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BOOK REVIEW

Learning, the Sole Explanation of Human Behavior: Review of *The Marvelous Learning Animal: What Makes Human Nature Unique*

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Seemingly everyone is interested in understanding the causes of human behavior. Yet many scientists and the general public embrace causes of behavior that have logical flaws. Attributing behavior to mental events, emotions, personality, or abnormal personality, typically, is committing one of a number of common errors, such as reification, circular reasoning, or nominal fallacies (Schlinger & Poling, 1998). An increasingly frequent error is embracing genetic explanations of behavior in the absence of an identified gene. Similarly, explaining behavior in terms of brain structure or function fails to ask what caused that brain structure or function to develop or function in a particular way.

As Arthur Staats (2012) notes in his valuable book *The Marvelous Learning Animal: What Makes Human Nature Unique*, unfortunately, such flawed explanations have prospered at the expense explanations based on learning mechanisms. Consequently, many behavior analysts would like to see a book that uses non-technical language to clearly delineate the limitations of explanations based on mind, brain, genes, and personality. Such a book would clearly describe how human behavior (both typical and problematic) can be understood in terms of learning principles, how myriad daily interactions from right after birth make us who we are, how the relevant behavioral research progresses, how interventions are developed based on the research, and how these interventions are subject to research demonstrating their effectiveness. The book would also describe the proper role of genetics and brain structure and function in an understanding of behavior. Perhaps no single volume can do all of these things equally well, *The Marvelous Learning Animal* is a useful complement to existing works with which behavior analysts may already be familiar (e.g., Schneider, 2012; Skinner, 1953).

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The Great Scientific Error

Attributing causes of behavior to mind, brain, genes, personality, intelligence, abnormal personality, or genetics Staats calls the Great Scientific Error. According to Staats, learning was overlooked as a cause of behavior because early behaviorists did not develop research programs examining learning principles in complex human behavior, behavior occurring outside the laboratory under natural contingencies. Behaviorisms' total rejection of "personality, intelligence, attitudes, interests or psychological measurement" (p. 33) exacerbated the problem in two ways. First, many in the general population rejected behavioral views because behaviorists rejected these concepts that seemed self-evidently true. Second, behaviorists did not examine the contingencies producing the behaviors subsumed under these labels. Research on reading and language shows the importance of identifying the natural contingencies in development (Hart & Risley, 1995; Moerk, 1990). Thus, Staats calls for a new learning paradigm that extends from the genetic basis of learning principles through how these learning principles function in complex human behavior. Given the methodological advances in genetics and neuroscience, Skinner, were he alive to see it, may well have agreed with this approach.

The Human Animal

Homo sapiens, according to Staats, are unique in two ways. First, humans have considerable sensitivity to a wide range of stimuli (e.g., light, sound, heat, and tactile). Within each stimulus modality, humans are not the most sensitive (e. g., many birds see better than we do). Some species can sense stimuli that humans do not sense (e.g., honey bees discriminate polarized light). However, we are the only species with very good sensitivity in many modalities. Similarly, we have a diversified motor system. True, other species have as much or more strength or fine control of specific motor systems (e.g., cats can jump further and with greater accuracy than we can jump). But we are the only species that has very good control of a wide variety of motor systems (e. g., facial muscles, hand/finger muscles, and arm and leg muscles).

Second, diverse sensory and motor systems need a brain that not only relays "messages" from sensory receptors to muscle fibers but also integrates the inputs from diverse sensory receptors along with neural results of prior experience producing complex sets of outputs to muscle fibers (what normally is called learning). It is estimated that humans have upwards of 100 billion neurons and on average several thousand synaptic connections for each neuron (Kolb, Gibb, & Robinson, 2001). This very large brain, interacting with our diverse sensory and motor systems, is what makes humans unique.

Child Development and the Missing Link

The Marvelous Learning Animal is informed by Staats' own scholarly career, in which he focused on examining contingencies of naturally occurring behavior. Once Staats identified what he hypothesized were the critical contingencies, he would manipulate them to see if he could speed development and thereby demonstrate their importance. Throughout *The Marvelous Learning Animal*, Staats divides behavior and its development, for convenience, into three broad areas: emotion-motivation, sensory-motor, and language-cognitive. Despite these labels, the analysis is thoroughly behavioral; there are no hidden behaviors or processes. In all of these domains, Staats argues, maturation is a function of physical growth interacting with natural contingencies, which change as a child's behavior changes. In Staats' world view, there is no separate process of child development.

Staats rejects genetics (except for those that program for unconditioned reflexes) and epigenetics as the cause of any behavior. Much of the evidence supporting genetic and epigenetic accounts takes the form of documenting that behavioral disruption results when genetic mechanisms are perturbed. Missing from these accounts, however, is an explanation of how, in relevant disorders, changes in genes affect learning. Thus, the behavior analyst's task is to identify how a defective gene disrupts learning. In Staats' view, that knowledge combined with knowledge of the natural contingencies that support normal development allow a complete understanding and effective interventions to minimize or eliminate these so-called genetic or epigenetic disorders.

An example from medicine illustrates the general spirit of this approach and its benefits. Phenylketonuria is a genetic disorder that invariably kills young children with a particular defective gene. Investigators identified the defective gene, but did not stop there. They also found that the non-defective version of the gene produces enzymes necessary for metabolizing phenylalanine, an amino acid toxic to neurons at high doses. A diet with limited phenylalanine, supplemental amino acids, and other nutrients prevents phenylalanine from accumulating and killing young children (Macleod & Ney, 2010), even though the genetic defect remains.

Identifying the natural contingencies in development is an exciting research area for behavior analysts. The working hypothesis, of course, is that behavior putatively caused by natural selection can instead be understood by prior experiences. For example, many consider exploratory behaviors of infants to result from genetics, as this quote from Skinner (1948, reprinted 1975) might be taken to imply: "No one asks how to motivate a baby. A baby naturally explores everything it can get at…." (p. 144). Staats takes the view that exploratory behaviors, and by implication differences in exploratory behaviors, result from natural reinforcement, that is, changes in the environment produced by exploring as when a baby touches an object it may rattle. If natural selection is not responsible for individual differences in behavior, then it follows that these differences result from differences in learning experiences. This is not to say that there are no intraspecies differences in behavior potential. Humans, for instance, evolved genetic and brain mechanisms that are specific to language, but critically it is early experiences that result in language acquisition and language differences across individuals.

As too few behavior analysts have recognized (e.g., Bijou & Baer, 1961; Schlinger, 1995), only a detailed examination of early experiences can identify the role of environment in typical development, and by extension in atypical development. In the case of language, research suggests a clear role for early experience in language acquisition. For instance, the more children are exposed to verbal interactions, the greater their language competences' (Hart & Risley, 1995; Moerk, 1990). This work has inspired a spate of programs to increase the number of words heard by young children with, or at risk for, language problems, with the goal of nudging language development toward a more normal developmental trajectory (e.g., Suskind & Suskind, 2015). It is not yet clear whether these programs adequately reproduce the *natural contingencies* identified in Moerk (1990) and Hart & Risley (1995), but the general approach is consistent with what Staats' advocates: using natural contingencies as the inspiration for early intervention strategies for children who are falling behind developmental norms.

Crucial Concepts in Human Development

In explaining development, Staats assigns an important role to classical and operant conditioning, but he proposes that complex human behavior is best understood in terms of *behavior repertoires* and *cumulative learning*. These two processes, according to Staats, are unique to humans and, when combined with basic learning processes, account for all human behavior.

For Staats, behavior repertoires are complex sets of related stimulus-control relations. He gives the example of a reading repertoire that was built in a dyslexic child via 64,000 trials with a variety of stimulus-control relations involving letters, words, etc. (Staats & Butterfield, 1965.). Staats identified a large number of these repertoires and their interrelations. Such a reading repertoire, combined with sensory-motor development, can promote a writing repertoire. The reading repertoire may combine with a repertoire for following spoken instructions to allow individuals to follow written instructions, or combined with a sensory-motor repertoire allowing individuals to write instructions. Individual behaviors can be part of several repertoires, and repertoires can be hierarchical, with bigger repertoires comprised, in part, of smaller repertoires. One important goal of behavioral research, in Staats' view, is to identifying relations among different repertoires and how contingencies influence these repertoires and their interrelations.

Behavior repertoires result in cumulative learning. In mastery of a repertoire, behaviors learned later are acquired more quickly than previously learned behaviors. For example, children learning to print letters late in the alphabet only require one fourth the trials compared to learning to print the letter *A*. Additionally, mastering one repertoire can make it easier to master a subsequent repertoire. For example, a sound-imitation repertoire combined with suitable prompts produces a word-imitation repertoire that promotes faster language learning. While it may be uncontroversial among behavior analysts to claim that behavior consists of many repertoires and learning one repertoire facilitates learning others, there are few systematic research programs to identify these repertoires, their components, and the contingencies that produce them and establish and maintain their relation to other repertoires.

Staats speculates that cumulative learning influenced human cultural development. Cultural transmission of learning in effect allows one individual's repertoire to build upon another's. As one generation masters a repertoire the succeeding generation can master that repertoire faster and is able to expand that repertoire or beginning learning a repertoire new to the group. Staats gives the example of artistic repertoires becoming more sophisticated across generations. Unfortunately, Staats is somewhat vague on the specific mechanisms driving such changes, implying without sufficient explanation that the cumulative learning of a culture's individual members somehow translates to intergenerational effects (Skinner, 1984, was similarly vague in his account of cultural selection). Staats also places great emphasis on contingency-shaped behavior in his account of cultural development and, surprisingly, omits any function for rule-governed behavior.

From a behavior analytic perspective, a further limitation of Staats' account is uncertainty regarding whether behavior repertoires and cumulative learning, as Staats invokes them, qualify as new concepts. By claiming that these phenomena are uniquely human Staats certainly suggests so, but nevertheless behavior analysts will find much that feels familiar in his use of them. For instance, Staats' analysis of behavioral repertoires and their complex interrelationships brings to mind how reinforcers organize behavior into operants and how the resulting class of responses may not be identical to the class of reinforced responses (Catania, 2013). His description of cumulative learning may relate to learning sets (Harlow, 1949), pivotal response (Bryson, Koegel, Koegel, Openden, Smith, & Nefdt, 2007), and behavior cusps (Rosales-Ruiz & Baer, (1997), although Staats is silent on these possible connection. In the end, readers will be left to ponder important questions that are suggested by, but not answered in, *The Marvelous Learning Animal*, not the least of which concerns what sort of research program may be imagined to test Staats' ideas.

Learning Human Nature

With the preceding as foundational knowledge, Staats addresses specific types of behavior that supposedly are explained by the Great Scientific Error. For example, intelligence tests subsume a variety of repertoires, such as naming, counting, instruction following, and imitating. Differences in intelligence test scores must therefore be interpreted as differences in acquisition of these behavioral repertoires, not differences in an internal entity called intelligence. Staats points out that intelligence test scores predict school performance not because they describe inherent ability but rather because many of the behavior repertoires required for success in school are assessed in intelligence tests. This leads naturally to the proposal for an analysis of the repertoires comprising what we call intelligent behavior, which would include research on the natural contingencies producing these repertoires and, eventually, attempts to foster development by systematically implementing those contingencies.

Behavior analysts will correctly anticipate that Staats proposes that abnormal experiences produce abnormal behaviors. His examples of problematic early childhood behaviors—including tantrums, yelling, hitting, defiance, and so forth—are familiar, as is his suggestion that how caregivers respond to these behaviors influences whether or not they continue and become more severe. These unfortunate natural contingencies produce behavioral repertories that may eventually qualify the individual for a "psychiatric" diagnosis, and once the diagnosis is in place, it elicits sympathy or fear that may only exacerbate caregiver acquiescence to problem behavior. Within the context of autism and a few other disorders, Staats' recommendation for action is equally familiar. He prescribes clearly identifying the relevant behavior repertoires, analyzing the abnormal contingencies which produce those repertoires and exploring how these repertoires may, through cumulative learning, produce additional problem repertoires. A particular contribution of *The Marvelous Learning Animal* is to apply the same approach to understanding the development of dyslexia, paranoid schizophrenia, paraphilias, depression, and other problems less frequently addressed by applied behavior analysts. Staats holds steadfastly to his environmental perspective even in cases where biological damage or genetic abnormalities typically are held to cause the disorder (e.g., Down's syndrome).

Human Evolution and Marvelous Learning

There is much more in Staats' analysis that is worthy of consideration by behavior analysts, including his assertion that cumulative learning has been an important influence in human natural selection. As Staats notes, those in the field of human evolution are beginning to reach a similar conclusion (Diamond, 1992; Gould, 1977; Jablonka & Lamb, 2005), although Staats' account is interesting for the emphasis it places on selection for verbal abilities and how verbal abilities influence selection. Critical thinking is required to examine ways in which the account deviates from those of behavior analysts (see Skinner, 1984, in reinforcement as a mechanism of natural selection) and evolutionary biologists. In the latter case, Staats' hardest-to-swallow view, namely that natural selection provides all humans with equal learning abilities because variation in learning ability is selected out. This notion is at odds with the widely accepted notion that natural selection is possible only when populations contain variability (Dawkins, 1976).

A Human Paradigm

It is refreshing to see an environment-centric alternative to the Great Scientific Error, and behavior analysts will appreciate Staats' panache in placing learning at the center of all explanations of human behavior. They also will be interested in his conclusion that radical changes are required in the basic science of human behavior and the application of that science to clinical practice. In Staats' view, the revised science needs to know much more about how learning and biology combine to produce behavior, which implies relying on techniques (e.g., brain imaging technology, genetic assays) to understand the interrelatedness of learning and biology. Many behavior analysts will sympathize with Staats' proposition that the field of child development needs to be almost entirely restarted, using sophisticated observational methods required to identify the natural contingencies in development. Perhaps less intuitive, and therefore more challenging, to behavior analysts is Staats' implication that, ultimately, the study of human behavior can only proceed with a proper study of development as he defines it. For example, an infant lies on their stomach pushes up with their arms which raises their head allowing them to see objects hidden behind other objects. If seeing a new view is reinforcing, or seeing objects previously followed by reinforcers is reinforcing, then infants will continue to push up. As they raise their head further above the surface, more items come into view. Eventually the standing infant may lean toward a favored object. They move a foot, preventing themselves from falling, bringing them closer to a reinforcing object. The first proto step has been naturally reinforced. Although, non-behavior analysts have collected data supporting aspects of this analysis, they did not include the *functions* of behaviors as walking developed (Adolph, Cole, Komati, Garciagurre, Badaly, Lingemanm, Chan, & Sotsky, 2012).

A central irony of behavior analysis is that its adherents (beginning with Skinner, e.g., 1953) have maintained that complex environmental relations account for the diversity of human behaviors, while their own work carefully analyzed only a limited range of interesting behaviors. *The Marvelous Learning Animal* challenges behavior analysts (and other readers) to imagine what a behavior science would look like if it thoroughly examined all of those interesting behaviors. In this regard, it matters little if along the way Staats commits a variety of transgressions such as failing to fully explain every concept, possibly playing fast and loose with natural selection, relying on lay terms that carry mentalistic connotations (this is, after all, a popular press book), and occasionally speaking ill of radical behaviorism.

These details should not be allowed to distract from the book's essential challenge, which is to ask those who would advance environmental experience as the primary engine of behavior development to develop the science that is needed to test and support such an account. Staats delivers an analysis of complex human behavior that is indisputably behavioral and often consistent with a radical behavioral view. Where the analysis diverges from radical behaviorism as it has traditionally been practiced, it most often offers expansion rather than contradiction and thereby provides a stimulating basis for further inquiry.

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