Preface

The Author's Education and the History of this Book

During the late 1950s as an undergraduate, first at Florida Sate University and continuing at the University of Colorado, I pursued extensive studies in mathematics, physics, chemistry, and geography before specializing rather passionately in geology, a field that I voraciously explored, earning 64 semester hours of undergraduate credit while planning to pursue geology graduate degrees and a career. To meet the general education requirements of those two universities and to pursue in greater depth various scientific fields of interest I regularly attended summer sessions and also added a fifth year to my undergraduate training.

However, the completion of my undergraduate studies coincided with a period in United States history when employment opportunities in geology were sparse, and the prospect of finding an attractive job was low. Having recently become married to a young woman who was still in the midst of her own university studies, I soon discovered that most of the scarce available positions in geology were in unattractive remote locations, mostly in specializations in which I had limited interest. Those jobs also tended to come with few amenities and afforded no opportunities for the continuation of university studies. As the field of geology plunged further into its recession cycle, the competition for openings in preferred programs of graduate study stiffened accordingly.

After reconsidering my narrowing professional options I turned to another kind of scientific career, science teaching, the appeal of which had been increasing in part because it offered the prospect of a more stable and reliable professional employment. In the teaching field jobs were relatively plentiful, especially in the scientific areas. One could find an open teaching position almost anyplace, and various kinds of advancement opportunities abounded. At the University of Colorado, while taking some courses to earn a secondary teaching credential, I entered a masters program that focused on basic scientific principles among the various natural sciences. Having previously neglected biology, I took that opportunity to delve into such topics as genetics, ecology, entomology, and animal geography along with some additional physics.

That episode of training culminated with a Masters degree in Basic Science, and I accepted a high school science teaching job in Denver, Colorado that was to begin in the fall of 1960. However, during the summer before the first term began, I unexpectedly received the offer of a teaching position at a much higher salary in the Panama Canal Zone for which I had earlier applied on the basis of its adventurous appeal but with little expectation of acceptance. I negotiated out of the Denver contract and moved to the Canal Zone as a teacher of physics and mathematics at Balboa High School. My wife also found employment with the Canal Zone schools, she as a Junior High School science teacher.

After five years of teaching high school physics and algebra II, the distinction between doing science and teaching science had become increasingly evident to me, and it was the challenges of the latter that increasingly had come to interest me in a technical sense. Although I had been trained formally to teach, after several years in the classroom it was slowly dawning on me that during the course of my formal training *teaching* per se had gone undefined in objective terms that could help one do it. Increasingly, I was left with an uneasy feeling that the entire education curriculum through which I had passed had failed to penetrate analytically to the essence of the teaching task, but in spite of that growing unease I was unable at that time to specify precisely what was wrong.

I left Panama to enter a doctoral program in the field of Instructional Technology at the University of Southern California in Los Angeles. As my studies in that doctoral program progressed, it soon became obvious that the field of education was relying on the currently prevailing psychological theories, which typically were informed by the superstitious assumptions about the nature of human beings and their behavior that prevailed in the ambient culture. Educators focus on human behavior, but I found that those practitioners, whose job is to produce worthwhile changes in student behavior, were not being provided with effective principles and procedures by which to establish objective functional accounts for the important behavioral effects that they were expected to produce. My required doctoral–level courses in educational psychology were bereft of any coherent behavior science that could account effectively for the behavioral phenomena upon which the field of education was focused. Humans, it was assumed by most leaders in education, have a mystical essence whether revealed religiously or secularly, and with the substantial majority having accepted that, educators were unable to develop an education science that was effective in practical ways while remaining compatible with such mystical philosophy. With the development of an effective technology of teaching thus out of their reach, instead of continuing to bet on eventual success, the educational psychologists had increasingly come to invest their professional capital merely in the quixotic cycle of futile efforts.

Speculative psychological theories arose and faded in fashionable temporary eruptions. Each new theory informed a special set of practices that were reflected in a passing wave of popularity within the field of education. Not incidentally, its originator's career would typically be accelerated to its pinnacle. As a result, educational practice was characterized by its ever changing bag of tricks. Each of the often fanciful theories, along with the new practices and catch phrases that it supported, was touted as effective during its heyday, but with respect to the professional status of particular educators, it was the recency of emergence that always tended to trump the actual effectiveness of their practices.

At the completion of my doctoral studies, I accepted a faculty position in the College of Education and Human Resources at West Virginia University, which I held for 32 years until my retirement in 2001. Upon arriving at West Virginia University I soon became affiliated with a small group of colleagues who were interested in finding and establishing a basic natural science of behavior that could inform an effective behavioral technology of teaching. That

group was centered around professors Ernest and Julie Vargas who were assuming its leadership roles. With the three of us housed in adjacent offices, Julie Vargas became my close colleague and Ernest Vargas, who headed the unit to which I was initially assigned, became a friend and a mentor. None of us had had an opportunity to study such a natural behavior science during our earlier formal training, but we enjoyed a kind of link to a science of that nature that had been emerging across past decades via the work of professor B.F. Skinner at Harvard University. Julie Vargas was Skinner's elder daughter.

Upon recognizing that the science that Skinner had been developing and publishing was the basic natural science of our teaching profession, we set about to educate ourselves, belatedly, in the relevant fundamentals of our own field. To do that, we formed a reading and study group that met weekly, usually in the home of a participant. We took on one Skinner book at a time (see the *Bibliography*), beginning, as I recall, with *Science and Human Behavior.* We also read parts of Skinner's first great work, *The Behavior of Organisms.* We read and discussed *The Technology of Teaching* (Skinner's analytical foray into education). But our greatest undertaking was a thorough exploration of Skinner's masterpiece, *Verbal Behavior,* the completion of which had required 25 years of Skinner's authorial labor. Our study group, usually from six to ten individuals, included a few other faculty members from around the university as well as a couple of the more promising graduate students. Each week, the next section of the current book would be assigned and one member of the group would be responsible for leading the group's discussion of its contents. The social contingencies of that collegial approach proved effective in that my weekly preparation for those meetings tended to take precedence among the activities on my busy professional calendar.

Subsequently, the Vargas duo and I began cooperatively to develop a graduate training program in the basic natural science of human behavior and its applications in the field of education. Over the next 20 years Julie Vargas developed, taught, and continually refined a graduate course that emphasized the adoption of the basic principles of that science to practical problems in teaching. She had soon authored an effective textbook on that theme. Ernest Vargas concentrated on two courses, one an introductory undergraduate two–semester course for future teachers, and the other an advanced graduate course that focused exclusively on verbal behavior as Skinner had earlier defined that phrase (see Chapter 26 in this book). I soon began work on a comprehensive general graduate course that would introduce the breadth and depth of this natural science of behavior mainly to students who had not yet encountered such a discipline. My course would eventually come to be known informally as General Behaviorology.

From the outset I began writing textual materials for that graduate course and designed the instructional exercises in which the students engaged. With new refinements, expansions, and additions being added to the subject matter every semester across the 1980s and 1990s, those accumulating materials began to take the form of book chapters. Eventually, each semester's edition of the growing and maturing book was produced by a local copy service and sold to the students in my current class. By the time of my retirement from the uni-

versity in 2001 the book included earlier editions of Parts 1 and 2 of this book, with most of Part 3 yet to be written. To produce the current three–part science book, I extracted and transferred many of the routine quiz items, practice exercises, and other purely instructional devices to a separate file while leaving behind a few such items with which readers of this book can verify the validity of their forming concepts. As the initial project of my retirement I then began writing the final set of chapters in this book to complete Part 3. During 2006 the first draft of Part 3 was concluded. Following two more years of editing and supplementary writing, the first edition of this book was readied for production in 2008.

Relevant Accidents

An author, upon completing a substantial writing project, may reflect on the sequence of events that led functionally to that project, perhaps experiencing a sense of awe at the historical improbabilities that fell into place along the way to enable its occurrence. In a more limited way it represents the kind of contemplation by which one ponders the likelihood of one's existence given all those ancestors—each female with hundreds of eggs and each male with millions of sperm cells. And if that sort of regressive multiplication is continued phylogenetically all the way back to the primordial slime, in just being here each of us, to astronomically understate it, has already won a lottery far more grand than any for which we may now buy a ticket.

With the conceptual isolation of any given step in a historical sequence of events, and with a sufficient objective analysis of that step, functionality can be revealed—functionality being our descriptive term of reference for a relation that is fundamentally established via a transfer of energy. In the language of common lore, every event happens for a reason, but our capacity for the analyses that are necessary to explain it is subject to rather quick exhaustion. The common term for an event beyond the bounds of our current capacity for explication in objective technical detail is *accident,* but contrary to a common conception, accidents are not best regarded as spontaneous events. It is better to regard them as functionally determined events beyond the scope of our analytical and explicative economy. Unlike the former kind of regard, the latter kind preserves the worth of our investments to expand that economy.

While in the functional continuity to which we refer as a relevant history *every* step is critical, some take on a contextual salience. We say that those events stand out, and those are the ones that we tend to talk about. This book, I am quick to note, could not have been written by the geologist that I once trained to become, and had not the eventual collapse of the post World War II market for uranium ore dumped a flood of unemployed geologists into the job market, perhaps I could have found attractive employment opportunities in that field. Other such factors included finding an open position at West Virginia University, discovering that my closest colleagues there were the daughter and son–in–law of B.F. Skinner, and the revelation that Skinner had been

developing the rudiments of a comprehensive behavior technology that would provide the missing foundation of our profession.

Note on the Style of this Book

To make this a more readily readable science book, I have not interrupted the flow of its text with citations to the sources of every detail that is being mentioned. That would be more characteristic of a journal article in which a new scientific step is being announced to a narrower audience of critical peers. Where a citation may be of particular interest or importance I have included it, often parenthetically or in a footnote. A partially annotated list of related literature, with the relevance of many of its entries indicated, is provided in the *Bibliography* that is located at the end of this book.

Studying This Book

Persons, perhaps well trained in the natural sciences and perhaps employed in a natural science specialization, who are nevertheless unfamiliar with the behaviorological level of analysis, are left by the shortcomings of their respective formal education within a highly superstitious culture to discover for themselves the *natural* science of human behavior. As such persons are undergoing their subsequent introductions to the natural science of human behavior they become progressively more aware of (a) the perhaps daunting gap in their schooling left by the often disguised curricular absence of naturalism in the disciplinary treatment of that subject matter and of (b) the far–reaching implications of that omission. Under those circumstances it can be especially helpful to recreate the functional atmosphere of a university seminar by approaching the study of this book as part of a perhaps informal reading and study group. Such an approach to this book can prove especially productive among a group of natural scientists and philosophers who are trying to raise the low spot left in their respective scientific proficiency profiles as a result of the natural science community's traditional forfeiture of human behavior to organized superstition including the secularized versions that are widely prevalent in contemporary academia.

Some Persons whose Behavior Affected this Work

It was the fall of 1951. I was a tenth–grade student at Clearwater High School on the west coast of Florida. One afternoon at the end of classes I returned to the biology classroom to ask a question of Mr. Robert Nesti, my biology teacher. It was a simple question, although the answer that I would receive was loaded with profound implications: I asked simply, "What is *life?"* Nesti responded by asking whether I was seeking a religious or a scientific kind of account. When I indicated to him that I was seeking an objective explanation of

the scientific kind, he sat down with me and sketched out in rudimentary form a general scientific description of the nature of life. That account did not involve any recourse to supernatural phenomena. Within less than a year after that discussion, the ongoing analytical course along which that milestone occurred had led me to the conclusion that the world was entirely natural. In 2005, as the writing of this book was drawing toward its conclusion, I made contact with Robert Nesti for the first time in over 50 years. He was in his 80s and long retired from his teaching career. As we continued to exchange some of the details of our lives I hope that I was able to give him a sense of the constructive impact that he had had on mine.

The early part of this Preface provides some historical details about my career at West Virginia University, including my years of collegial association with Ernest and Julie Vargas. For over two decades they were close colleagues and good friends as we worked as a team to introduce natural science to the study of human behavior in a college that tended to be an academically hostile environment for anyone whose scientific pursuits and teaching were informed by a philosophy of naturalism. Among the things that I now have to say, where an element seems entirely or partly new, its incipience can often be traced to conditioning that occurred during hundreds of rich and challenging discussions that seemed to ignite on most any occasion that we met—discussions that tended quickly to carry to the intellectual frontier of the moment. In 1987 we three, along with a small group of colleagues from other institutions, including Stephen Ledoux, coined the term *behaviorology* and organized the first meeting of its professional followers.

Through the last couple of decades of my professorial teaching career I taught the continually expanding contents of Parts 1 and 2 of this book exclusively to graduate students about two–thirds of whom were in college doctoral programs. The remainder of my students were enrolled in various masters–level programs. Excepting the relatively small number of students who were specializing in behaviorology, among the remaining students in each class (a substantial majority), almost all brought nearly intractable mystical assumptions to my course. In most cases, those mystical assumptions had been conditioned through religious indoctrination and in nearly all cases had been bolstered in secularized social science academic programs. Such academic programs tended to accept uncritically any religiously installed mysticism and then to build constructively upon it by devoting scientific efforts only to the pursuit of those of its behavior–related implications that led to no substantial contradictions of the underlying mystical assumptions. Speaking of *selves* instead of *souls* afforded a guise that had no transformational impact on the prevailing mysticism. Such mystical assumptions, brought to my classroom by the majority of my students, informed those students' personal interpretations of all objective evidence pertinent to the nature of human beings and their behavior.

The strict natural science perspective that I maintained in all of my courses proffered no compromises with such superstitiously derived assumptions and operated according to a kind of logic that tended to be incompatible with those students' preconditioned and heavily superstitious intellectual framework. Not surprisingly, while they could not mount logical challenges to the objectively

established relations that constituted the basic principles of behaviorology, they tended to resist mightily the induction of any naturalistic assumption that would contradict the superstitiously derived assumptions with which they arrived. That resistance usually took the form of the most penetrating critiques of the natural philosophy and science of behavior that their kind of logic and assumptions would support. I always encouraged their best counterarguments, and I got them in abundance. Each class session sent me reeling back to my computer to repair whatever breaches that those assaults had left in my concepts. As a result of such cycles, during each semester the new class of students confronted presentations of the subject matter that better withstood such attacks. It was not that the validity of natural science can be threatened by superstition, but the presentation of natural science has to be crafted carefully to disallow what to superstitious people may seem like opportunities to do so. Also, whenever I carelessly did present anything invalid, however subtle its intrusion, in such a critical atmosphere it was usually soon exposed, and I had to fix it quickly. Thus, the initial contents of my personally authored text and the lectures that I based upon those contents were subjected to a relatively intense clean–up across the semesterly iterations.

That ongoing game of challenge–and–react occurred in the friendly academic atmosphere of a university graduate classroom and, in general, was enjoyable to all for whom intellect could trump emotion. To the extent that a reader may find the text in Parts 1 and 2 to be characterized by logical explication, it is much the legacy bestowed by those legions of students. Nevertheless, as a current reader will probably be able to verify, they could not have found all of the flaws that I left embedded therein.

Finally, as I have worked over the past decade to complete the writing and to prepare this book for publication, the advance of this project would not have occurred had it not been for the extraordinary contribution of my good friend and colleague Dr. Stephen F. Ledoux, a faculty member at the State University of New York at Canton. Professor Ledoux has established himself in the field of applied behavior science from the natural science perspective. Having designed courses for an applied behaviorology curriculum at his university, he has emerged as a leading promoter of the discipline. Professor Ledoux has provided critical and detailed reviews of the drafts of the chapters in this book resulting in substantial improvements. And, finally, he has become involved in facilitating the publication of this work. He and I have also previously collaborated in authoring a detailed history of the emergent discipline of behaviorology (see Fraley, L.E. & Ledoux, S.F. [1997]. Origins, status, and mission of behaviorology. In S.F. Ledoux. [2002]. *Origins and Components of Behaviorology—Second Edition* [pp. 33–169]. Canton, NY: ABCs).♣

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