – some time before one hundred thirty thousand years ago, the time when long-distance trade was definitely established.[11] Some small band of African human beings apparently took over the world starting at this time, and we are all their descendants.

Of course, there is no direct evidence that FOXP2 was anything other than a fortunate bystander at this revolution, and even if it did play a role, it has plenty of other functions in the body besides facilitating language – it is expressed in the lung, for example. But it is also expressed during early development in those parts of the brain crucial to speech. People with mutated FOXP2 genes show under-activation of Broca's speech area when engaged in linguistic tasks, implying that some deficiency in the structure of that part of the brain resulted from that mutation.[12]

Birds have a FoxP2 gene that is surprisingly similar to that of mammals, given the evolutionary distance between the two classes, which suggests extreme conservation or convergent evolution.[13] This gene (and another, FoxP1) is expressed especially strongly in male songbirds in the striatal nucleus known as Area X – part of the 'song circuit.' For instance, expression here rises during the period when young zebra finches learn their songs and during the season when adult canary songs become unsta-

10 Wolfgang Enard, Molly Przeworski, Simon E. Fisher, Cecilia S. L. Lai, Victor Wiebe, Takashi Kitano, Anthony P. Monaco, and Svante Pääbo, "Molecular Evolution of FOXP2, a Gene Involved in Speech and Language," *Nature* 418 (2002): 869 – 872.

11 Sally McBrearty and Alison S. Brooks, "The Revolution That Wasn't: A New Interpretation of the Origin of Modern Human Behaviour," *Journal of Human Evolution* 39 (2000): 453 – 563.

12 Gary F. Marcus and Simon E. Fisher, "FOXP2 in Focus: What Can Genes Tell Us About Speech and Language?" *Trends in Cognitive Sciences* 7 (2003): 257 – 262.

13 Note that the current convention is to express the names of human genes in uppercase letters, mouse genes in lowercase letters, and bird genes in a mixture of the two. This absurd system cannot last.

ble. Both these results hint that FoxP2 expression is somehow vital to the laying down of new vocal procedures in birds' brains.[14]

Assuming human FOXP2 does alter the development of Broca's area in such a way as to facilitate the learning of language, there is an obvious problem. The first human being with a modern FOXP2, somewhere in Africa two hundred thousand years ago, would have been in the same fix as Victor of Aveyron, Kaspar Hauser of Nuremberg, or Genie of Los Angeles – children reared largely in isolation from spoken language until their teens and who thus missed the critical period when the brain is most open to language learning. He or she would have developed little of his or her full linguistic potential. However, once there were several children with the new gene, a sort of bootstrapping might have been possible as they practiced their language skills among themselves; something similar happened in Nicaragua in 1979 when deaf children were suddenly brought together in one school and spontaneously developed their own Creole sign language. Then each generation would have added to the complexity, and within a few generations this chattering group of people would have been capable of feats of planning and organization foreign to their fellow human beings.

I repeat: it is highly implausible that changes in FOXP2 alone made language possible. Rather, it was probably one of many genetic changes that helped improve the emerging communication skills of proto-people. But the principle, that species-wide changes in single genes can affect 'higher' behavioral traits in predictable ways, is well supported.

The third gene that affects a human trait concerns love. One way in which human beings differ markedly from their closest evolutionary relatives, the chimp and the bonobo, is in habitually forming long-term pair bonds. These are so intrinsic to human nature that they form even in libertarian communes that expressly try to outlaw them. Of course not all human beings form long-term or exclusive pair bonds, but human beings show all the hallmarks of a long-bonding species: sexual jealousy, paternal care, sexual division of labor, etc. Chimpanzees and bonobos, on the other hand, maintain only brief pair bonds that do not last longer than the estrus period of the female, if that.[15]

In this respect, human beings resemble prairie voles and chimpanzees resemble montane voles, two equally closely related species that also differ in mating systems. The control of pair-bonding in voles is now well understood. In both sexes in both species of vole, sexual intercourse stimulates the release of the small peptide hormones oxytocin and vasopressin in the brain. Injecting the hormones into the brain brings on pairing behavior in prairie voles but not in montane voles. Increasing the expression of the receptor genes also makes prairie voles quicker to form pair bonds.[16]

14 Sebastian Haesler, Kazuhiro Wada, A. Nshdejan, Edward E. Morrisey, Thierry Lints, Eric D. Jarvis, and Constance Scharff, "FoxP2 Expression in Avian Vocal Learners and Non-Learners," *Journal of Neuroscience* 24 (2004): 3164 – 3175.

15 Matt Ridley, *The Red Queen: Sex and the Evolution of Human Nature* (New York: Penguin, 1995).

16 Expressing the prairie-vole version of the gene in a mouse markedly increases its social-affiliation behavior. See Thomas R. Insel and Larry J. Young, "The Neurobiology of Attachment," *Nature Reviews in Neuroscience* 2 (2001): 129 – 136.

Receptors for these hormones are distributed differently in the brains of the two species. In prairie voles, the receptors are found in the nucleus acumbens (oxytocin) and the ventral pallidum (vasopressin). These brain areas contain a dopamine system that is responsible for addictive behavior. A prairie vole therefore becomes 'socially addicted' to its mate following sex. A montane vole does not. Likewise, when human beings who are in love are asked to contemplate a picture of their beloved, the area of the brain that is active is a dopamine region implicated in cocaine addiction.[17]

The different distribution of the receptors is in turn caused by the presence (in prairie voles) or absence (in montane voles) of a long segment of highly repetitive DNA text in the promoter upstream of the gene. Inserting this text into the promoter of a promiscuous vole species essentially monogamizes the rodent.[18] Human beings also have a repetitive segment in this region, though it is shorter than that in prairie voles. As of this writing, the equivalent region of the chimpanzee genome has not yet been looked at. I predict it will be shorter than the human one.

These three cases illustrate very graphically that it is possible to isolate genes that have disproportionate influence on behavior, and to do so in features relevant to 'higher' human nature, such as intelligence, language, and love. In the 1960s, the idea of finding 'behavior genes' at all would have been astonishing, not to say heretical, but people such as Benson Ginsburg working with mice and Seymour Benzer with flies soon established that behavioral mutants could be produced just as easily as anatomical mutants. The unexpected similarity of human and animal genomes has now made it possible to study in other species the evolution of genes relevant to human intelligence, language, and love. The development of behavior, in other words, proves to be just as amenable to genetic reductionism as anatomy and physiology.

Human nature, however, is not identical in all people, and much of that diversity in behavior is a consequence of the fact that we are not clones. Studies of identical and fraternal twins raised apart, but in similar social settings, have unambiguously revealed that different people have different personalities largely because they have different genes, rather than because they have different upbringings. However, these studies, which prove so powerful in showing the influence of genes, have been largely incapable of shedding light on precisely which genes influence personality. From the other end of the telescope, however, genetic differences among individuals are emerging that correlate with differences in how people behave. The haystack is revealing its first few needles.

One example is the gene on chromosome 11 for a protein called brain-derived neurotrophic factor (BDNF). The gene spells out the recipe for a protein that acts as a sort of fertilizer in the brain, encouraging the growth of neurons, and that probably does much else besides. In most people, the 192nd letter in the gene is G, but in about one-quarter of people it is A. This causes a slightly different protein to be built – with methionine instead of valine at the 66th

17 Andreas Bartels and Semir Zeki, "The Neural Basis of Romantic Love," *NeuroReport* 11 (2000): 3829 – 3834.

18 Miranda M. Lim, Zuoxin Wang, Daniel E. Olazabal, Xianghui Ren, Ernest F. Terwilliger, and Larry J. Young, "Enhanced Partner Preference in a Promiscuous Species by Manipulating the Expression of a Single Gene," *Nature* 429 (6993) (2004): 754 – 757.

(out of 247) codon. Since everybody has two copies of each gene, there are three kinds of people in the world: those with two methionines in their BDNFs, those with two valines, and those with one of each. Personality questionnaires reveal that, at least in one population, the met-mets are noticeably less neurotic than the val-mets, who are in turn noticeably less neurotic than the val-vals.[19]

However, this kind of single-nucleotide polymorphism (SNP), while frequently found to cause rare hereditary diseases, is proving to be the exception rather than the rule in the study of normal human variation. It is much commoner to find a polymorphism that consists of different lengths of sequences of promoters upstream of genes. To return to the vasopressin receptor gene, for instance, it appears that the repetitive box in the promoter is highly variable in length in wild prairie voles. Its length ranges from 350 to 550 base pairs in a typical sample of the rodents. Likewise, in a sample of 150 human beings, there were seventeen different lengths of the equivalent box next to the same gene. It is perhaps too simplistic, and possibly unethical, to ask if those people with longer boxes generally form more lasting pair bonds. But note that divorce rates show surprisingly high heritability in studies of twins raised apart.[20]

Meanwhile, the study of twins shows that the same upbringing does not necessarily produce similar personalities in two different people, whereas the same genome often does. A possible explanation of this surprising result is that genes do not decide personality directly, but they do decide how an individual will respond to a particular upbringing. Hard evidence for this hypothesis is now beginning to accumulate. Perhaps the best example is the study of childhood maltreatment and genotype in a New Zealand cohort.

In a study of 442 young men from Dunedin born in the year 1972 – 1973, Terrie Moffitt and her colleagues found evidence that an abusive upbringing does predispose a boy to later antisocial behavior (including getting into trouble with the law), but much more strongly if the boy has a particular genotype: a low-activity version of the monoamine oxidase A gene on the X chromosome. In the promoter upstream of the gene there is a 30-base pair phrase repeated three, three and a half, four, or five times. Those genes with three or five repeats are much less active than those with three and a half or four repeats. About one-third of men have low-activity versions of the gene (women, having two X chromosomes, present a more complicated picture). The low-activity allele itself does not appear to cause antisocial behavior, nor does childhood maltreatment alone, but together they have a marked effect.[21]

The correlation between parental abuse and antisocial behavior in the Dunedin study cannot be assumed to be causal. It may be that another undiscovered gene causes both the abuse and the antisocial behavior in combination with

19 Srijan Sen, Randolph M. Nesse, Scott F. Stoltenberg, Sheng Li, Lillian Gleiberman, Aravinda Chakravarti, Alan B. Weder, and Margit Burmeister, "A BDNF Coding Variant Is Associated with the NEO Personality Inventory Domain Neuroticism, a Risk Factor for Depression," *Neuropsychopharmacology* 28 (2003): 397 – 401.

20 Judith Rich Harris, *The Nurture Assumption: Why Children Turn Out the Way They Do* (London: Bloomsbury, 1998).

21 Avshalom Caspi, Joseph McClay, Terrie E. Moffitt, Jonathan Mill, Judy Martin, Ian W. Craig, Alan Taylor, and Richie Poulton, "Role of Genotype in the Cycle of Violence in Maltreated Children," *Science* 297 (2002): 851 – 854.

the low-activity MAO-A gene. A long history of fallacious assumption teaches us to be cautious before presuming that parents cause effects in children by their actions rather than by passing on genes.[22]

This precaution, however, does not apply to a similar result in another gene. Again using the Dunedin cohort, Moffitt found that a functional polymorphism in the promoter region of the serotonin transporter (5-HTT) gene affects the way people react to stressful life events. Stressful life events are less likely than abusive treatment to be even indirectly caused by genes. People with one or two copies of the short allele of the 5-HTT promoter showed more symptoms of depression following at least three stressful life events than people with two copies of the long allele.[23]

Considering that genes influence depression by altering people's ability to cope with life events, can anybody doubt that the genes that influence personality and intelligence work this way – that they are genes for responding differentially to experience? A person with high intelligence is a person whose genes enable him to react efficiently to the experience of learning. A person with an athletic talent is one whose genes enable her to respond easily to practice and training.

Notice, in passing, how important the length of, rather than the sequence of, a promoter often proves to be. This is a general principle that is emerging from many studies of gene function. The diversity in the human population is starting to be explained at least as much by variations in the number of repeats of a genetic phrase in the regulatory region of the gene as by single-nucleotide polymorphisms. The phrase may be two or three letters long (as in the case of the vasopressin receptor), twenty-two letters long (5-HTT serotonin transporter gene), thirty letters long (monoamine oxidase gene), or seventy-five letters long (ASPM gene). Varying the number of repeats of a phrase has a much subtler effect on gene function than does changing a single nucleotide in a codon, which tends to shut the gene down. It seems to be the principal way in which natural selection alters the intensity, and perhaps the pattern, of gene expression. Nor is this phenomenon confined to the regulatory regions of the genome. At least six neurological diseases are now known to be caused by excessively long polyglutamine runs – most notably Huntington's disease, whose severity depends on the number of repeats of a three-letter phrase (CAG) in the gene for the huntingtin protein.

Precisely how does a gene open the organism to experience? A nice example of how, paradoxically, the capacity for nurture can be genetically programmed comes from features that show critical, or sensitive, periods in development. There are many features of animal and human behavior that are sensitive to environmental influences only during a limited period in youth. Language learning is one. Filial imprinting in birds is another. The best-studied case, however, is that of ocular dominance, or the sorting of cells in layer 4c of the visual cortex into those that take their signal from the right eye and those that take it from the left. Ocular dominance emerges in response to experience soon after a mam-

22 Harris, *The Nurture Assumption*.

23 Avshalom Caspi, Karen Sugden, Terrie E. Moffitt, Alan Taylor, Ian W. Craig, HonaLee Harrington, Joseph McClay, Jonathan Mill, Judy Martin, Antony Braithwaite, and Richie Poulton, "Influence of Life Stress on Depression: Moderation by a Polymorphism in the 5-HTT Gene," *Science* 301 (2003): 291 – 293.

mal's eyes first open and is thereafter irreversible. Experiments have revealed that the gene for a protein called GAD65 must be switched on for the sorting to occur, and that another protein, BDNF, brings the sorting to an end. Genetically modified mice with no GAD65 gene never enter the critical period; those with overactive BDNF genes close down the critical period prematurely.[24]

Both genes regulate the activity of GABA, a neurotransmitter that has also been shown to be vital to filial imprinting in chicks. This finding hints at a general genetic mechanism, based in GABA-ergic neurons, for opening the organism's brain to calibration by experience during a narrow window in infancy. If individuals' critical periods differ in length or openness, this may be because they differ in sequences of promoters attached to GABA-related genes. These variations, in turn, would produce a different pattern of learning in different individuals. Thus, even the acquired differences between people in skills and interests might be partly caused by sequence differences at promoter sites. A good tennis player is the product of much practice, but the ability to benefit from practice could prove to be innate. Nurture, in that sense, is a form of nature.

There was an old joke, first told by Jane Gitschier, that we would one day be able to find out where on the Y chromosome lie the male tendencies to flip between channels on the television, to sit on the john reading, and to be incapable of expressing affection over the telephone (the ME-2 gene). It was a joke that exposed not only the absurdity of men, but also the absurdity of specific genes for specific behaviors – the old Daltonian, particulate, 'blueprint' model of a genome, in which one gene corresponds to one attribute of behavior. Genes are not, of course, like that. As Pat Bateson has argued, they act more like recipes than blueprints. Attributes of an organism no more map directly to single genes than pieces of a cake map directly to lines in a recipe: they are the product of a transaction between many genes and the environment in which they find themselves.

Nonetheless, it was widely assumed in the heyday of the blank slate in the 1950s – 1970s that specifically behavioral mutations would not be found, and that therefore behavior would remain a P2C2E (a process too complicated to explain), at least in genetic terms. The studies of twins raised apart, and the discoveries of DNA sequence changes that cause predictable changes in behavior, even in 'higher' behavior, demolish this assumption. The magnitude of that paradigm shift has yet to dawn on many social and even biological scientists.

A different hypothesis is needed if we are to reconcile the evident fact that there is an innate human nature with the equally evident feeling that experience molds individual lives. That hypothesis, I suggest, must hold that human nature is specified in species-typical DNA sequences, that many of those sequences determine the expression rather than the protein product of genes, and that the expression of many of these sequences is actually 'designed' (by natural selection) to be affected or calibrated by expected kinds of environmental experience.

24 Z. Josh Huang, Alfredo Kirkwood, Tommaso Pizzorusso, Vittorio Porciatti, Bernardo Morales, Mark F. Bear, Lamberto Maffei, and Susumu Tonegawa, "BDNF Regulates the Maturation of Inhibition and the Critical Period of Plasticity in Mouse Visual Cortex," *Cell* 98 (1999): 739 – 755; Michela Fagiolini and Takao K. Hensch, "Inhibitory Threshold for Critical-Period Activation in Primary Visual Cortex," *Nature* 404 (2000): 183 – 186.

Poem by Geoffrey Hill

Improvisations for Hart Crane

Thou canst read nothing except through appetite.

1

Super-ego crash-meshed idiot-savant.
And what háve you.
This has to be the show-stopper. Stay put.
Slumming for rum and rumba, dumb Rimbaud,
he the sortilegist, visionary on parole,
floor-walker watching space, the candy man,
artiste of neon, traffic's orator,
gaunt cantilevers engined by the dawn
of prophecy. A sight to see itself:
he, swinger with the saints in mission belfries,
broken and randy zooming on the toll,
love-death by elocution a close thing.
Publish his name, exile's remittancer,
prodigal who reclaimed us brought to book.

2

The Stars-and-Stripes looks best when it's unfurled
stiff as a board on a declaiming wind
under a cobalt sky; the National
Guard at stand-to, half-cock weaponry;
the Chief's advisers, unsexed white and black,
good with binoculars and shown to be so;
their photo-faces lit with simple purpose,
their public selves the sanctum, the arcane;
their privacy the clamor of events;
the keys of war bestowed like a small heirloom
of sentimental value to the clan.
Poets are unstable, least to be trusted
with scripts of grand arraignment. All in all
you screwed us, Hart, you and your zany epic.

3

Unwise these thoughts high-spanned. A shade too much
Library of America, liberty
safe on the list, shiny-electric-gated,
noble its new-old mansions. Heave him in
bounced for some lethal kind of bunkum test,
my self-accusing bard: naked bacardi
and sailors. Straight sex mothered him
all the while he threw up. I'm yours, I said,
reckless, twizzling the ever-fuzzy dial
to get Roosevelt. Admit, though, we had plunged
before that first term, faithful old depression
working us all the way. What derelicts
we must have been, ripped off by infancy.
Thou canst grasp nothing except through appetite.

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Fiction by Victor LaValle

I left my heart in Skaftafell

He was meek, homicidal, wore a long scarf tied once around his neck as must have been the style for trolls that year. I never saw him board the bus, but it may have been in Varmahlid, though I can't be sure since I slept so much in Iceland.

I was there at summer's end, meaning August. Most folks in their twenties had already scamped cross-country in July so I found myself with the elderly wanderers. On trails I passed couples catching breath and rubbing each other's knees through waterproof pants. The Germans regarded me with tacky detachment, snubbing me while wearing bright red boots and brighter orange parkas. I tried not to feel hurt by their disdain, told myself it was like being expelled from clown college, but you can guess how much it really bothered me.

Also, I had the amazing misfortune of sitting behind French people on every plane and bus. Minutes into a ride a pair, woman and man, brazenly checked that yes there was, certifiably, undeniably, someone sitting behind them, then slid their chairs so far back I had a headrest against my gullet. This happened so much. Even when I asked, slapped, tapped, or pushed their seats they only gave that stare the French invented to paralyze the dumb.

Luckily the Icelanders liked me, even with being an American, because I was shy. Firm, polite, and quiet, a perfect personality for these reserved Northern Europeans. Many times I was told so. – Don't take this the wrong way, one girl in a candy shop said to me, but I explained to my coworker that here, finally, is an American who isn't boring. Being loud and asking so many boring questions!

Most Icelanders used English skillfully, but it was a quirk of speech that they said boring when they meant frustrating. Like, – This knot in my shoe is so boring! Or, – I can't reach my girlfriend, this connection is boring!

I heard it like that many times.

So this was me: an American, not boring, black, and alone in Iceland.

Being both a troll and a smoker he had little lousy teeth. When his mouth opened it was hard to distinguish them from his lips. Everything fed into a gen-

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eral maw. Once, he lit up right on the bus just as we left Akureyri so the driver stopped, walked down the aisle, and explained that those were the old ways and he could no longer smoke everywhere he pleased. Many places yes, but not here. I sat farther back, but we all heard the warning. There were thirty-one of us riding the bus, mostly couples. No one else was going alone, but me and the monster.

I'd describe myself as a nosy person because I can't turn away when someone gets in trouble. There's a level of decorum I can't manage so I, but not only I, watched the troll stub his cigarette out, though he tried to smoke again after we'd seen a waterfall called Godafoss, Waterfall of the Gods. So named because it was the site where Iceland's ruling chief tossed all their pagan idols when Christianity became the religion of the land one thousand years ago.

After that second cigarette flared, the driver, one big farm bastard, almost choked the troll, but the little one worked a humble, fawny apology. His plea, spoken in English, didn't affect me, but our driver relented. I was disappointed because now the driver didn't seem like a grown man. Big and strong, but what's it worth without a backbone?

By the way, this whole time, let's not talk about the Africans. They had no allegiance to me of course. Why should they? The white folks weren't hugging each other in Caucasian familyhood – still, fuck those Africans, and I mean that from the bottom of my pockets. In Reykjavik I went whiplash trying to get a little love from any one of them. Not even the faintest soul-brother nod. May they all enjoy another hundred years of despotic rule.

When I say troll it probably implies a smaller size. We hear troll and think dwarf, but out here trolls were enormous according to reports. In a town called Vik there are three spires said to be trolls who were caught in sunlight and transformed to stone as they tried to drag a three-masted ship ashore. They're six stories high.

My troll was man-sized. He wore one beige sweater the whole time though he paid his checks from a fold of green and purple bills kept tied in a big red handkerchief. Wherever I got off, he got off. I'd see him walking around towns at night, moving with a predatory hunch, hands in his pockets and holding out the sides of his jacket as he moved so that when a wind got in there the fabric expanded and he grew wings.

I didn't come to Iceland to fuck white women nor to spin in the flash nights of Reykjavik. As far as fashion, what did I have on Europeans? People my age whose every kronur, lira, pound, franc had been deposited into some great shell-toed Adidas account. Only a Japanese college student was going to outdo those kids.

Iceland was my destination because there was nowhere else to go. The rest of the world was only getting hotter and, much to the shame of my sub-Saharan ancestors, warm weather was a torment to me.

Once there I paid a little over two hundred dollars for a one-way bus ticket around the island (excluding the western fjords). Get off in any town you want, explore, be both gawked at and ignored, then get on the next bus the next day to the next place. I couldn't pronounce any of the names so I'd point to one on my ticket, let the new bus driver say it aloud and then repeat it so that I'd sound well versed. Of course, the guy never cared if I was saying it correctly. But I did.

Not long before coming to Iceland I stopped wanting marriage. Not only

with the woman I loved, but the rest of them too. While it's true that each family is unhappy in its own way, every married person's affair is monotonous and plain. At least according to me. I had friends who'd participated in a few, read about many, and the impression I had was that the wedding band makes you a member of one great dull secret society. I hated the men my friends turned into. Relentlessly horny for any woman besides their wives, angry at their wives for having just one pussy. I decided I'd rather be alone than unhappy. Despite the change of mind, it was me feeling all sad and longing for my ex. She'd recovered by making herself busy.

I felt so sexy over there. I felt sexy everywhere, actually. My signature had carnal appeal. Also the way I wore my wool hat with the earflaps tied around the bottom of my chin. Sexy. I'm not being self-deprecating in the slightest. Despite this feeling, I hadn't been to bed with a woman since my breakup, so I felt like a light socket hidden behind the bookshelf.

That was probably best though. Nothing worse than meeting a new woman when you're still organizing your heartache about the last one and instead of dating this new lady she's just keeping you company. What I hate are those folks who can't spend time alone in a room. They seem so weak. But of course that's exactly the kind of guy I am so the only way to get isolated was to run far, far away.

The problem with a trip like mine, and the reason I didn't full-nelson the troll on the first day he followed me, is that I kept seeing the same people in different towns. There was a stumpy Italian couple that I must have greeted eighteen times in four days. There was a woman from who-can-say-where who became as uncomfortable around me as I eventually did around the troll. She and I just kept picking the same lifeless churches to visit, the same damn coffeehouses, until I must have seemed to own a map of her future engagements. I was constantly, accidentally, trailing her.

She had a lovely awkward smile because her teeth were concave. It was endearing to me, but by the twentieth encounter either she or I would always cross the street. Whenever I entered a rest stop and found her there I became flustered and took my meal outside. Having gone through that made me sympathetic, so the troll got an untold number of rides sitting in a seat near me because I wanted to be fair, to be fair.

I hoped for a few good days. Iceland was only dark four hours a night, so in the other twenty why not expect a few minutes of brightness? At Lake Myvatn I camped in a long cooled lava pool under a constant drizzle and, occasionally, downpours. The rain let up only when there was a forceful, misty wind.

I forgot the troll. I was by Lake Myvatn four days and never saw him. Rented a bike to go around the lake and, at one point, found fields of lava that had cooled into grotesque stacks.

Enormous columns of petrified ash two stories high. There were little holes dug into them that resembled shelves, up near the top, where, purportedly, goblins slept. That's the story.

When I walked into these endless fields they seemed to twist behind me. It was confusing, but not frightening. I imagined myself wandering forward until I found the Liege of the Goblins reclining on a throne made of sheep skulls.

I liked Iceland because they still had myths on their minds. Not that you'd find anyone under forty who'd admit to believing in goblins, yet even the most

skeptical refused to say so very loudly in a public place. After all, they might be listening. I needed to be around superstitious people, having recently become superstitious myself.

As I got back on the bus, after four days, the troll was there. I imagined he'd been sleeping in the hood of my jacket this whole time.

When I saw him I tried to remember that beautiful woman with her concave smile. The troll was probably only doing his own gamboling through the country. Why be paranoid? But then he looked up, turned backward and stared right at me until I turned away.

I wrote a postcard to the woman I'd almost married. In the note I described the guy, but then decided not to mail her the card because I'd been so damn sure I wanted to be single, yet at my time of fear whom did I automatically turn to?

Since the troll sat ahead of me the driver reached him first to check tickets and ask for a destination.

– Breiddalsvik, the troll croaked.

His voice was even sleazier than his appearance. The way he whispered the name it sounded like he was about to crawl up the inside of the driver's leg and bite him in the thigh.

– Djupivogur, I told the driver breezily.

When we reached his stop the troll had changed his mind.

– Not here, not yet.

Our bus wove through sharp mountains. Big basalt cliffs with little plant life on them because winds eroded them too quickly to grow much. Sheep and cows grazed in the meager fields.

Djupivogur. Fishing village of four hundred. Four hundred and thirty-one once the bus parked.

Couples disembarked. I took my pack from below the bus. The troll took his single hefty black bag. It was a good size, but not enough to carry camping gear, sleeping bag, change of clothes, toiletries. Big enough to hold a human head, I thought; by now my thoughts were getting macabre.

The only hotel in town was beside a tiny harbor. Two rowboats were anchored nose to nose in the water, thirty feet from me. There were other boats, a more modern fleet, moored in tidy rows at the other end of the harbor, three hundred feet farther. Of the twelve vessels there, ten wouldn't fit more than four people. The last two were big, for tours to the island of Papey, famous for its puffins. The clumsy little birds with adorable faces and multicolored bills were the reason I'd stopped here. I wanted to eat one.

I let the troll register first because I kept making this mistake of thinking that if I caught him in a lie it would be enough to stop his plans. I'd confront him, yell: You said you were getting off in Breiddalsvik, but you got off in Djupivogur! And he'd buckle under the weight of my keen observation. He'd screech, then disappear back into the realm of haints and phantoms.

– For one night, he said to the young girl behind the desk.

– A room? she asked.

– Oh no. My sleeping bag will do.

English wasn't his first language, that was clear, still he didn't stammer between each word as a novice would. His hard consonants had no sharp edges. Instead of 'bag' it was 'bay.' Not 'sleeping,' but 'sleppen.' But I understood him.

I was on that same plan. Iceland was expensive, even here in the outer reaches. A single room was sixty dollars and wouldn't be much better than a homeless shelter. Sleeping bag accommodations, a tiny cubicle with a flat cot and a shared bathroom, cost only twenty.

Fiction by Victor LaValle

My room was 8 and the troll's was 9. When I went to the front desk later, alone and unwatched, to switch, the clerk told me the rest of the rooms had been reserved by a team of Norsemen off hulking around an unpronounceable mountain. Climbing it with their bare hands, probably. I was relieved. A hall of Vikings was enough company for me to feel safe, even if I was directly next door to the fiend.

But they never came. The next day I asked the teenager at the desk, the same clerk, where they'd gone. She told me they'd slipped away. A towrope gave out in their climb and they cascaded into a pyre of bones, flares, and ice axes.

I went back to my room to sleep away the rest of the morning, listening for the sound of the troll packing up and leaving. From his room I heard throat clearing and much coughing. He'd hack so hard I swear I heard the wet tear of his trachea. Rolling around his bed he bumped the wall, he kicked the wall, then back to coughing. I didn't go out to the communal toilet. Just peed in the room's small sink. Fell asleep.

When I woke up it was 2 p.m. The day was pleasant, overcast, and gray. I wanted a baloney sandwich. Deli meats were all I could get. Actually, there was smoked lamb but the taste was like having someone empty a full ashtray on my tongue. You'd think there'd be mass varieties of fish delicacies, plentiful as blintzes in Borough Park, but they must have been exporting the marine life and keeping not a fin for themselves.

I sat around in my plain white room and did fifty push-ups just to make myself move. Seventy-five sit-ups to get my stomach working.

After buying a ham sandwich and two small packets of orange juice at the only convenience store in Djupivigor I came back to my hotel, sat at a small desk under a picture window that looked out at the tiny harbor.

In the communal bathroom the troll was shaving at the sink. I was actually feeling terrible right then. Too lonely for fear, I soldiered over to the troll, stood three feet away, and said, – Hey look. Are you following me?

– Yes.

What kind of boar's hair was he growing? I wondered as I listened to his razor run across his neck and below the chin. It wasn't some disposable either. An enormous contraption. It wasn't electric. Actually it looked like one of those settler-era plows. With a pair of lurid blades that formed the two upright sides of an acute triangle. As it pulled across his pinkish skin the sound was a crackling fire.

– I'm not going to play dicks with you, I explained. If that's what you're about.

– No, he agreed and very firmly. He slapped the side of the sink once.

He seemed so offended by the idea that it threw me into a state of juvenile confusion.

– So what are you doing? I asked him this straightforwardly, but my voice had all the man knocked out of it.

– I'm going to kill you, he said. There was still shaving cream on the right side of his face. Then I'm going to eat your flesh and put your bones into my soup.

– You really are?

– I am.

– So you're a cannibal?

He stopped shaving, but didn't turn to me. I looked at him though he only looked at my reflection in the bathroom mirror. – How can I be a cannibal when we are not the same species?

I stumbled into the men's toilet. It was where my feet directed me. My room would've been more sensible, but I went to the shitter instead. It had a full door

so that I was on the inside and, at least nominally, safe from him.

He went on shaving that prickly neck for fifteen minutes longer. Out of fright I had to pee, but was too scared to pull down my pants. The sound of metal on skin went for so long that I thought he must be regrowing the hair he'd just cut.

My hirsute pursuer eventually ran water in the sink and after that he came to the toilet door. He knocked as if I was just going to open up for him. – Hello, he said. Hello?

I pressed my hands against the cool, blue concrete walls on either side of me. If he bashed through the door I was going to press myself up and kick him straight in the teeth and then do a backflip out the tiny window behind me.

– Why be so afraid? he whispered. I could tear this door down, but I don't want to be boorish. My name is Gorroon. I can smell your blood from here.

Because of Gorroon I never saw the puffins. I rolled my sleeping bag, deflated my air mattress, changed my clothes, and turned in the key. The teenage girl at the desk was sad when I told her I was going. She really wanted me to see Papey.

I asked her to have lunch with me, but she said she couldn't so I went out to that deli, bought another ham sandwich and orange juice, and came back to her. She accepted half the meal. I leaned against the reception counter.

– Have you been to Papey?

– I haven't, she admitted. But I've seen many puffins.

She had a dimpled, wide face and couldn't have been more than seventeen so she was safe with me. I've never been attracted to younger women. Forty-five minutes until the bus arrived. I would've played jacks with children just to have company during the wait. As she and I talked I leaned with my back to the desk lest Gorroon rush the office with a paring knife and surprise me.

The girl's work schedule was seven days a week, eight hours each day. When I commiserated she corrected me. – I like it so much, she told me. What else would I do today? My husband is at home without a job.

– You're married?

There was gold on the ring finger of her right hand, but you'd be excused for missing it. The metal was whiter than her skin, thin as thread.

– Does everyone here get married young?

– No, no. A lot of women have children and raise them alone. The father might live nearby, but not in the same home.

– We've tried that in the U.S., I said.

– And what did you find?

– The boys all grow up to be crybabies.

She laughed. – How boring that must be!

The bus arrived. A white one with many blue stars painted across the body. I stayed at the desk with the girl, who had finished her half of the sandwich and then taken much of mine. She even drank my orange juice, but I didn't care. The girl let me pay my bill and offered the receipt, which I declined.

– There's still time to stay and see Papey, she offered.

Considering that I was being chased by a brute I could have read her insistence as providence. Protection by an unseen force. Except that this had been happening to me for the whole trip. Icelandic people who really wanted me to see every part of their country. More so, I think, because I was a black American. They all hated the weather, but loved their land.

As a souvenir I gave her my pen.

She looked at it, but was too kind to sneer. As soon as it was between her fingers I understood how silly I'd been. I mean, it was a blue pen. They cost about eighty cents. The cap was chewed.

– It's very nice, she decided.

I laughed so then she laughed. Me with humiliation and her with relief that I wasn't going to press her for a kiss.

– Let me take it back.

The girl put my pen in her pocket.

– Nay, she said, which was the way they said no sometimes. It's mine now.

– Do your people really believe in elves and all that? I asked her.

I wanted her to both confirm and deny the idea. Sometimes I placed so much weight on random conversations. You can't help but occasionally wish there was a thing like destiny, it's why I can't stop reading my horoscope. As if fate was always trying to reach us, if only we would listen. At that moment I expected some teenager to tell me, definitively, what I should believe.

– If you ever see one then you will have faith in it and if you never do then you won't. It is the same here like it is anywhere. And both sides will never accept each other.

The bus driver grumbled into the hotel lobby to ask if there were any passengers to board. She nodded. – These two.

The ride from Djupivogur to Skaftafell was three hours. I tried to write another postcard to my ex, but there was an unsteadiness to the roads that showed up in my penmanship. It made even a standard greeting look panicked.

We moved from the mountainous surroundings that I'd taken for granted into these ongoing fields of long-cooled lava. Evidence, on either side of the national highway, of an eruption that took place six hundred forty years before. Old things here. The fields weren't barren, but growing bright green, mossy puffy tufts that made me want to roll around on them.

We stopped at the lake called Jokulsarlon where the farthest end of a glacier had crumbled into colored hunks of ice. Even these fragments were three and four stories tall. Some blue, others white. This glacier had been moving, incrementally, for centuries, dragging across the land; the ice was packed with brown and black earth in varied zigzag patterns. Our bus parked for pictures. I was one of the first shooting from the shoreline.

There was a mound that we climbed to get new perspectives. Twenty feet up, the lake seemed smaller, if only because the glacier was in full view. These dinky chunks were overshadowed by the endless gray sheet of the glacier, which led far back toward the mountains in the distance and right up over them. The glacier had frozen right over them. It seemed unlikely the mountains could ever struggle free.

My hands were cold (this was summer, remember) because I hadn't brought gloves. I stopped taking photos to rub my hands together, march around in a circle. In August it was usually fifty degrees, but this close to the ice fields the temperature dropped way down.

Gorroon stayed by the bus.

I wondered if he was afraid of the cold, or of getting too close to the glacier. How do you defeat a troll? Put salt on his tongue? Make him say his name backwards? If I knew a trick I would have used it.

Instead I watched him lean against the bus, right beside the bus driver. He didn't even have to stare back at me. We were past aggression and now I just understood that he was going to grab me. Women know the feeling I'm talking about.

Back on the bus we rode for another forty minutes until we reached a tiny white sign welcoming us to Skaftafell National Park. There wasn't much to it. One building, a parking lot, campgrounds, and a mountain.

I rented a tent, but didn't know how to use it. My whole life I'd been sleeping in apartments. Buildings manufactured by sweaty immigrants. I didn't understand an iota about driving little posts into the ground. When I camped out in Myvatn the tents were already pitched.

While other people raised their nylon homes in fifteen minutes it took me that long to read the instructions. I kept hoping a sympathetic pair would offer to help me, but once their tents were up the travelers went directly to the hills.

On my knees I counted every stake, stake loop, and fiberglass segmented pole. Snapped elastic strainers and tugged the guy lines. When I tried to thread the poles through the tent loops they kept coming apart in the middle until I learned to slide them in with the tent flat on the ground. It started to rain, but it rained every day.

I went back to the tent rental station and complained that I'd been given the wrong tent poles. I needed the curved models. The guy at the desk wouldn't even look at me.

After half an hour I figured out that those tent poles bend. It became much easier after that.

Once I got both poles in, the frame popped up naturally. From there it was an easy prospect to drive in the stakes on one side, then the front, then the rear. Only when I tried to push them in on the last side did I notice the enormous stones in the ground.

Then I had to take the structure down and replay each step at a location about ten feet away. When it was done I plucked at the top of the tent to see if it was stable. No matter how I tugged or flicked, the green tent didn't move. I proudly snapped pictures of it from every angle.

– Took you long enough, said a man walking back with his wife. I'd seen them pitch theirs in seven minutes. They'd been up the mountain and back by now.

French.

With the sun up twenty hours a day there was still a lot of time to climb. I started moving at 4 p.m. Rain stopped, daylight was vivid. Foreign languages sounded profound around me.

At the far end of the campground there was a well-established path that slipped onto the hill, and once I was on it the land, the people behind me, dissolved. Buses in the parking lot, children calling to parents. Instantly there was only me.

I listened to my pants. I wore slacks that swished. They kept me company. Counting my pace not by how far I'd come, but by the tempo of my khakis.

These trails weren't even steep, it's just that they went on for so long. I took pictures of a waterfall called Hundafoss, another, Magnusarfoss, then Svartifoss, and after that I'd had quite e-damn-nuff of cascading water.

Past the range of waterfalls the ground lost most of its grass. Just dirt and stones. Mostly stones. Walking on them made my ankles hurt. Another forty minutes and the pain reached my knees.

When I turned around I could see, far below me – even beyond the campgrounds – a hundred little streams, runoff, faint melt from the glaciers behind this mountain that bled out to the sea. They crossed each other playfully. Then I saw the troll walking toward me. Using a cane.

Fiction by Victor LaValle

His beard had grown in. Down to his collarbone. His scarf was tied below it. He didn't wear a hat. The stick was small, but store-bought, redwood. He waved to me. He didn't hurry. I turned toward the peak and went up that way. If I could have run, I would have run, but my legs were aching.

I didn't even come to Iceland for anything. Iceland came to me out of a dream. Not one of my paranoid racism dreams that, my being black, occur about once every twenty-eight days. There are a few versions, most of them forgettable.

But one night it was different. I'm transported to the future. Still in New York. I'm by the water. Sort of. The Gowanus Canal. Around me thousands of black people wear yellow rain slickers because the day is overcast. We have boats. Or rather, boats are docked. Catamarans actually. Those cruiser types used for whale-watching tours. A hundred of them taxi up against the docks in Red Hook.

Black people climb on the catamarans to capacity. Once full, the boats go out to New York Harbor and from there, the sea. Those of us on the shore cheer and those on the ships excitedly wave. No one carries suitcases, but I know that we're leaving. Not being deported. Forget that. Choosing to go.

And where are we off to? Iceland. All the black folks in the United States are taking to Iceland because no one lives there anyway. This was a dream, remember. So finally I get on a catamaran. Stay out on deck even though it begins to rain. The engine is so powerful that I feel the vibration up through my shoes, strong enough to shake me.

The drawbridges have been lifted, not so much for clearance, but to wave goodbye. As our boat pulls off we pass the garbage transfer stations and old warehouses that have yet to be refurbished. They're slagged apart, walls falling, broke down and decrepit. I can see into each one as we go by. I'm overjoyed. We all are. Imagine that, a happy story about black people.

As we seek larger bodies of water our boat passes a warehouse ramshackle as the last ten, but this one's full of gold. Not gold, but honey.

In jars and bowls. Two hundred clear containers. Honey spread sticky across the wooden floorboards. Yellow candles are lit and flickering. I hear the wind against the side of my face. Rain slaps my temples, but I am warm. It feels like we are making a break from all accumulated human history to be brand new.

Gold coins are gathered into piles two feet high and just as far across. I want to sit inside that warehouse, but know the heat would kill me. Seeing it from the catamaran is close enough to dry my mouth out. Yellow fabric is strung up on the walls. Yellow fabric, tied into enormous bows, sits in the puddles of honey. It is majestic and reassuring. A send-off, not a sayonara.

I saw it. The boats were going to Iceland, and I couldn't have felt better.

Almost at the top of this mountain, called Kristinartindar, Gorroon fell farther and farther back. Maybe he was heavier than he looked. My own thighs were boiling from the exertion. I was nearly jogging to the top.

There were actually two peaks. You ascend either one and from those points see the southwestern end of the country. But I couldn't look backward. I went around the peaks instead, on the well-marked trail. Passing no one. A ribbon of clouds descended over me. I stopped to watch it happen. A gray mist came down from the gray sky until it touched the

highest peak of the mountain. Then it descended. Consuming the earth, quietly.

I crouched to keep clear, but the cloud overwhelmed me. Then I was inside. I expected to cough, but there was no real effect except that the trail behind me was obscured. There was still the trail ahead. Around the rounded curve of Kristinartindar I came to view the glacier. Skaftafellsjokull.

I wasn't near it; the ice was still miles away, but I saw it clearly. Sunlight reflected against ice particles in the air, surrounding the glacier with pixie dust. I took pictures and waited for Gorroon. The view was pure mesmerism so I couldn't actually leave. It wasn't the troll that had captured me, it was the country.

Gorroon's beard had grown since I'd seen him an hour ago. Now it was at his navel. He stooped deeply as he walked, resembled the old Chinese women at the Canal Street train station. I always wanted to protect their fragile spines from injury; scoop them up in my hands, and carry them to a room full of cushions. For an instant I felt the same affection toward the troll.

Our breathing was different because his was loud.

– Not used to the climbs? I actually taunted the thing.

His cane had a blue stone imbedded in the handle, which he rubbed with his fat, yellowed thumb.

He admitted, – I'm having a hard time with this part. I really didn't expect you to go all the way up.

I took off my small backpack. The larger one was at the camp, in my tent. I'd brought a bag of nuts and two packets of orange juice. I drank one packet and had a few handfuls of cashews before Gorroon could breath normally again. Instead of waiting I should have sprinted some more, but at that moment I felt, oddly, safe. It was all that sunlight on the snow: I stood in a dreamy field of gold. If you can't trust in a prophetic dream then nothing will ever soothe you.

Once he'd recovered, the troll stopped seeming like a fool. As soon as he could stand straight he was next to me. I didn't even feel the movement. Like water trickles through a closed hand. From ten feet away he'd seemed like an old man without the sauce to catch a cab. Now I could see his mouth quite clearly.

His teeth were tiny; splintered, bone fragments. I didn't think he'd be able to chew through my arm, but shred the meat instead.

– Hello again, he said.

He bent down. I thought it was a bow. Instead he grabbed my left leg and pulled it from under me so that I fell backward, landing in the stones and snow.

Wow. He had small hands, but a strong grip. One hand on my left ankle, one on my left knee. I struggled, but it was a cursory movement. Just to say I tried. He pulled my knee toward him and pushed my ankle the other way. The pressure was instant, amazing.

I looked down, thinking: will my knee pop out of the skin? Will my ankle turn to splinters? Gorroon patiently insisted that my lower leg snap.

My left hand moved into his long hair.

I hadn't meant to do it. I wasn't thinking, just fighting.

The stuff on his head rivaled his beard for length. It wasn't as greasy as it looked. It cracked in my hands. I grasped closer to the scalp until I found a patch that wasn't brittle. My leg bled down onto my left shoe. He ignored my efforts and continued to press.

Once I had a tight grip I leaned back so all my weight was pulling at his skull. His skin tore away from his scalp, but the

only sound was when he started panting. Had I hurt him?

The mountains, the glacier, they were waiting for an answer. Who do we get?

– You can't have it, I told Gorroon, but he wasn't listening. I don't think I even understood what I meant. There was blood on my shoe, yes, but there was blood in my left hand as well. His blood.

My right hand went for his beard and the left was doing so well that I decided not to intervene. My body knew what it was doing. You might even call my determination happiness. He'd take my leg, but I would steal his face.

As my right hand came near his whiskers Goroon opened his mouth. I thought I was far enough away that he couldn't bite, but he had a jaw like a shark's and the teeth sort of popped past the lips to reach me. The outer edge of my hand was there for him to rip so he tore into the flesh and then pulled backward, peeling the skin and taking some meat. My right pinky curled down on itself and wouldn't straighten though I still had feeling in the rest of that hand.

I thought maybe I should just roll and take us both over the precipice, but the point wasn't to kill him, it was that I should live. I refused to die. If I had to I'd stay here with him, on our backs, for fifty thousand years. Locked in place until our bodies calcified, until we became another landmark, one more folktale.

My leg wouldn't break. It was obvious from the troll's consternation. He might have liked to scare me by appearing nonchalant, but when he attempted a laugh it made his shoulders buckle. It easily could have turned into a cry.

Meanwhile my grip had locked onto his scalp, all nine of my usable fingers pulling there. Who knew I was such a wonderful stubborn bastard? In my experience there seemed to be only two kinds of men: brooders and brats. I'd come all this way to discover there was a third. My fatigued brain was commanding my hands to release, relent, surrender but, bravely, they refused.

Charles Altieri

on difficulty in contemporary American poetry

Experimental poetry has fallen on hard times. Poetry that makes its difficulty a basic means to accomplishing its ends seems now mostly a throwback, a fantasy that the excitements of modernist art can continue into the present. It also faces charges of privileging artistic complexity over political obligation, of championing ambivalence over conviction. And, finally, it is often difficult to see the point of difficulty in poetry: isn't the aim to give pleasure and thereby enhance life? So I sometimes wonder whether my commitment to difficult poetry is merely the elitism of an aging critic who mistrusts the simpler pleasures. But then often when I do take considerable pleasure in a poem that is not provocatively difficult, that pleasure turns quickly to guilt, to a feeling that I am betraying allegiances and succumbing to seductions that oversimplify the intricacies of experience.

Partially to convince myself, I want to trace such an event where pleasure turned to guilt and I was forced to recognize by contrast why I persist in these possibly ridiculous commitments. This is a poem that I found quite moving, C. D. Wright's "Utopia" from *String Light* (1991):

Inside of me
there are no cathedrals
even in the vaulted halls
where you thought you would come upon
some providential soul
letting go a cage of doves
there are only vaulted halls.

Inside of me
there is a period of mud,
flies and midges come with the mud
followed by a time of intense sun;
with the sun comes a cool room
furnished by a rotating fan, a typing
machine.
While there is the sun I type then I walk
often for long stretches
in search of hidden springs, curative herbs
or not in search of a blessed thing.

Inside of me
a stranger rubs its knees
against the palings of my ribs
someone who may be born to fail,
a drifter hunched over a cinder block
pitching rock at mounds of garbage,
someone who may catch and tear
like a plastic bag in a fence.

Charles Altieri, a Fellow of the American Academy since 2003, is professor of English at the University of California, Berkeley. His books include "Painterly Abstraction in Modernist American Poetry: The Contemporaneity of Modernism" (1989), "Postmodernisms Now" (1998), and "The Particulars of Rapture: An Aesthetics of the Affects" (2003). *Permission to reprint "Utopia" was granted by C. D. Wright and the University of Georgia and Copper Canyon Presses; permission to reprint "No More Boffins" was granted by Joshua Clover.*

Note by Charles Altieri

But beyond this zone
of tire heaps and oil drums
a clearing entertains one tree;
where you thought you would come upon
blades of steel light or where
you thought the doves would collect
themselves
there is only enough soil enough blood
and seed good enough for one tree.

Wright explores many styles, often far more experimental. But I have chosen this poem because I identify with it despite myself, and because I think the appeal to identification is elegantly and seductively handled.

The poem's leisurely pacing sets up the sense of surprise one experiences at the suddenly pointed and parsimonious ending. Three anaphoric stanzas elaborate a single governing metaphor: the speaker's inner self is available for a guided tour. First there is the thwarted possibility that the vaulted halls "inside of me" betoken a cathedral, or even constitute an adequate setting for a soul to engage in religious ceremony. It turns out that these vaulted halls are only empty signs of what could host a spiritual life but does not.

The second stanza seems spiritually less bleak, because there the poem arrives at a better adjustment to powers of agency that the speaker might actually possess and find appropriate for the material conditions provided. These conditions, however, are so distinct from the world of religious expectation that now the presence of an agent disappoints as much as its absence had in the previous stanza. Then in the third stanza the anaphoric structure arrives at someone "inside of me" who may be the poet's demonic other, someone at home in the sense of failure that pervades the poem.

The poem's concluding stanza in effect pushes further inward, to a clearing beyond the zones possessed by demonic others. This clearing contains the realm of utopian possibility, the inner garden. But this is a late-twentieth-century garden, where "there is only enough soil enough blood / and seed good enough for one tree." Why only one tree? Why the insistence on blood as the means of nourishing this tree? And why repeat "enough" three times, as if the repetition were also its own denial, since more than one "enough" can only call the assertion into question. Does the poem suggest that this single tree indicates a willful loneliness excluding the person addressed, or does it gesture toward inclusion? I want to say both. Then the repeated "enough"s would register the uneasy difficulty of both desiring to share the soil and recognizing that this may be a limit case where sharing would be destructive.

I admire the poem largely because this ending refuses clear answers to such questions while managing at the same time not to rest in indeterminacy. The point is not that language fails but that language succeeds by bringing us to a sense of its inherent limitations. The speaker has arrived at a clearing that yields an intimacy and a sense of the specificity of one's own being that beggar description. And in this clearing what playful metaphor has created yields to something else – to the convincing presence of a self who can assert a self-sufficiency won out of facing disappointment.

Now that I have shown why the poem gives me pleasure, I have to ask if the pleasure is a sufficient compensation for my years of learning from the avant-garde to distrust the theatrical way the poem manipulates emotions. Much as I admire the poem's self-confident pacing, I have to admit there is a luxuriating in the domain of metaphoric possibility that is deeply at odds with the bare sense

of sufficiency celebrated by the ending – a luxuriating that seems to bring the poem dangerously close to the self-indulgent portentousness that constitutes one common strand in contemporary lyricism. Of course the poem presents a good deal of irony in relation to its quest to understand the conditions of its own saying – but it does not subject the promise of an inner principle of identity to that irony. Nor does the poem register its species of inwardness as a now anachronistic model of subjectivity, nor does it make any effort to explore alternative locales for selfhood – for example, in qualities of sensation or habits built on ways of engaging social relations.

Yet the poem is beautiful (consider just the vowel music in the second stanza with its elaborate harmony of long *o* and *i* sounds). And the portentousness works because the spare concluding stanza defines so dramatic a contrast with the utopian possibilities raised by the anaphoric rhetoric in the rest of the poem. I cannot not acknowledge this beauty, nor my increasing sense that this suffices for what poetry can offer social life. And yet there is in this very seductiveness proof that the avant-garde spirit from Eliot on has its own crucial social role to play in challenging the ease of identification produced by elegant rhetoric. That modernist spirit wants poetry to take on other roles – to insist that beauty is not enough precisely because it can be so seductive. To fall for beauty is to ignore how much we need the imagination to devise models of the self and of intimacy that make identification problematic and that test other resources for elaborating utopian social relations.

Now consider Joshua Clover's "No More Boffins," not by any means his best poem, but one that I can handle here. This poem is utterly different in pacing, preferring constant impersonal ironic motion to Wright's elaborate focusing. In the place of inwardness, Clover seeks a different locus for subjectivity based on resistance to lyrical and social conventions. Rather than projecting this inwardness for the subject, Clover makes poetry a site where the subject has to experience the strange impersonal or transpersonal dependencies that bind us to our cultural moment:

> We were drinking gin and tonics on the terrace when the midi skirt
> Came back into style. At this time movies were extremely popular
> Although no more than usual, after which many people stopped in
> At the Liberty Equality Fraternity Café for ice cream,
> The ice cream of novel thoughts. Everyone was wearing
> Those sunglasses everyone's wearing. Just a few felicities
> Make a movement, the kind that should really have its own comic book
> Exploring the great issues of the age but still with boffo action
> And a speaking part for the lightbulb.
> And so the crowd promenaded, lacking a manifesto,
> Yet to have condemned the passésists or started the exclusions,
> Scarcely aware they were (in the words of Archigram –
> Clever boys, give them their own terrace immediately!)
> A moment-village. They goeth abroad in the land.
> How long have we been discussing whether we are a part
> Of what passes by, and at what point did that become
> The main conversation, replacing the summer, our cadastral survey
> Of its many crowded quarters, its tuned suburbs and departments,
> Its way of being a different sort of parade,

Note by Charles Altieri

The kind which can be conveniently
depicted with a spectrum?
Paint samples from Jane's Hardware will
do in a pinch.
Already the fete is erasing itself from the
popular memory
Like exploding instructions, leaving
stained confetti as a reminder
You were supposed to get something done.
Little tasks,
Large problems, philosophers say: Who
will do the laundry
Now that history is coming to an end?
What advantage
Would someone have over me who knew a
direct route
From blue to yellow, far from this shady
way-station
Where we dream aimlessly of love in the
afternoon,
The post-historical kind? However big
you grow in my estimation,
You will always be a dwarf compared to
these buildings,
Their skins glassy and inviting as that lake
just to the west
Of wherever we grew up, you remember,
Something Lake.
The information lurks in the shoals in
forms by now
Almost unrecognizable. Now if only you
could dive sideways.
When is the real holiday, the one for
which everyone gets a sharp haircut,
Cruel atonal singing seeps from the crypt
and the meaning of objects
Is once again up for grabs? Even bricks
were once straw.

The poem begins by quickly surveying several social locales; in effect the poem wants to know what kinds of information might sustain and give substance to its own desire to speak as and for the first-person plural. Clearly this world is too dispersed to allow an "I" to emerge, except in the form of a lamentation for all that it cannot possess of its own social conditioning. But even its "we" comes to our attention as states of consciousness where the festive flow of possible identifications has no anchor, no site where examination and judgment can take hold. And the possibility of a manifesto to give meaning to this flow is quickly dismissed, because the movement that would pen it is only a "moment-village," united not by ideas but by these proliferating processes.

Lines 15 and 16 – "How long have we been discussing whether we are a part / Of what passes by" – thicken the poem's obsession with information, with how one comes to terms with all the ways one registers oneself part of a world – or, in our post-Stevensian climate, parts of worlds. Notice how the lines intricately place time elements against space elements so that geography and history pull against each other. Each dimension is necessary for grasping the "Now," but each involves different kinds of measurements, and each demands different kinds of self-consciousness. Positioned in time, we have to work our way through narrative forms; positioned in space, we find the movement conditioned by the many crowded quarters through which the parade passes. No wonder the poem is driven to surreal notions of how depiction might take place.

The sense of festival made us attend to our social place. But as that sense explodes, the feeling of sociality takes on content primarily as a set of questions that comes to structure the poem. And two interesting aspects of the social come to the fore. First, second- and first-person pronouns now enter the poem because the issue of person is inseparable from these questions about what kind of place the individual might have in working out the consequences of the initial attention to festival. Second, the

speaking presence seems increasingly locked into the postures Clover takes as basic to capitalist society. On the one hand, insecurity reigns because there is fear of being disadvantaged in relation to others; on the other hand, there is the temptation to cultivate one's private being apart from all social relations.

I am not sure how to read the last section, or whether it is best to treat the rest of the poem as a single unit. But I think the difficulty is not a problem with the poem but a problem for the poem – given the situation that has been depicted. Trapped by what we might call the historical geography shaping cultural identities, the speaking presence wobbles between a tentative, unrealizable lyricism addressed to the "you," and an unbearably clear awareness that the facts sustain an order of information more capacious and more determining than the positioned intellect has the resources to grasp. When the speaking presence tries to be expansive about the "you," it is instantly forced to recognize how pathetic the human seems in relation to the buildings that frame the scene. But, good interpellated subject that it is, the speaking presence also lets its fascination with the buildings provide a lyrical hope of reconciliation with the environment. Still, the terms of reconciliation depend on the fantasy that the glass of those buildings will dissolve into the waters of an idealized lake visited in childhood.

The impossibility of that action produces the urgent direct wish for the real holiday, only to bring into the present the sounds of an atonal operatic funeral procession. Dreaming and dying turn out to be dangerously close to one another. However, even if people cannot dive into the lake-buildings, the dream of revolution persists in the reminder that even meanings reduced to straw can become the bricks that get hurled against the dominating glass. The poem is left in the horrible position of refusing to give up on the dream of revolution while it has to recognize how this dream makes every present attachment to the social a source of alienation.

Were an individual to offer this account of alienation, many of us would find his pathos self-indulgent. But if poetry can imagine itself into the symptoms, into an abstracted and nonsubjective version of the pains and uncertainties that shape our relation to our sense of what the social might be, then the dream of revolution, sufficiently tempered by despair, might seem itself an ineluctable part of our culture. Theory can explain why revolution may be necessary and analyze what constrains us. But perhaps only poetry can show how that cry emerges from modes of awareness more intimate, more widely shared, and more desperate than theory can develop.

Identification then is as fundamental a concern in Clover's poetry as in Wright's "Utopia," but almost never in ways that can reinforce us as subjects. As in the work of John Ashbery, we are always already coming upon the identifications that shape us. But Ashbery's fluidity among personal pronouns becomes in Clover a constant sense of how weak a hold we have on the various permutations of self-reference. The ideal of fluidity becomes a measure of the impotence felt when one looks at the many ways individual subjects become utterly bound to their roles and narrow interests.

Clover's poem is not uplifting, even as a bare personal resolve. In fact, its difficulty may be necessary for expressing such bleakness, because then that bleakness can be at least tempered by the play of intelligence. But the difficulty also helps interpret the impotence it renders:

perhaps such impotence is an inevitable result of poetry's inability to find convincing collective voices that might make revolutionary sentiments less wistful and less dogged by irony.

Lynn Margulis

on syphilis & Nietzsche's madness: spirochetes awake!

In the foothills of the Italian Alps, in a snow-draped piazza in Turin on January 3, 1889, a driver was flogging his horse when a man flung his arms around the poor beast's neck, his tears soaking its mane. The horse's savior was the German philosopher Friedrich Wilhelm Nietzsche (1844 – 1900). His landlord later found him collapsed in the square and brought him back to his room, where Nietzsche spent the night writing a flurry of bizarre postcards. As soon as his friend and colleague Jacob Burck-

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hardt received a crazed letter, he convinced his close friend Peter Gast to go and accompany Nietzsche on his return to Basel. Much of the rest of the century, the last eleven years of his life, Nietzsche spent in incoherent madness, crouching in corners and drinking his urine. The most productive year of his career had been immediately prior to the psychotic break. After it, he wrote no more philosophy. Deborah Hayden, in her recent book *Pox: Genius, Madness, and the Mysteries of Syphilis* (2003), summed up the famous incident:

> The story of Nietzsche's sudden plummet from the most advanced thought of his time to raving dementia is often told as if there were a razor's edge demarcation between sanity and tertiary syphilis, as if on 3 January armies of spirochetes woke suddenly from decades of slumber and attacked the brain, instead of the biological reality that paresis is a gradual process presaged over many years.

Hayden's case to prove that Nietzsche indeed suffered all his adult life from syphilis is as strong as any posthumous medical history can be. He was diagnosed at a time when clinical familiarity with the disease abounded. Detailed evidence shows that he passed through each of the three stages: the chancre of primary syphilis immediately after infection; the terrible pox, fever, and pain of secondary syphilis that emerges months or years later; and the dreaded third: paresis. 'Paresis,' like the word 'syphilis' itself, refers to a syndrome. An acronym, its mnemonic is: *p*ersonality disturbances; *a*ffect abnormalities; *r*eflex hyperactivity; *e*ye abnormalities; *s*ensorium changes; *i*ntellectual impairment; and *s*lurred speech. Paresis often begins with a dramatic delusional episode, but in the following months and years dementia alternates with periods of such clarity that there seems to have been a cure.

Infection by the spirochete of syphilis – declared eradicated in the mid-twentieth century – still prevails, I believe. The efficacy of early treatment with penicillin, improved hygiene, condom use, and attitudes that lead the afflicted to seek help for venereal disease conspire to bolster the common myth that syphilis has disappeared. We are deceived; many people suffer from syphilis called by other names.

Syphilis symptoms are caused by venereal infection with a spirochete bacterium called *Treponema pallidum*. The treponeme family of spirochetes consists of tiny corkscrew-shaped bacteria, all of which swim and grow in animal tissue. The bacterial flagella are encased within an outer membrane. Spirochetes, like other 'gram negative' bacteria, all have two cell membranes with a space between them. In this periplasmic space between the inner and outer membranes the flagella rotate. Smaller spirochetes such as the syphilis treponeme have only one or two such flagella, whereas some giant spirochetes have more than three hundred. The efficient screw-wise motion into genital and other tissue requires this flagellar arrangement.

Treponema pallidum is one freak among a huge diversity. The vast majority of spirochetes live peacefully in mud, swamps, and waterlogged soils all over the world. Benign, 'free-living' spirochete relatives of *Treponema pallidum* are everywhere. They thrive where food is plentiful: lakeshores rich in decaying vegetation, marine animal carcasses, hot sulfurous springs, intestines of wood-eating termites and cockroaches, and the human mouth. Most kinds are poisoned by oxygen, from which they swim away to avoid. Very few cause illness, yet ticks infected with the *Borrelia*

Note by Lynn Margulis

burgdorferi spirochete of Lyme disease can induce serious arthritis and other enduring symptoms. Another spirochete nearly indistinguishable from the Lyme disease *Borrelia* is a healthy symbiont in the intestines of termites. A treponeme similar to that of syphilis is associated with the tropical eye disease yaws. Leptospirosis, a systemic and sometimes fatal infection found usually in fishermen, is due to spirochetes that are carried in the kidney tubules of rats that urinate into nearby water. The fishermen acquire *Leptospira* spirochetes from fishhook cuts and other skin lesions. And, of course, there is syphilis.

Nietzsche's letters from 1867 until his breakdown provide a vivid account of the suffering of secondary syphilis. He complains of the pain, skin sores, weakness, and loss of vision that typify the repertoire of the disease. In his last year, his letters give evidence of euphoria. His published works show the grandeur and inspiration that tertiary syphilis sometimes brings to brilliant and disciplined creative minds by removing inhibition as brain tissue is destroyed. When Nietzsche wrote in *Thus Spoke Zarathustra* (1884), "Die Erde, sagte Er, hat eine Haut; und diese Haut hat Krankheiten. Eine diese Krankheit heist zum Beispiel: 'Mensch'" (translated as "The Earth, he says, has a skin, and this skin has a sickness. One of these sicknesses is called 'man,'" or as "The Earth is a beautiful place but it has a pox called man"), what terrible insight Nietzsche must have had into the devastating horror of pox!

Multiple sources indicate that he was treated for syphilis in 1867 at age twenty-three. Seeking medical treatment for eye inflammation, a frequent syphilitic symptom, he consulted Dr. Otto Eiser, who reported not only Nietzsche's penile lesions, but that he had engaged in sexual relations several times on doctor's orders! Years later, in 1889, when Nietzsche broke down and was taken to the clinic of a paresis expert, he was admitted with the diagnosis "1866. *Syphilit. Infect.*"

In 1888 Nietzsche's productivity was, by any standard, extraordinary. He completed his philosophical project: *Twilight of the Idols*, *The Antichrist*, *Ecce Homo*, and *The Case of Wagner*. The style of these works is apocalyptic, prophetic, incendiary, and megalomaniacal, leading many scholars to claim the excesses of these works were due to incipient paresis. Now, after more than half a millennium of the study of syphilis and more than a century after Nietzsche's breakdown, our research suggests that the philosopher really did plummet abruptly into madness; armies of spirochetes *did* awaken suddenly from decades of slumber, and literally began to eat his brain.

Many claim syphilis was known in Europe prior to the return of Columbus; but as Hayden describes and I agree, it is more likely the insidious venereal infection was a new gift of the Americas to the people of Europe. Columbus and his crew returned to Spain with a novel set of symptoms that soon spread to Naples and France. From that year, 1493, the disease was described in detail, first by the physician who treated Columbus and his men, Dr. Ruiz Diaz de Isla. Diaz reported, "And since the Admiral Don Cristobal Colon had relations and congress with the inhabitants . . . and since it is contagious, it spread." Eventually it affected the waterfront prostitutes of Barcelona. Diaz, in work published in 1539, wrote that infected sailors were accepted into the army that Charles of France brought to besiege Naples in 1495 and into the forces that Ferdinand of Spain employed to defend Naples. Ferdinand's army alone is estimated to have had five hundred prostitutes among its camp fol-

lowers. Soon after the victorious entry of Charles's army, the Great Pox of Naples erupted. His multinational mercenaries brought infection back to every European country. Charles himself returned to France infected. By the next year, the disease spread across the continent, puzzling physicians with its novelty.

Within the early decades of the contagion, in cities across Europe physicians reported that between 5 and 20 percent of the population suffered. Variously named at first, it came to be called *morbus gallicus*, the French malady. Charles's army was blamed for its introduction to Naples – perhaps rightly. Physicians who published work on it in the *lingua franca* of Latin soon after the great outbreak of 1495 drew international attention. Girolamo Fracastoro, in 1530, wrote a verse treatise on the disease entitled *Syphilus sive Morbus Gallicus*, in which the eponymous protagonist, a shepherd, is the first to bear the disease, as a punishment for impiety. The name stuck.

Syphilis has been surprisingly well documented since its outbreak in the closing years of the fifteenth century, as microbiologist and sociologist of science Ludwik Fleck (1896 – 1961) wrote in his masterpiece *Genesis and Development of a Scientific Fact*. From the sixteenth through the end of the nineteenth century, the prevalence and peculiarities of syphilis inspired a wide range of literature, from scientific arcana to torrid novels. Meanwhile, the cause of the disease was avidly sought. Then in 1905 Erich Hoffmann sent a genital chancre specimen to German microscopist Fritz Schaudinn, who confirmed the etiology. He aptly called the lively, translucent, thin, corkscrew-shaped bacterium he observed "thin, pale thread": *Treponema pallidum*. In 1913 Udo J. Wile found *Treponema pallidum* spirochetes in the brains of patients that manifested tertiary syphilis symptoms. (The best recent photo I've seen of spirochetes in the frontal cortex of a paresis patient, figure 8-14 in W. E. Farrar's *Atlas of Infections of the Nervous System*, is at too low a magnification to see round-body details. See the inside back cover and page 125 below.)

Syphilis & Nietzsche's madness: spirochetes awake!

Syphilis has gained attention again because of its disputed relationship to AIDS. Today, although physicians rarely record cases of tertiary syphilis, the earlier two stages of the disease seem on the rise. AIDS patients who have a past record of syphilis that was apparently cured by antibiotics succumb again to the disease. "Syphilis in patients infected with HIV is often more malignant with a greater disposition for neurological relapses following treatment," says Dr. Russell Johnson of the University of Minnesota Medical School, a world expert on the Lyme disease spirochete. Dr. Peter Duesberg, discoverer of the retrovirus, rejects exclusive focus on HIV as the cause of AIDS in his excellent book *Inventing the AIDS Virus*. He questions the common assumption that, as a contagious virus, HIV is even the main cause of the lesions, tumors, rashes, arthritis, weakness, pneumonia, and other severities that accompany immunosuppression. Such symptoms, including the presence in tissue of both the HIV antibody and of the virus itself, may, as in other opportunistic infections, be the consequence, not the cause, of AIDS. I suspect that many of the symptoms in the immunosuppressed sufferers correlate both with the tenacity of the syphilis treponeme and the sexual and other behaviors of the patient.

Joan McKenna, a physiologist with a thermodynamic orientation, writes:

> Because spirochetes can be harbored in any tissue for decades and can move from latency to reproductive stages,

Note by Lynn Margulis

> their survival in any host and despite any known therapy is nearly certain .... [We also] know that unknown factors will activate the microorganism [*Treponema pallidum*] from latency into an aggressive infection ....

She goes on to remark about the relation between syphilis and AIDS: "No symptoms show up in AIDS that have not historically shown up with syphilis and the history of these populations [where AIDS is rampant] includes a high incidence of syphilis."

Clinical confusions (misdiagnoses, anomalous symptoms, conflated multiple infections) have abounded since the early centuries of syphilology. Yet many studies confirm the variety and severity of symptoms attributable to the *Treponema pallidum* spirochete. The malady remains idiosyncratic in its course, with variability in the timing of the stages, and in the absence of any reliable test or single diagnostic. Still, the evidence suggests that the virulence and severity of the disease have diminished dramatically since the initial violent pox outbreak. This behavior is expected of pathogens in first exposure to naive populations. Syphilis in Europe showed the same pattern as measles and smallpox did when Europeans first introduced them to the Americas. As early as the first few decades that followed the Pox of Naples, subsequent generations of Europeans were more resistant. Pathogenic microbes maximize not by rapid lethality, but by transforming into a chronic disease that lasts a lifetime and subtly affects behavior in the stricken animal.

Since the late nineteenth century, the Wassermann blood test has often been touted as the best diagnostic test for syphilis. The fear of syphilis transmission was so common that the Wassermann test was, and often still is, legally mandated in many places, required prior to marriage. However, as shown by Fleck and others, the Wassermann reagent does not measure the presence of *Treponema pallidum*. It indicates, and not even 100 percent of the time, the exposure of a patient to unspecified infectious bacteria: a positive Wassermann test shows only that a person makes antibodies against certain blood-borne bacteria that may include the syphilis treponeme. Furthermore, this test in known syphilitics in advanced stages of the syndrome often converts to negative.

To preclude mother-to-infant transmission of syphilis during parturition, drops of silver nitrate, thought to suppress the syphilitic spirochete, were placed in the eyes of most newborns. This practice occurs in some regions even now, and even when blood tests for syphilis in the mother are negative. These irrational practices measure residual fear of the contagion of syphilis.

In the beginning of the twentieth century, arsphenamine, an arsenic-based remedy, was said to improve the health of syphilitic patients. Often it made people sicker. After 1943 came the 'miracle drug': the claim was that a single or a few massive doses of penicillin cured the body permanently of the dreaded treponeme. After hefty antibiotic treatment in newly detected cases, the insidious corkscrews disappeared. Whereas the apparent remains of 'dead' spirochetes – tiny, shiny round bodies – might sometimes be found in tissue, the moving treponeme was declared gone. J. Pillot, the French researcher after whom the beautiful large spirochete *Pillotina* was named, 'proved' that the round-body remnants of the lively corkscrew are dead. The confusion comes from the fact that – penicillin or not – during the long latent phases of the disease after the primary chancre, moving corkscrew treponemes are not seen anyway. Many

years and studies later we can say that whether or not any treponemes are visible in the patient, penicillin (except when given in an appropriate dose very early in the course of the disease) is not an effective and permanent cure.

Yet some physicians still insist that penicillin and strong immune systems definitively eliminate this disease; others claim that treponemes 'hide' in tissues where antibiotics are inaccessible. Some speculate that tertiary syphilis occurs when the syphilis treponemes finally manage to spread, after decades of invisible stealth, and penetrate the blood-brain barrier. Alas, most physicians and syphilis scholars (and scientists such as I) simply don't know the relationship between *Treponema pallidum*, syphilis symptoms, the immune response, the HIV virus, secondary infection, sexual behavior, and the putative cures.

Finally, in 1998, the description of the entire genome of *Treponema pallidum*, one of the smallest bacterial genomes known, with about nine hundred genes in total, was published. Two other spirochete genomes are known: *Borrelia burgdorferi*, with some eleven hundred genes, and *Leptospira*, with nearly five thousand genes. Spirochetes like *Leptospira*, which are capable of life outside the body of animals, have at least five times as many genes as the syphilis treponeme. The leptospires all by themselves internally produce all their necessary components (proteins, lipids, vitamins, etc.), whereas *Treponema pallidum* does very little by itself; it survives only on the nourishment of rich human tissue. For this reason, it is likely that the syphilis treponeme lost four-fifths of its genes as it became an obligate parasite.

To identify any bacterium, the microbiologist needs to separate it and grow it by itself, that is, in isolation. Despite the specific genome knowledge of the single treponeme strain investigated, however, the routine growth of any *Treponema pallidum* in isolation (outside the warm, nutritious mammalian body) has not been achieved. Whether in organic mud or changing human tissue, these spirochetes depend utterly on their immediate environment. Unfortunately, moreover, no one has ever been able to induce round bodies of *Treponema pallidum* to form in isolation in a test tube, or to test these round bodies in isolation for their ability to resume growth.

My students and colleagues and I are not experts on any disease bacteria, nor on illnesses where symptoms are associated with visible spirochetes. We have been living closely with spirochetes for very different reasons. Our interest is in the possible role these wily bacteria played in the evolution of larger forms of life. Attempts to reconstruct the evolutionary history of the nucleated cell, the kind that divides by mitosis, have led us to study harmless spirochetes.

I suspect that the mitotic cell of animals, plants, and all other nucleated organisms (algae, water molds, ciliates, slime molds, fungi, and some fifty other groups included in the Protoctista kingdom) share a common spirochete ancestor. I believe that with much help from colleagues and students, we will soon be able to show that certain free-swimming spirochetes contributed their lithe, snaky, sneaky bodies to become both the ubiquitous mitotic apparatus and the familiar cilia of all cells that make such 'moving hairs.' Our lab work, coupled with that of other scientists, reveals that certain spirochetes when threatened by death can and do form immobile, shiny round bodies. Furthermore, these round bodies can hide and wait until conditions become favorable enough for growth to resume.

Note by Lynn Margulis

Since 1977, a group of scientists and students has been traveling to Laguna Figueroa (called Lake Mormona by Anglophones) near San Quintin, Baja California Norte, Mexico, to study microbial mats. These communities of organisms resemble ancient ones that left fossils in rocks. They are the best evidence we have of Earth's oldest life-forms. Many times we have brought microbial mat samples back to our lab and left these bottles of brightly colored mud on the windowsill, where photosynthetic bacteria powered the community. On several occasions the bottles were assiduously ignored through semesters of classes and meetings. From time to time, we took tiny samples and placed them in test tubes under conditions favorable for growth. Various kinds of spirochetes did begin to swim and grow; we suspect they emerged from round bodies after the samples were put into fresh, clean, abundant liquid food. Spirochetes, mostly unidentified, persisted in hiding in these bottles and jars for at least ten years.

Today we study another microbial-community sample, collected by Tom Teal in 1990 at Eel Pond in Woods Hole, Massachusetts. It is in our lab at the University of Massachusetts, Amherst in a forty-liter glass jar. To it we add only 'rain' (distilled water), but with sunlight as the energy source an abundance of life still thrives. Long after no typical spirochetes were seen in the sample, we added bits of either wet or dry mud to food and water known to support the activities of spirochetes, swimming and growing. In a very few samples, within about a week, armies of spirochetes awoke from at least months of slumber.

We have observed and filmed spirochetes in samples from all over the world rounding up to form inactive bodies. Continuation of work on spirochetes led to our collaboration with Spanish colleagues at the delta of the Ebro River. Professors Ricardo Guerrero and Isabel Esteve had begun a strong research project. One stake, a stick in the mud labeled #1 UAB, marks a site on a microbial mat that somehow seems exceptional. Many fascinating organisms were taken from that place, but none as interesting as the large spirochetes we named *Spirosymplokos deltaeiberi*. Whenever these easy-to-see spirochetes are confronted with harsh conditions – such as liquid that does not support their growth, water that is too acidic, sugars that they cannot digest, a temperature that is too high – they make round, dormant bodies much like those that Pillot and nearly all his successors argue are dead.

The spheres of *Spirosymplokos deltaeiberi* we studied look just like the round bodies published by Norwegian microbiologists Oystein and Sverre-Henning Brorson. (They call them cysts.) The Brorsons showed that under unfavorable conditions the *Borrelia burgdorferi* spirochetes of Lyme disease make round bodies. After weeks of dormancy, of no growth and no sensitivity to antibiotics and other chemical insults, these round bodies revive. At high magnification they look just like those of *Spirosymplokos deltaeiberi*, only smaller. The *Borrelia burgdorferi* round bodies convert to form swimming spirochetes all at once and begin to grow easily as soon as they are placed into proper liquid food at the correct temperature and salt concentration.

The Brorsons confirmed what we suspected: spirochete round bodies, like the spheres of *Spirosymplokos deltaeiberi*, are fully alive. Either mixed with other mud organisms or growing by themselves in isolation, just supply them with what they need to grow and within minutes they revert into swimming, active, feeding, corkscrew spirochetes. Armies of

them awake from months of slumber. Our work with Guerrero on *Spirosymplokos deltaeiberi*, coupled with our reading of the literature (especially several studies by the Brorsons), leads us to emphasize an ancient secret of spirochete success: persistence via round bodies.

Nietzsche's brain on January 3, 1889 experienced a transformation like that of the microbial mat sample transferred into new fresh food. Our interpretation is that the spirochetes transformed from dormant round bodies into the swimming corkscrews in a very short time. Deborah Hayden, however, is also correct. Nietzsche was inoculated in his early twenties, and his long-standing condition was confirmed both by the physician's diagnostic on the medical record ("*Syphilit. Infect.*") and, at his autopsy, by pox scars on his private parts. The dormant spirochetes had been hiding out in his tissues for over thirty years. But on January 3, 1889 in Turin, armies of revived spirochetes munched on his brain tissue. The consequence was the descent of Nietzsche the genius into Nietzsche the madman in less than one day.*

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Inside back cover: Spirochetes from low-oxygen muddy water of a microbial mat, growing near the salt works of the Alfacs Peninsula, northeast Spain. (Phase contrast light micrograph, magnified 1000x, false color.) The large ones – *Spirosymplokos deltaeiberi* – and many of the smaller ones have formed round bodies as evaporating water threatens them with desiccation. See Lynn Margulis on *Syphilis & Nietzsche's madness: spirochetes awake!* pages 118 – 125: "after more than half a millennium of the study of syphilis and more than a century after Nietzsche's breakdown, our research suggests that the philosopher really did plummet abruptly into madness; armies of spirochetes . . . literally began to eat his brain." Photograph © Lynn Margulis.

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