BOOK REVIEW

Natural Science and Learning: A Review of Behavior Analysis and Learning (5th Edition)

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The fifth edition of *Behavior Analysis and Learning* (Pierce and Cheney 2013) clearly identifies learning as a natural science process and places behavior analysis at the center of learning research and theory. The text progresses from fundamental assumptions, methods, and basic principles, to complex applications and culminates with a strong discussion of selection by consequences as the underlying principle for behavioral, evolutionary, and cultural change. The authors root their text in classic and contemporary empirical studies in the experimental analysis of behavior. Additionally, the text frequently branches into applied behavior analysis, behavioral neuroscience, and other topics with thoughtful and challenging subsections. The depth and scope of this latest edition of *Behavior Analysis and Learning* makes it a highly versatile text that can fulfill various goals of undergraduate and graduate programs. What follows is a review that highlights selected chapters, summarizes noteworthy supplemental sections, and identifies considerations for potential readers.

Chapter Highlights

Simply reaching a fifth edition of *Behavior Analysis and Learning* suggests that the text resonates with teachers and students across the field of behavior analysis. The

success of the book has been predicated, in part, on the authors' ability to introduce topics in a clear, logical, and student-centered manner. Furthermore, topics are anchored by the description and discussion of empirical data. Like previous editions, and like other established textbooks (cf., Catania 2013; Cooper et al. 2007; Malott 2008; Martin and Pear 2011; Miltenberger 2012), the text introduces fundamental concepts in early chapters then develops them into complex applications and theoretical discussions in later chapters.

The first chapter wastes little time introducing the experimental analysis of behavior and the principle of reinforcement to the reader (p. 2). Chapter one identifies behavior analysis as a natural science and outlines the assumptions of the field in a manner that provides historical and contemporary context. For instance, the discussion related to selection as a causal process for behavior uses work by the evolutionary biologist Richard Dawkins (1996) to provide contemporary context to some of the earliest work by behavior analysts (Skinner 1938). This opening chapter sets that stage for a well-rounded discussion of behavior analysis as a natural science.

Pierce and Cheney emphasize operant conditioning as the primary way to understand behavior, but one of strongest aspects of the text is the treatment of respondent conditioning, beginning with a chapter that introduces the foundational concepts. The text then introduces operant conditioning over the next three chapters. The authors return to respondent conditioning for an engaging discussion on the interrelations of operants, respondents, and biology in the seventh chapter, discussing phenomena such as instinctual drift (Breland and Breland 1961) and autoshaping (Brown

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and Jenkins 1968) in a manner that provides insight into concurrently operating operant and respondent processes. Similarly, species-typical behavior and evolutionary preparedness are discussed through work such as taste aversion, which addresses neurobiological context of operant and respondent conditioning (Barot et al. 2009). Chapter seven is exemplary for its ability to clearly describe complex behavioral relations between respondents and operants. Furthermore, this chapter serves to remind the reader that behavior is an extension of biological principles, and it sets the stage for a later discussion of the role of selection by consequences on a biological, behavioral, and cultural level.

Fittingly, the text culminates in an analysis and synthesis of selection by consequences on those three levels: biology, behavior, and culture. Unifying these diverse fields of study under one principle, without reducing behavior or cultural practices to biology, is fairly unique for learning texts and is an important lesson for all students of learning theory. Natural selection is discussed as the principle that guides evolutionary change at the level of biology. The discussion of evolution through natural selection covers well-traveled terrain, such as the influence that genes have on behavior, but also highlights how behavior can affect genes. Classic (Skinner 1984, 1986) and contemporary (Ginsburg and Jablonka 2010; Leal and Powell 2012) theories relating the impact that behavior may have on survival are presented as compliments to established evolutionary theories (Dawkins 1976; Gould 1989, 2002).

Reinforcement is the selection principle on the behavioral level. The concept of reinforcement is thoroughly established in earlier chapters, so this section is well-suited to support the concept through discussion of ontogenetic adaptability (Glenn 1991), computer analogs (McDowell and Popa 2010), neuroscience (Donahoe 2002), and genetics (Pierce et al. 2010). Finally, selection on a cultural level is introduced and discussed.

Selection on the cultural level is described as interlocking operant behavior of individuals within a group. Functional relations between cultural practices and cultural outcomes are then described using the concept of metacontingencies (Glenn 1988, 1991, 2004). Unfortunately, this discussion of metacontingencies in human culture is not supported with citations or examples of relevant empirical research, and it would be beneficial to incorporate some of the empirical work with metacontingencies in future editions (e.g., Ortu et al.

2012). In the current edition, the authors effectively use nonhuman animal research to illustrate shifts in socially transmitted behavior (Pierce 1991) and interpretations of established cultural practices (Harris 1974) to guide their discussion of culture. In total, the chapter makes clear that selection by consequences is a viable principle to explain change at the biological, behavioral, and cultural level. Furthermore, this discussion illustrates that change as a response to consequences improves the odds of survival for the individual or species, which places learning and cultural practices in the realm of the natural sciences.

The major thesis of the book, that behavior analysis is a natural science, is apparent in most chapters and punctuated in chapters 1, 7, and 14. The text also includes chapters that expand the scope of behavior analysis to the realms of language (Chapter 12: Verbal Behavior) and clinical applications (Chapter 13: Applied Behavior Analysis). In the case of verbal behavior, the authors introduce the verbal community, verbal operants, and more complex symbolic relations (e.g., stimulus equivalence) as part of a focused introduction to this area of study. The treatment of the subject closely follows the early theoretical work of B.F. Skinner (1957) while providing contemporary empirical evidence (e.g., Normand et al. 2011) and conceptualization (e.g., Sundberg and Michael 2001). This chapter succinctly introduces the reader to the complex endeavor of studying the functional relations found in language and communication. The chapter on applied behavior analysis exposes the reader to some specialized methodological practices and areas for clinical application. Importantly, the chapter describes a number of successful applications of behavior analysis to show how it can be applied to solve social problems in the manner described by Baer et al. (1968). Furthermore, including classic applications, such as precision teaching (e.g., Lindsay 1972) alongside contemporary applications like contingency management (e.g., Higgins et al. 1994) might inspire students to transfer the principles of behavior analysis to social problems in their own lives and careers.

Summary of Supplemental Sections

Along with the chapters themselves, the supplemental sections embedded within the said chapters are a strength of this text. These brief sections—typically one to four pages—come under various headings, such

as the following: “Focus On,” “Comment On,” “Note On,” “Advanced Section,” “On the Applied Side,” and “New Directions.” The authors use the supplemental sections to introduce challenging material in at least four different contexts. The first types of subsections (Focus On, Comment On, and Note On) typically highlight historical figures (e.g., “Focus On: B.F. Skinner,” p.11) or controversial issues (e.g., “Note On: The Legal and Ethical Use of Electric Shock in a Residential Treatment Program,” p.163). The “Advanced Sections” challenge the student by providing quantifiable equations and discussions related to complex chapter topics (e.g., “Advanced Section: Schedule Performance,” p.141). The socially relevant applications of basic behavior principles are illustrated with applied behavior analysis examples in “On the Applied Side” sections. For instance, an analysis of data from self-injurious behavior illustrates one of the many potential uses of Herrnstein’s matching equation (McDowell 1980) in “On the Applied Side: Application of that Quantitative Law of Effect” (p. 267). Finally, advances in behavioral neuroscience as they relate to behavior analysis are discussed in the “New Directions” sections. In these sections, findings in behavioral neuroscience are interpreted through the principles of behavior analysis to support chapter topics (e.g., “New Directions: Neuroscience and Conditioned Reinforcement,” p. 301). Again, these sections help challenge the reader and illustrate the scope of behavior analysis.

The preface notes over 300 additional citations (p. xix) that supplement the text by providing depth and scope. Many of the added citations are from contemporary material and help to bolster established behavioral phenomena. One example is a novel use of progressive ratio schedules (PR) to assess the reinforcing efficacy of drugs with abuse liability in contemporary behavioral pharmacology (e.g., Stoops et al. 2004). Additions to the text are perhaps most notable when included as supplemental sections. For instance, the authors address ethical issues related to treatment by describing a recent high profile and controversial application of punishment in “Note on: The Legal and Ethical Use of Electric Shock in a Residential Treatment Program” (p.163). Additionally, the authors have added a number of New Directions sections to this edition, which reflect the well-established and growing practice of accounting for neurobiological mechanism in learning theory. In all cases, the inclusion of new material expands the scope and depth of the text.

These supplemental sections, along with the final three chapters, help expand the natural science of behavior analysis and increase the versatility of the text. The discussions introduce closely related fields to readers who may not be exposed to them, otherwise. Furthermore, the topics covered are influenced by, and influence, the experimental analysis of behavior; thus, the reader can see the interplay between the natural science philosophy of behavior analysis and the practices of some closely related fields.

Audience Considerations

Behavior Analysis and Learning is primarily an introductory text, but due to its scope and depth it is a highly versatile text that is suitable for undergraduate and graduate students. Instructors could successfully introduce the field without the inclusion of the supplementary subsections (e.g., Advanced Sections) and challenging later chapters (e.g., Verbal Behavior). The text allows undergraduate instructors the freedom to focus on basic principles while maintaining their ability to include supplementary subsections and chapters, as warranted. A graduate-level application of the text might use it to introduce or, perhaps more likely, reintroduce the subject matter. Of course, given the goals of most graduate programs, instructors should make every attempt to include the supplemental sections and challenging chapters. Additionally, the instructor could use the text as a tool to support reading and discussion of primary sources. Regardless of the level of instruction, the book is versatile and can be used to inform and challenge students at all levels.

Within the field of behavior analysis, there seems to be a trend for specialization; the most relevant for the purpose of this review is the distinction between “basic” and “applied” research. The relative merits of this distinction have been, and will continue to be, debated, but this debate is not the focus of the current discussion (cf., Morris et al. 2001). What is important is whether the so-called basic and applied students would benefit from the instruction with this text, and the resounding answer is yes. True, the book is primarily driven by discussion of the experimental analysis of behavior and basic laboratory research; however, it frequently ties these lessons to applied behavior analysis. The frequent ties to applied behavior analysis and the correspondence between the foundations of basic and applied behavior analysis

should help prepare students for any career behavior analysis. Likewise, instruction based on this text should adequately prepare students for certification by the Behavior Analysis Certification Board®. Thus, this book represents a versatile text for both basic and applied students with various career goals.

Conclusions

The fifth edition of *Behavior Analysis and Learning* is a highly adaptable text that identifies behavior analysis and operant conditioning as the guiding principles of learning. The text not only positions behavior analysis as a natural science, but also establishes the role of selection processes working at the biological, behavioral, and cultural level. The unifying themes of natural science and selection by consequences allows the text to not only account for learning on a behavioral level, but to also explore its applications to clinical treatment, cultural practice, and neurobiological mechanisms. The exploration of the unifying themes progresses through a well thought-out structure that makes the text accessible for undergraduate and graduate students in both the basic and applied realms of behavior analysis.

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