

The Almost Blank Slate

Making A Case For Human Nurture

H E N R Y D . S C H L I N G E R

IN 2002, THE PSYCHOLOGIST STEVEN PINKER appeared on the *New York Times* bestseller list with *The Blank Slate: The Modern Denial of Human Nature*,¹ a book that attempts to catapult the nature-nurture issue back into public debate, while squarely coming down on the side of human nature. I shall argue, however, that there is overwhelming evidence that learning exerts the most significant influence on human behavior—a fact that is rarely acknowledged, publicized or even understood. If anything, there is a modern denial of human nurture, not human nature.

A Case for Human Nurture

In his review of Pinker's book, the behavioral biologist Patrick Bateson wrote that it may lead to "yet another round of the tedious and increasingly irrelevant nature/nurture debate."² Although I resist being drawn into more tedious debate on the nature-nurture issue, Pinker's prominence as a public intellectual demands a rejoinder and compels me to make the following assertions:

- Humans come into the world much closer to the blank slate end of the continuum than any other species.

- Most of what humans know or know how to do is not present in any form at birth.
- Many, if not most, of the important similarities and differences in behavior between individuals can parsimoniously be explained due to learning.

These are so obviously true it seems odd to have to repeat them, but the scientific evidence for the influence of learning on human behavior is overwhelming.

All other species rely more upon reflexes or fixed-action patterns that, although not insensitive to learning experiences, are relatively stable. Examples include aggressive displays, courtship and mating, migration, imprinting, and care of young. Human behavior, on the other hand, is noteworthy for its variability. As the evolutionary biologist Douglas Futuyma so aptly put it: “On balance, the evidence for the modifiability of human behavior is so great that genetic constraints on our behavior hardly seem to exist. The dominant factor in recent human evolution has been the evolution of behavioral flexibility, the ability to learn and transmit culture.”³

The renowned evolutionary biologist, Ernst Mayr, has also acknowledged the flexibility of human behavior with his distinction between open and closed programs. According to Mayr, “closed programs” include reflexes and fixed-action patterns controlled by areas of the brain that are rigidly programmed by genes. Other areas of the brain (e.g., the language areas) are suitable for “open programs” because the information is not rigidly programmed the way that reflexes are. These areas are primed by certain learning experiences early in life while even more general areas of the brain (e.g., the association cortices) remain malleable to learning experiences throughout life.⁴

No one would deny that genes, selected throughout human evolutionary history, code for a nervous system that makes possible our extraordinary ability to learn, or that some genes may be specialized for such learning. But let us not forget that all genetic expression, from relatively simple Mendelian traits such as eye color, to complex behavioral tendencies such as verbal behavior, is dependent on environmental input. Such input can be located on a continuum from the very simple stimuli that elicit reflexes to the complex associative processes that produce learning.

The crux of the debate is not *whether* genes influence learning or behavior—no behavioral scientist would claim they don’t—but rather *how* they influence learning and behavior.⁵ The flip side of the question, and the one of interest to me as a behavioral psychologist, is how the experiences we call *learning* influence behavior. This question is much easier to answer because the experiences that produce learning are easily accessible to experimental scrutiny and there already exist decades of sound experimental work from which to draw. But first we must clarify the relationship between learning and evolution by natural selection as causes of behavior.

Ultimate Causation of Behavior

The nature-nurture debate is typically portrayed as a simplistic paradigm where, in the nature corner, proponents claim that genes exert the overriding influence on human behavior, such as language, intelligence, and social and sexual relations. In the nurture corner, proponents argue that learning exerts the overwhelming influence. Put in these terms the nurture proponents win hands down. In other words, even though our ability to learn is made possible by a nervous system shaped by a particular evolutionary history, the experiences scientists call *learning* account for most of the similarities and differences between individuals. In this regard, as behavioral psychologist Galen Alessi suggests, learning may be viewed, along with evolution, as a set of ultimate causations of behavior.⁶

Since at least the early 1960s, Ernst Mayr has argued that every process in living organisms is the result of two separate causations called proximate (i.e., functional) and ultimate (i.e., evolutionary). Ultimate causation explains why an organism is the way it is, as a product of evolution. According to Mayr, because ultimate causation relates to the origin of adaptation or diversity, it answers “Why?” questions, such as “Why are desert animals usually colored like the substrate?” Such questions “deal with the historical and evolutionary factors that account for all aspects of living organisms that exist now or have existed in the past.” Mayr reminds us that it was Darwin who was responsible for making “Why?” questions scientifically legitimate and for bringing “all of natural history into science.”⁷

If we want to know why an organism exhibits a particular behavior, we are asking

about the behavior's natural history and its ultimate causation. Therefore, it makes sense to adopt Alessi's modification of Mayr's strictly evolutionary (or phylogenetic) account of ultimate causation to include the life history (or ontogeny) of the organism. Thus, in this neo-Mayrian view, the ultimate causes of behavior, especially in humans, occur in both the evolutionary history of the species and in the learning history of the individual. Explanations involving both types of ultimate causations necessarily involve speculative accounts of the natural history of the behavioral phenotype—interpretations based on basic principles of evolution and learning and carried out by evolutionary biologists and behavioral psychologists respectively.

Evolution, Learning and the Nervous System

Naturalists try to buttress their position by marshalling evidence from neurobiology. They do this in at least two ways. First, evolutionary psychologists assert that there are specifically evolved modules in the brain that underlie particular human abilities.⁸ Other scientists seriously question such claims, however. For example, neuroevolutionary psychobiologists Jaak and Jules Panksepp bluntly state, "By simply accepting the remarkable degree of neocortical plasticity within the human brain, especially during development, genetically dictated, sociobiological 'modules' begin to resemble products of dubious human ambition rather than of sound scientific reasoning."⁹ Psychologist William Uttal calls this modular approach "the new phrenology."¹⁰ In fact, serious scholars argue that instead of containing specifically evolved and specialized modules (for emotion, language, etc.) as evolutionary psychologists suggest, the human brain is more accurately described as consisting of subcortical systems shared with other mammals that interact with a more recently evolved human neocortex that is specialized for learning.¹¹

Second, naturalists point to studies using brain-imaging technologies to support their claims of the inheritability of behavior. It is fashionable nowadays for psychologists and neuroscientists to use functional Magnetic Resonance Imaging (fMRI) scans to view the brain while subjects engage in various activities. Despite a flurry of such studies in recent years, some scholars note serious methodological and interpretive problems that plague this research.¹² More to the

point, however, locating areas of the brain related to certain behaviors in no way implicates inheritance as an ultimate cause. For example, a recent study compared brain scans during recognition tests in adults, who as children were judged as shy or inhibited, with adults who were not judged as shy.¹³ The results showed more activity in a certain area (the amygdala) of the brains of the once-shy adults. The media reported that the study lent support for the inheritance of shyness. However, nothing in these, or any other results purportedly showing brain-behavior relationships, suggests inheritance as the ultimate cause. Simply identifying structures in the brain that seem to relate to behavior does not in and of itself implicate either evolution or learning as the ultimate cause.

In fact, a sizeable body of research shows that learning changes the physical and chemical structure of the brain. Readers may already be familiar with experiments by Mark Rosenzweig, William T. Greenough, and their colleagues which show that placing rats in either impoverished or enriched environments produced changes not only in their behavior but also in the structure of neurons and synapses in their brains (e.g., dendritic branching, synaptic and neuronal density, and synapses per neuron).^{14,15,16} Other research on non-human animals shows that specific learning experiences produce measurable changes in the nervous system. For example, the Nobel prize-winning neuroscientist Eric Kandel and his associates have shown changes in the structure and function of individual neurons as a function of classical (Pavlovian) conditioning.¹⁷ And research by Joseph LeDoux and his colleagues has shown that classically conditioned fear in rodents changes the amygdala, which controls fear reactions by way of output projections to the behavioral, autonomic, and endocrine response control systems located in the brainstem.¹⁸

Of more interest, however, are data showing that learning experiences produce changes in the human brain. One recent study showed that behavioral methods used to ameliorate dyslexia in children both improved reading performance and increased activity in corresponding brain areas as observed using fMRI.¹⁹ In another study, PET scans found metabolic changes in associated brain areas in patients with major depressive disorders who were treated with interpersonal

psychotherapy as well as with medication.”²⁰ Yet another study showed that successful behavior modification of obsessive compulsive disorder produced changes in the function of a part of the brain called the caudate nucleus.²¹

Pinker regards these facts as obvious and unconvincing. But they do lend support for a view of the human brain in which the neurophysiological underpinnings of behavior are established by learning experiences rather than being specialized evolved modules. Pinker is correct about one thing, however: “Neural plasticity is just another name for learning and development, described at a different level of analysis.”²² This echoes B.F. Skinner’s contention that we may study laws of learning without knowledge or consideration of the underlying neural structures and processes.

Although I am reluctant to use the phrase “blank slate” for fear of being caricatured, I will venture to say that the human neonate’s cortex is a relative blank slate. And there is neurological evidence to support this contention. The well-known pediatric neurologist, Harry Chugani and his colleagues use Positron Emission Tomography (PET) scans, which measure glucose metabolism that occurs when neurons fire, to compare brain activity in newborns to that in older children and adults. In general, they find the most activity in the neonate’s brain occurs in the primary sensory and motor cortexes, thalamus, and brainstem, areas associated with the primitive reflexes seen in infants. Activity in the frontal association cortex and other cortical areas associated with “higher cortical and cognitive function” is relatively nonexistent. As the infant is exposed to more and more learning experiences, as a result of interacting with the social and non-social environments, areas of the cortex that mediate these behaviors show more activity.²³

In addition to neurological data, anthropological and anatomical evidence corroborates a general-purpose model of the human cortex. Ernst Mayr explained it this way:

There is much to indicate that physically the human brain reached its present capacity nearly 100,000 years ago, at a time when our ancestors were culturally still at a very primitive level. The brain of 100,000 years ago is the same brain that is now able to design computers. The highly specialized mental activities we see in humans today seem not

to require an *ad hoc* selected brain structure. All the achievements of the human intellect were reached with brains not specifically selected for these tasks by the Darwinian process.²⁴

From Genes To Behavior

The pathway from genes to behavior is anything but straightforward, thus rendering many genetic (and neurological) explanations of behavior overly simplistic. Genes do not code directly for any trait, especially behavior. Genes code for proteins, which constitute the entire body including the nervous system. One of the functions of the nervous system is behavior—the actions of muscles and glands in response to environmental stimulation. Perhaps more than any other phenotypic trait, behavior does not occur in a vacuum; the expression of behavior always depends on substantial environmental input.

So, while the ultimate causes of an individual’s behavior occur in the evolutionary history of the species (as coded in the genes) and in that individual’s past experiences, both processes produce their effects first on the structure of the brain, the former mostly during prenatal development and the latter mostly after birth. It is important to note here that although evolutionary causation of structural or behavioral traits is coded in the genes, the causation is not *in* the genes. Likewise, although the causation of behavioral traits due to learning is coded somehow in the nervous system, the causation is not *in* the nervous system as some authors strongly imply.²⁵ Because of the complex interactions between learning and inheritance, their relative contributions to behavior cannot be teased apart and certainly not by the heritability studies of behavior geneticists. Such studies, flawed as they are methodologically, can at best only estimate the correlation between questionable phenotypic differences in a population, such as differences in IQ scores, and genetic differences.²⁶

What Modern Denial?

Is there a modern denial of human nature? I don’t think so. In fact, quite the opposite. Hardly a day goes without hearing about research on the role of inheritance in depression, homosexuality, intelligence, language, promiscuity, dyslexia, anorexia, and so on. And evolutionary psychology is such a hot field that some individuals have simply become evolutionary psychologists by

declaration, without any special training in biology, evolutionary theory, genetics, or without conducting any scientific research in these areas. Moreover, many of the claims made by evolutionary psychologists are elaborate just-so stories, based on less than adequate scientific evidence or logic.²⁷ Countless introductory psychology textbooks now include sections on evolutionary psychology, not because a strong case for it has been made, but because it is currently in vogue to explain behavior due to genes selected during the Pleistocene era when we were hunters and gatherers.

I would contend that, if anything, there is a modern denial of the role of learning in human behavior. There are several possible reasons, including poor public relations by learning theorists and simple ignorance by the media, the public, and even psychologists about the voluminous research over the past century on the specific ways in which experiences change behavior. Perhaps most important, the experiences we refer to as *learning* are extremely complex and occur with such speed and fluidity and at such a constant rate that their observation is rendered difficult even under controlled laboratory conditions. Another possible factor in the denial of learning is that if we acknowledge that learning accounts for the most important similarities and differences in human behavior, then it becomes harder for us to shirk our responsibility in solving problems caused by human behavior.

What Is Learning?

Learning is typically defined in terms of specific changes in behavior due to certain kinds of experiences. Over the past century, scientists have discovered two, often overlapping kinds of experiences, called *classical* and *operant learning*, which produce such behavioral changes. In classical learning an otherwise neutral stimulus, such as the sight of a dog, can come to elicit a response, such as fear, if the sight of a dog occurs reliably with a stimulus that already elicits fear, such as being bitten by that dog. In operant learning, behaviors are either strengthened (reinforced) or weakened (punished) by their consequences. For example, if a parent gives a child candy (reinforcing consequence) every time a child screams, then the child will continue to scream or scream more.

Classical conditioning was first quantified by

the Russian physiologist Ivan Pavlov and, contrary to its popular reputation of dealing only with slobbering dogs, it has now been shown to influence a range of phenomena in humans, including anxiety and phobias, physical dependence produced by drugs such as heroin and alcohol, taste-aversions, psychosomatic disorders, sexual arousal, and immunosuppression caused by treatments for cancer.

Operant learning has been shown to account for a much wider range of behaviors, including most if not all actions involving skeletal muscle activity. Operant learning has been observed in species ranging from simple to complex, and has even been observed in individual nerve cells.²⁸ Because of its ubiquity and its relevance to behaviors related to language, intelligence, and consciousness, it is surprising that learning is rarely mentioned by psychological scholars.

Learning as a Parsimonious Explanation of Behavior

In many instances where evolutionary explanations are offered for human behavior, learning explanations are more parsimonious, which means they explain the same facts with fewer assumptions. Consider phobias. Sociobiologist E. O. Wilson claims that humans have a genetic aversion to snakes as evidenced by his contention that humans are much more likely to develop “fear and even full-blown phobias” to snakes than to guns, knives, and automobiles. For Wilson, this aversion to snakes is due to the “constant exposure through evolutionary time to the malign influence of snakes,” with “the repeated experience encoded by natural selection as a hereditary aversion and fascination.”²⁹

First we must realize that not everyone who is bitten by a snake will learn to fear snakes, so we must have a science that can account for such individual differences. Nevertheless, if we assume that, in general, humans are more likely to develop fears and phobias to snakes than to cars or knives, the question we must ask is what most parsimoniously explains it. The sociobiological explanation is appealing and makes evolutionary sense, but a number of learning explanations offer a simpler account. For example, it is well documented in the Pavlovian conditioning literature that the tendency to acquire specific conditioned reflexes (in this case, fears) is determined by the relative amount of experience one has with the stimuli that produce the reflexes:

The more numerous the experiences with an object without adverse consequences, the longer it takes a fear to develop when there is an adverse consequence. For example, a typical person in our culture has countless experiences with cars and knives without any adverse consequences. If we are in an automobile accident or are cut by a knife, it is only one unpleasant experience in a sea of experiences with those objects that have not produced adverse consequences, so we are less likely to develop a fear. Learning theorists would say that the myriad non-aversive experiences with knives and cars have produced a *latent inhibition* with respect to developing conditioned emotional responses (i.e., fears) to them. That means that it would take relatively many more unpleasant or painful experiences before fear toward those objects would develop.

Most of us, however, have very few, if any, direct experiences with snakes. If one of those rare experiences produces an adverse outcome (e.g., the snake bites us) it may be more likely to condition a fear quickly because there is no built-up reservoir of non-aversive experiences to counter it. So, the speed of learning may be due to those experiences rather than to a specific evolutionary predisposition.

Fear of snakes can also be acquired by observing and modeling others' extreme reactions to them (either in real life or in movies) and, relatedly, by being told about someone's bad experience with a snake. Interestingly, Pavlovian learning is implicated in these types of learning as well.³⁰ Finally, as Stuart Vyse of Connecticut College reminds us: "Because they are live animals, snakes are less predictable and controllable than objects such as cars or knives. Being physically close to a knife is not risky, whereas being physically close to a snake can be."³¹ Perhaps what we've inherited is a predisposition to learn fears quickly from such unpredictable and uncontrollable events. But we must learn the fear of snakes nonetheless. In the case of phobias, learning explanations are preferable to sociobiological explanations because they require fewer assumptions and because the principles to which they refer—latent inhibition and modeling—have been demonstrated in countless experiments. The evolutionary explanation requires many assumptions about the history of hominids and their relationship to snakes (not all

of which, by the way, are dangerous).

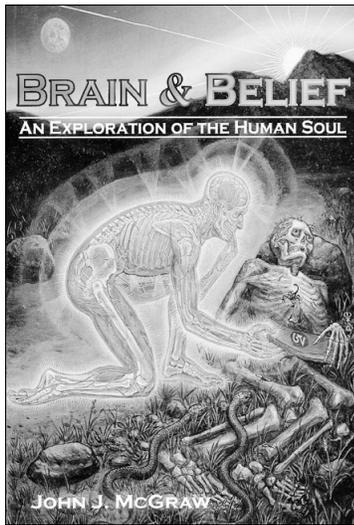
The Denial of Learning in Human Behavior

To find evidence of a modern denial of human learning, one need look no further than the field of psychology. Most introductory psychology textbooks devote an entire chapter to the principles of classical, operant and social learning. Learning is said to account for much of human behavior. But then, oddly, those principles are rarely if ever mentioned in succeeding chapters that deal with learned behaviors involved in remembering, perceiving, talking, thinking, or emotional responses. Learning is even given short shrift when dealing with such obvious examples as social and maladaptive behaviors, despite the fact that it has been demonstrated to be a critical determinant of many of these behaviors. For example, nowadays it is customary to explain problem behaviors such as anxiety, depression, ADHD, and learning disabilities as having a strong inherited component. Learning, however, provides a much simpler and more easily testable explanation; but the learning account gets little press. Moreover, effective therapies for treating these behavioral problems come not from evolutionary psychology, but from learning theory.

Because of the almost infinite flexibility of the human cortex, learning determines most everything we do. Among the behaviors we learn are talking, reading, writing, doing math, thinking logically, interacting socially, and playing sports and musical instruments. Even behaviors that on the surface seem to represent closed programs, such as standing, walking, reaching and grasping, and perceptual abilities have a significant learned component. Many theorists who deny the importance of learning in human behavior often pay lip service to it, but for them it is never more than some unspecified, passive process; a mere annoyance along the road to understanding what they perceive to be the essence of human behavior—genes.

The Denial of Learning Language

Often learning is flatly denied for behaviors that clearly have a strong learned component. In his book, *The Language Instinct*, for example, Pinker writes, in his usual self-assured manner: "First, let us do away with the folklore that parents teach their children language." Pinker compares



“Thought provoking and well-argued...”
—*Library Journal*

BRAIN & BELIEF

An Exploration of the Human Soul

\$14.95 • ISBN 0-9747645-0-7

Available online
or through
your local bookstore

“I know of no other single volume that covers such a wide range of topics and still retains a depth of analysis...this book is an important addition to the pantheon of popular science books that should be read not only by general readers, but by professional scientists, philosophers, and scholars of all stripes. And it's a good read to boot!”
—Michael Shermer

www.theaegispress.com

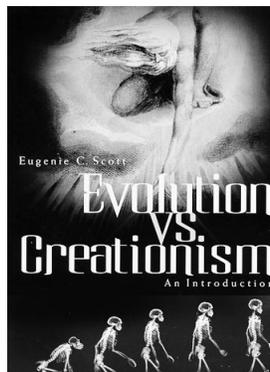
Evolution vs. Creationism An Introduction

Eugenie C. Scott

Provides a badly needed, comprehensive, and balanced introduction to the many facets of the current debate over the teaching of evolution. Includes: the scientific evidence for evolution; the legal and educational basis for its teaching; various religious points of view, and a concise history of the evolution-creationism controversy. A section of primary source documents from all sides of the issue is included.

Eugenie C. Scott is the executive director of the National Center for Science Education, a non-profit organization that defends the teaching of evolution in the public schools.

\$49.95 • ISBN 0-313-32122-1
Greenwood Press, 2004



Buy it on-line: www.ncseweb.org/evc

language to sitting, standing, and walking which, according to him, parents don't teach but which children do anyway. Pinker also denies the role of imitation in language learning when he writes, “The very concept of imitation is suspect to begin with (if children are such general imitators why don't they imitate their parents' habit of sitting quietly in airplanes?)” and that, “normal children do not learn language by imitating their parents.”³²

Statements such as these reveal no appreciation for the subtle power of learning, and a lack of knowledge of the sizeable body of experimental research on it. When linguists and psychologists repeat the tired rhetoric that parents don't teach their children language, what they mean is that parents don't intentionally teach their children how to talk, as if anyone ever suggested this. That does not mean, however, that children don't learn language from parents. Just as learning theorists in the 1960s reanalyzed tapes of the so-called “non-directive” therapy sessions by the humanist psychotherapist Carl Rogers and discovered that he was actually reinforcing his clients' positive self-statements (forcing Rogers to change the name of his approach to “client-centered”),³³ psychologist Ernst Moerk exhaustively reanalyzed psychologist Roger Brown's data on early language interactions between mothers and children and, in so doing, identified detailed instances of mothers prompting and reinforcing vocal imitations and shaping by successive approximations, among other behavioral processes.³⁴ Such processes are subtle and difficult to identify if one's view of reinforcement is a naive, simplistic one in which only praise for speaking appropriately counts. The principle of reinforcement derives from the more general Law of Effect, which states that behavior is determined by its consequences. Specifically, reinforcement is any consequence produced by a behavior that causes that behavior to occur again (or to be strengthened) under similar circumstances. Thus, reinforcement is defined by how it functions and, in a manner analogous to natural selection, reinforcement operates on (selects from) behavioral variation.

The Reinforcement of Babbling

A good example of the subtle role of reinforcement in language acquisition is babbling. Babbling in infants begins at around 4-6 months

of age when the larynx descends into the throat. Instead of being able to breathe and drink simultaneously as babies can do before that time, they can now make all of the phonetic sounds found in all human languages. The question is how this amorphous sea of phonemes is transformed into the intelligible sounds of the parents' language usually by the second year of life. Someone naive about learning theory might answer by saying that parents reinforce the sounds they like and ignore the sounds they don't like. While most parents do respond more excitedly when their infants make sounds, especially recognizable ones, this probably only contributes to the continued strength of (i.e., reinforces) the infant's efforts, not to the shaping of specific phonemes.

Only a misunderstanding of reinforcement would lead one to claim that it plays no role in the acquisition and maintenance of infant (or even adult) speech. Although parents do intentionally reinforce verbal behavior in their children, the form of reinforcement that is responsible for shaping infant babbling into the recognizable phonemes of their native language is a more subtle form called *automatic reinforcement*.

Here's how it works. Beginning before birth, infants hear countless hours of human chatter. When they begin to babble, some of the sounds they make (i.e., those of their native language) "sound good" and familiar in the sense that they match the sounds the infants have heard since before birth. The rest of the sounds they hear themselves utter are not familiar. Hearing themselves match familiar sounds reinforces those sounds "automatically," in that no other person reinforces them, and so the infants keep making them. This is the main reason that deaf infants stop babbling. Automatic reinforcement also explains why the cadence and inflection of infant babbling sounds as if the infant is actually talking, something that drives parents crazy trying to understand what their babbling infants are saying (of course, they're not saying anything). In this case, not only are the individual phonemes uttered by the infant automatically reinforced by their similarity to what the infant has heard, but so too is their cadence and inflection.

The same phenomenon occurs when we take on colloquial expressions or accents of roommates or friends whom we like or admire, or when we find ourselves using trendy words

and expressions. Other people don't intentionally reinforce us for talking like them except in the usual ways by listening and responding. Hearing ourselves sound like our friends or using trendy words automatically reinforces the use of these words or expressions in the sense that we continue to use them. The process occurs without awareness, but it occurs nonetheless. In addition to this interpretation being parsimonious, it has experimental support.³⁵

Learning "Real" Words

Detractors may claim that babbling is not real language, so we must provide other examples of how language is learned. Once the phonemic sounds and sound combinations of a child's native language have been shaped by automatic reinforcement, parents are ready to hear "real" words, so when they hear "mama" or "dada" they respond excitedly, often repeating the word (both reactions functioning as reinforcement), and continue to do so as new words emerge. And, yes, they also use imitation to teach new words, as in, "Say spoon," or "Can you say spoon?" and then responding, "Right, spoon." When children use words to request things (e.g., food, comfort, relief from pain), parents provide those things. The parents' responses are not necessary for children to learn how to say words—they learn that through imitation—but they are necessary for children to learn to use words.

I've always been amazed that Chomsky and Pinker don't seem to understand that, more than any other behavior, verbal behavior is social behavior, and in the absence of an environment where words and sentences do something for the speaker, they won't occur. Following from Darwin, we must look for the function of behavior. For example, an infant raised all alone on a desert island with a tape player constantly playing human speech may eventually learn to say some words, but the words will never be used in a functional way because they won't do anything for the child. The words won't get the infant anything in the absence of other people (listeners) who know how to respond to the infant's requests. The infant will be little more than a parrot. This explains a popular example that Chomskian linguists use to counter the suggestion that language is learned and to support the suggestion of a Language Acquisition Device (LAD), namely that the children of immigrants

who spend their time in the streets playing with other children learn the language of their adoptive country faster than their parents who take classes. As anyone who ever took a foreign language class in school knows, learning a language in a classroom doesn't teach many conversational skills, whereas being immersed in a language environment will teach conversational skills because the words you learn actually produce immediate and naturally reinforcing effects.

Countless experiments have shown that various aspects of language, including grammar, can be acquired through operant and social learning. However, a longitudinal study by Betty Hart and Todd Risley demonstrates convincingly that parents' language and interaction styles determine their children's language and interaction styles.³⁶ This study, and the dozens showing the operant learning of language, should put to rest once and for all the critics' claims that children don't learn language from their parents.

In Hart and Risley's study, language interactions between 42 American children, from birth to 2.5 years of age, and their families were observed in the home for one hour a month. Not only was the children's amount of talking shown to be directly related to the parents' amount of talking, but 86-98% of the actual words in the child's vocabulary were also in the parents' vocabulary. There were strong correlations between what the parents actually did during interactions with their language-learning children and the children's language development. For example, the children's rate of vocabulary growth was a direct function of how many different nouns and modifiers they heard and how much the parents reinforced the children's utterances either with approval or by repeating what the children said. These relationships held up at age 3, as they also did with the children's performances on standardized achievement and intelligence tests (i.e., IQ scores) when they were nine years old. In addition, the data also revealed slower vocabulary growth rates when parents initiated verbal interactions (v. reinforcing the child for initiating) or issued imperatives (v. questions or choices) or outright prohibitions (punishment) for speaking.

The data from the Hart and Risley study are real data from real parents teaching their children a real language, not the idealized sentences or rationalist musings of Chomskian linguists, and

they offer a compelling picture of the enormous impact learning has on language acquisition.

Finally, Pinker's claim that children do not learn by imitating is simply wrong, as Claire Poulson and her colleagues, among numerous others, have shown.³⁷ True, children do not imitate everything their parents say or do. But when imitating produces reinforcing consequences, children imitate—and so do adults. Anyone who has been around a young child knows that they imitate much of what they hear and see, and children and adults use imitation and modeling as the main way to learn words and simple sentences in the first place.

Conclusion

We must not overlook the importance of evolution and inheritance, especially when explaining the distinguishing differences between humans and other animals. At the same time, we must not deny the importance of human learning. If we overlook learning as the primary determinant of human behavior in our search for elusive genes and vague mental constructs, we will be at a big disadvantage in solving serious problems. Knowledge of learning principles in developing programs of behavior therapy and applied behavior analysis has already greatly improved the lives of children with autism and other developmental disabilities and behavioral problems, as well as otherwise normal children and adults in a variety of settings from the home to the school to the workplace.

In his keynote address to the 98th Annual Convention of the American Psychological Association in 1990 (a week before his death), the famous American psychologist, B. F. Skinner noted, "After almost a century and a half, evolution is still not widely understood. It is vigorously opposed by defenders of a creator.... The role of variation and selection [learning] in the behavior of the individual suffers from the same opposition."³⁸ One can only hope that with time and better scientific training of psychologists, learning will be universally recognized as the most important element of human behavior. ▼

I am grateful to Julie Riggott and Stuart Vyse for their helpful comments on this essay. Correspondence may be addressed to the author, Department of Psychology, California State University, Northridge, 18111 Nordhoff Street, Northridge, CA, 91330-8255. Email: hschling@csun.edu.

References

1. Pinker, Steven. 2002. *The Blank Slate: The Modern Denial of Human Nature*. New York: Viking.
2. Bateson, Patrick. September, 2002. "The Corpse of a Wearisome Debate." *Science*, 297 (27), 2212-2213.
3. Futuyma, Douglas J. 1979. *Evolutionary Biology*, Sunderland, MA.: Sinauer, 491.
4. Mayr, Ernst. 1997. *This is Biology: The Science of the Living World*. Cambridge, MA: Harvard University Press
5. Weiner, J. 1999. *Time, Love, Memory: A Great Biologist and His Quest for the Origins of Behavior*. New York: Vintage Books.
6. Alessi, G. 1992. "Models of Proximate and Ultimate Causation in Psychology." *American Psychologist*, 47, 1359-1370.
7. Mayr, 1997, 115.
8. Cosmides, L. and J. Tooby. 2000. "Evolutionary Psychology and the Emotions." In: Lewis, M. and J. Haviland (eds). *The Handbook of Emotions, 2nd edition*. New York: Guilford, 91-116.
9. Panksepp, J., and J. B. Panksepp. 2000. "The Seven Sins of Evolutionary Psychology." *Evolution and Cognition*, 6, 108-131: 108.
10. Uttal, William R. 2001. *The New Phrenology: The Limits of Localizing Cognitive Functions in the Brain*. Cambridge MA: MIT Press.
11. Lieberman, Philip. 2003. *Human Language and our Reptilian Brain: The Subcortical Bases of Speech, Syntax and Thought*. Cambridge, MA: Harvard University Press. See also Panksepp and Panksepp. 2000, 108-131.
12. Faux, Steven F. 2002. "Cognitive Neuroscience From a Behavioral Perspective: A Critique of Chasing Ghosts with Geiger Counters." *The Behavior Analyst*, 25, 161-173.
13. Schwartz, C. E., C. I. Wright, L. M. Shin, J. Kagan, and S. L. Rauch. 2003. "Inhibited and Uninhibited Infants 'Grown Up': Adult Amygdalar Response to Novelty." *Science*, 300, 1952-1953.
14. Rosenzweig, M. R. 1984. "Experience, Memory, and the Brain." *American Psychologist*, 39, 365-376.
15. Greenough W. T., F. R. Volkmar. 1973. "Pattern of Dendritic Branching in Occipital Cortex of Rats Reared in Complex Environments." *Exp. Neurol.* 40, 491-504.
167. Turner A. M., W. T. Greenough. 1985. "Differential Rearing Effects on Rat Visual Cortex Synapses. I. Synaptic and Neuronal Density and Synapses Per Neuron." *Brain Res.* 329. 195-203.
17. Kandel, E. R. 2000. "Cellular Mechanisms of Learning and the Biological Basis of Individuality." In E. R. Kandel, J.H. Schwartz, and T. M. Jessell (Eds.) *Principles of Neural Science (4th ed.)*, New York: McGraw-Hill.
18. LeDoux, J. L. 2000. "Emotional Circuits in the Brain." *Annu. Rev. Neurosci.*, 23, 155-184.
19. Temple, E., G. K. Deutsch, A. J. Poldrack, S. L. Millier, P. Tallal, M. M. Merzenichi, and J. D. E. Gabrieli. 2003. "Neural Deficits in Children With Dyslexia Ameliorated by Behavioral Remediation: Evidence from Functional MRI." *Proceedings of the National Academy of Sciences*, 100, 2860-2865.
20. Brody, A. L., S. Saxena, P. Stoessel, L. A. Gillies, L. A. Fairbanks, S. Alborzian, M. E. Phelps, S. Huang, H. Wu, M. L. Ho, M. K. Ho, S. C. Au, K. Maidment, and L. R. Baxter. 2001. "Regional Brain Metabolic Changes in Patients with Major Depression Treated with Either Paroxetine or Interpersonal Therapy." *Archives of General Psychiatry*, 58, 631-640.
21. Schwartz, J. M., P. W. Stoessel, L. R. Batxer, K. M. Martin, and M. E. Phelps. 1996. "The Systematic Changes in Cerebral Glucose Metabolic Rate After Successful Behavior Modification Treatment of Obsessive-Compulsive Disorder." *Archives of General Psychiatry*, 53: 109-113.
22. Pinker, 2002, 86.
23. Chugani, H. T., M. E. Phelps, and J. C. Mazziotta. 1987. "Positron Emission Tomography Study of Human Brain Functional Development." *Annals of Neurology*, 22, 487-497.
24. Mayr, 1997, 74-75.
25. Quartz, S. R., and T. J. Sejnowski. 2002. *Liars, Lovers, and Heroes: What the New Brain Science Reveals About How We Become Who We Are*. New York: William Morrow.
26. Joseph, J. 2003. *The Gene Illusion: Genetic Research in Psychiatry and Psychology Under the Microscope*. Herefordshire, England: PCCS Books. Schlinger, H. D. 2003. "The Myth of Intelligence." *The Psychological Record*, 53, 15-32.
27. Schlinger, Henry D. 1996. "How the Human Got its Spots: A Critical Analysis of the Just-So Stories of Evolutionary Psychology." *Skeptic*, 10/4, 68-76.
28. Stein, L., and J. D. Belluzzi. 1988. "Operant Conditioning of Individual Neurons." In M. Commons, R. M. Church, J. R. Stellar, and A. Wagner (Eds.), *Quantitative Analyses of Behavior: Biological Determinants of Reinforcement*. Hillsdale, NJ: Erlbaum, 249-264.
29. Wilson, E. O. 1993. "Biophilia and the Conservation Ethic." In S. R. Kellert and E. O. Wilson (Eds.) *The Biophilia Hypothesis*. Washington, D.C.: Island Press, 34.
30. Schlinger, Henry D. 1996. "What's Wrong With Evolutionary Explanations of Human Behavior." *Behavior and Social Issues*, 6, 35-54.
31. Personal Communication.
32. Pinker, Steven. 1994. *The Language Instinct: How the Mind Creates Language*. New York, Harper-Collins, 38.
33. Truax, C. B. 1966. "Reinforcement and Nonreinforcement in Rogerian Psychotherapy." *Journal of Abnormal Psychology*, 71, 1-9.
34. Moerk, E. L. 1992. *First Language: Taught and Learned*. Baltimore: Paul H. Brookes.
35. Sundberg, M.L., J. Michael, J. W. Partington, and C. A. Sundberg. 1996. "The Role of Automatic Reinforcement in Early Language Acquisition." *The Analysis of Verbal Behavior*, 13, 21-37; Smith, R., J. Michael, and M. Sundberg. 1996. "Automatic Reinforcement and Automatic Punishment in Infant Vocal Behavior." *The Analysis of Verbal Behavior*, 13, 39-48.
36. Hart, B., and T.R. Risley. 1999. *The Social World of Children: Learning to Talk*. Baltimore: Paul Brookes. Hart, B. and T. R. Risley. 1995. *Meaningful Differences in the Everyday Experiences of Young American Children*. Baltimore: Paul Brookes.
37. Kymissis, E., and C. L. Poulson. 1990. "The History of Imitation in Learning Theory: The Language Acquisition Process." *Journal of the Experimental Analysis of Behavior*, 54, 113-127. Poulson, C. L., E. Kymissis, K. F. Reeve, M. Andreatos, and L. Reeve, 1991. "Generalized Vocal Imitation in Infants." *Journal of Experimental Child Psychology*, 51, 267-279.
38. Skinner, B.F. 1990. "Can Psychology be a Science of Mind?" *American Psychologist*, 45, 1206-1210.