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REVIEW ARTICLE

Resolving Barriers to an Applied Science of the Human Condition: Rule Governance and the Verbal Behavior of Applied Scientists

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Abstract

Rules / verbal behavior governing applied behavior scientists since Skinner have achieved great success resolving challenges experienced by individuals with severe developmental and intellectual disabilities. We extend prior work by Dixon, Belisle, Rehfeldt, and Root (2018, "Why We Are Still Not Acting to Save the World: The Upward Challenge of a Post-Skinnerian Behavior Science," *Perspectives on Behavior Science*, *41*, 241–267) by suggesting that many of these rules, applied inflexibly, are unlikely to resolve significant problems experienced by humans without these same intellectual challenges (i.e., most humans). Particularly, methodological models of human behavior that ignore both private events and advances in relational frame theory and that favor a bottom-up inductive theorizing have not, and we argue cannot, address uniquely human challenges. Instead, we propose alternative rules developed in part within contextual behavior science that are more consistent with Skinner's radical behaviorism than are current approaches and that may expand the scope of applied behavior science. Only by adapting our own public and private verbal behavior as applied scientists can we move toward solving the wide range of challenges within the human condition.

Keywords Radical behaviorism · Contextual behavior science · Pragmatism · Reticulated theory · Private events · Automatic contingencies

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Almost 50 years after Skinner (1938) first established a comprehensive account of basic behavior principles and extended this work to account for human behavior (Skinner, 1953), he questioned why *we* (all humans) were not using behavior science to address the widespread suffering that confronted humanity (Skinner, 1987a). In that article, Skinner's solution was to adapt what applied scientists knew about fundamental behavior principles to technologies that operate on our own behavior, moving people toward that which they value and away from self-imposed harm. Over 30 years later, Dixon, Belisle, Rehfeldt, and Root (2018) renewed this concern but instead suggested that the use of behavior technologies developed exclusively from principles found to control animal behavior (i.e., direct and immediate operant control) was the fundamental obstruction to developing more successful technologies for human problems. Dixon et al. (2018) suggested that current accounts of human behavior are not sufficiently sophisticated to account for uniquely human problems and called for much more extensive research in all domains of human suffering. Although successful behavior analyses over the last 50 years have been published in flagship journals of the applied subfield of behavior science (e.g., *Behavior Analysis in Practice* [BAP], *Analysis of Verbal Behavior* [TAVB], *Journal of Applied Behavior Analysis* [JABA]), that research has largely addressed behavior problems for people with severe intellectual challenges (e.g., self-injury, elopement). Additionally, although behavior analysis has been quite successful in developing language skills (e.g., Corsello, 2005; Dawson et al., 2010; Ejiyeh, Abedi, & Behnamnejad, 2015; Eldevik et al., 2009; Howlin, 2011; Lovaas, 1987), this, too, has largely been in establishing elementary language from a direct contingency account (Dixon, Small, & Rosales, 2007; Dymond, O'Hora, Whalen, & O'Donovan, 2006) or simple demonstrations of equivalence class formation (Belisle et al., under review; Dixon et al., 2018). The seemingly restricted application of behavioral principles to children with diminished language abilities is used as support for Dixon et al.'s (2018) argument that our scientific analysis of human language is not sufficiently sophisticated for the application with typically developing verbal humans. Although Skinner was confident in the accuracy of the then-present science of human behavior, he, too, was not certain the account was adequate (1987b, p. 11) because, despite the construction of such a useful science, people faced—and still face—significant challenges (e.g., violence, terrorism, personal suffering, suicide, substance abuse, environmental destruction, unsafe behavior, uncooperativeness).

In the current article, we not only support suggestions made by Dixon et al. (2018) but also contend that success in new domains of applied behavior science will rely on adapting our own verbal behavior as applied scientists (i.e., rules that govern the actions of scientists) and that doing so is entirely consistent with Skinner's pragmatic approach to radical behaviorism (RB). If we assume that the actions of applied behavior scientists operate under some degree of contingency control, then we must also assume behavior that is successful in achieving desired outcomes not only becomes more probable but also can become resistant and inflexible in changing contexts (Nevin & Grace, 2000; Nevin & Shahan, 2011). Resistance, including failure to adapt, may be especially apparent when a scientist's behavior, which at one point is controlled largely by external contingencies of data, begins to share that influence with private contingencies, rule governance, or what the scientist has to say about his or her data. That is, problems in adaptation can occur as the verbal scientist contacts reinforcement or successful work through the application of a potentially narrow set of rules (see Catania, Shimoff, &

Matthews, 1989, for an account of the interplay between contingency control and rule governance). As mentioned previously, rules employed by behavior scientists to solve the problems faced by people with severe language challenges have been extraordinarily successful. However, if rules that have been successful in disability treatment are not successful in other domains, we suggest adopting alternative rules that are more likely to be successful in new contexts.

This argument is, again, consistent with the Skinnerian method of manipulating independent variables unhampered by affirming any given theory[1] in the service of successfully producing reliable changes in behavior (Skinner, 1950, 1956)—in this case, in our own scientific behavior. In the sections that follow, we describe some specific barriers or rules that, though undoubtedly adaptive for changing the behavior of individuals with diminished verbal behavior, have not yet generated large-scale successful outcomes in addressing challenges experienced by the rest of the verbal world. These problematic rules are evident in the philosophy of behavioral work, in our approaches to theory development, and in our language-learning models. We offer corresponding alternative rules that are (a) consistent with Skinnerian RB and functional contextualism (FC) and (b) potentially more adequate to address challenges in the experience of verbally sophisticated humans. Our purpose in writing this article is that, although calls for increasing the scope of our applied subfield have been published in major behavior-analytic journals (e.g., *JABA, 39,* 2006, Special Section: Clinical Behavior Analysis, pp. 407-474), simply identifying the problem has been insufficient without an analysis of the functions leading to the problem. We therefore contend that verbal rules governing scientists and practitioners in applied behavior analysis, when applied inflexibly, are a major current factor that may functionally limit the current scope of our applied subfield.

Rule-Governed Barriers to Advancing the Scope of Our Science

Philosophical Rules

At the most fundamental level, precisely *what* is within the domain of behavior science and practice is a philosophical question addressed frequently by Skinner (e.g., 1953, 1957) and contemporaries (Chiesa, 1994; Cooper, Heron, & Heward, 2007; Moore, 2008). For example, the orbital trajectory of planets is decidedly not a topic of ongoing research for behavior scientists because studying the orbital trajectory of planets is unlikely to serve as a proximal cause for what people do (i.e., behavior). Although agreement between any applied behavior scientists may be easily achieved in determining what behavior science *is not*, agreement is less easily achieved regarding what behavior science *is*. Further, philosophical rules that operate successfully in one context may not be as successful in another context. In this section, we present competing philosophical positions that can guide the behavior of applied behavior scientists: RB

[1] Although Skinner advocated for theories that describe certain basic assumptions (e.g., that nature is orderly) and that guess at the result of an experiment before the experiment is carried out (Skinner, 1950), he advocated against hypothetico-deductive theorizing and using theory at one level of analysis to explain events at another level (Skinner, 1950, 1974).

and methodological behaviorism (MB). We suggest that some methodological approaches have been successful in many current applications of behavior science. However, rules more consistent with RB may be needed to solve other worldly problems.

RB versus MB approaches to private events Skinner's RB (1945) philosophy included all behavior, both public and private, as the scientific subject matter of the behavior scientist. The inclusion of private events in Skinner's RB approach differed markedly from MB (see Moore, 2008, for an in-depth discussion of these philosophical traditions), which insisted on an exclusive analysis of external stimuli and public behavior. Arguably, the role of many private events (e.g., thinking) is minimal or absent in animal learning compared to human learning, so an emphasis on immediate control of public antecedents and consequences (e.g., operants, reinforcement schedules) is pragmatic in basic animal research. These approaches have also served as the bedrock of behavioral treatments for children with disabilities and, therefore, as the foundation for most behavior science applications. However, Skinner never abandoned his concern for private events (1953, Chapter XVII; 1957, Part V; 1963; 1969, Chapter 9) because private behavior (analyzing, thinking, and language) was needed to make sense of all the available data to help formulate a "consistent account" of *all* human behavior (1969, p. 228). If much of the private behavior that participates in human behavior is derived from language or verbal behavior, then it should come as no surprise that those technologies that ignore private behavior have been most frequently applied for children with disabilities that present significant language challenges. Skinner, however, did suggest that once language develops, verbal events such as rules play a considerable role in a complete functional account of behavior (Skinner, 1969).

Palmer (2011) more recently suggested that private events are a vital part of the explanation for behavior. Even though private events cannot participate in the formulation of behavior principles, because they cannot be observable data and so play no role in the experimental analysis of behavior, private events can be used to interpret behavior that cannot be directly observed (see Donahoe, 2004; Palmer, 2013; Palmer & Donahoe, 1991; also see Anderson, Hawkins, Freeman, & Scotti, 2000). According to Palmer (2011), private events can be used to (a) assume the generality of established principles, (b) guide future inquiry, (c) make sense of the fragmentary data we do have about the world, and (d) displace the tendency to resort to mentalism or appeal to inferred events outside of what we know (p. 202). Early on, behaviorists such as J. B. Watson suggested utilizing only behavior and treatments that could be publicly observed. This account discounted private behavior, such as self-report, as mentalism (Hayes & Brownstein, 1986, p. 187), which suggested a philosophical emphasis on methodological rules. Although most behavior analysts may claim an RB philosophy, the behavior of our applied subfield implies that a methodological rule following, utilizing direct-acting contingencies for the most part, may be quite prevalent. As Wilson (2016) suggested,

> The absence of a large contribution by radical behaviorism was particularly visible in the relatively small influence of behavior analysis in applied realms where control of direct acting contingencies was limited. For example, traditional

> behavior analysts played a small role in the traditional clinic or counseling center, where psychologists, social workers, and counselors have access to perhaps an hour of the client's week, and virtually no access to contingencies at home, work, and in social settings. (p. 66)

Nevertheless, outcome data from families, schools, peer interaction, and clinical psychology suggest that these approaches can produce reliable and effective changes in behavior (Biglan, 2015, Part 2). Therefore, if changes in behavior can be made without directly influencing immediate environmental contingencies, then control cannot be exclusively housed within these public events. And, if control is not found in the immediate environment, yet our applied subfield is restricted to only intervening on those variables, then we may unintentionally limit our contribution in promoting meaningful changes in behavior for most (i.e., verbal) people.

A potentially narrow adherence to methodological rules is evident in our applied subfield. In a scientist-practitioner model, clinical practices are guided immediately by research outcomes. In applied behavior analysis, the flagship journal for the applied subfield is JABA, and other journals serve as alternative outlets for applied work (e.g., BAP, TAVB). We conducted a cursory review of research published in each of these journals that mentioned private events by searching within each journal using Google Scholar for articles that contained the words "private events," "thinking," or "emotion" (from January 2014 to October 2018). Simply, if an article mentioned any of these private events in the introduction, directly attempted to measure these events experimentally, or even reflected upon the potential influence of these events in the discussion, this would be captured in the total number of articles located in the search. The percentage of total articles published since 2014 that mentioned private events is shown in Figure 1. As can be seen, research that mentions private events is almost completely absent from JABA (4%). Again, MB differs from RB in that it does not include private events in its analyses, and—consistent with an MB approach to research—96% of research in JABA did not include an account of the potential contribution of private events. We do see a greater proportion of research that includes these terms in BAP and TAVB, but these articles still represent much less than half of the published work in these journals.

There is some evidence that greater inclusion of private events in research may extend the scope of our applied subfield. Hayes, Barnes-Holmes, and Wilson (2012) suggested that although there is overlap between "contextual behavior science" and "applied behavior analysis," the latter may have drifted too far from its initial RB philosophy and toward MB. The Association for Contextual Behavioral Science and the *Journal of Contextual Behavioral Science* (JCBS) were formed as a movement back to RB (Hayes, Barnes-Holmes, & Wilson, 2012). Using the same text search procedure mentioned previously for research published in JCBS, we found that 91% of published work contained the searched-for words. Therefore, it is not the case that all behavior research has seldom considered private events in an account of human behavior, but rather only in most studies published in purely applied behavior-analytic journals. These data alone, however, do not necessarily imply that the inclusion of private events in research can expand the scope of applied research. Rather, there appears to be a difference in the rules governing either the researchers who submit articles to these respective outlets or in the rules governing the expert reviewer

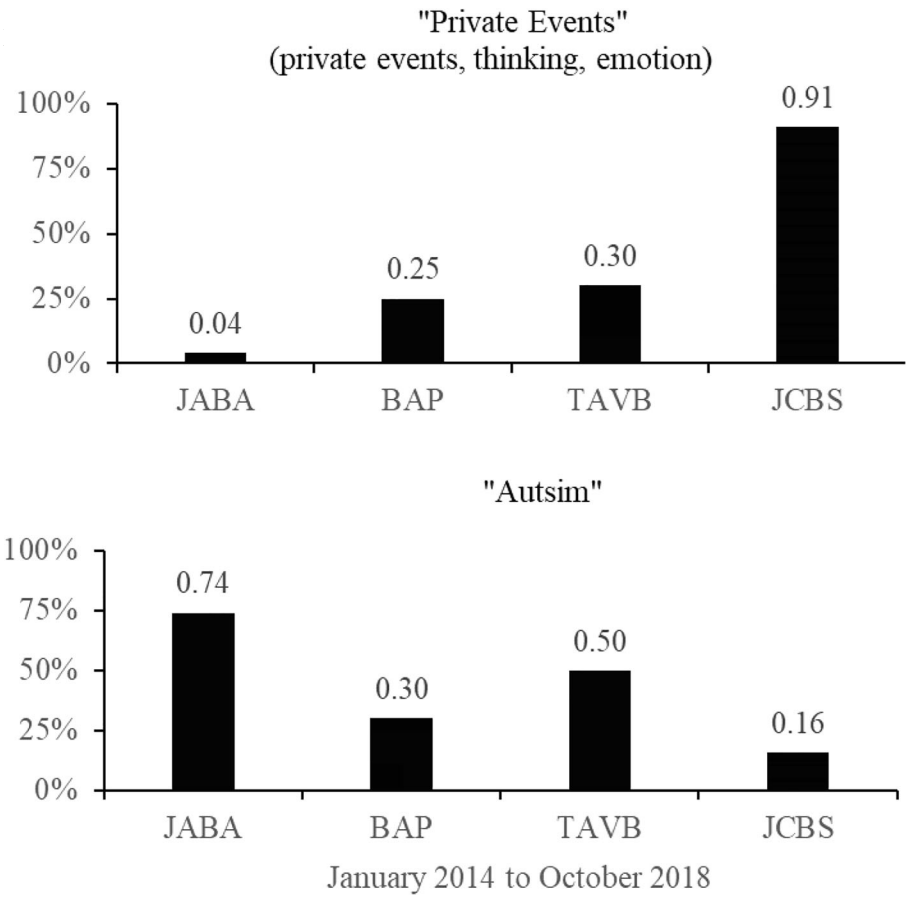

Fig. 1 Percentage of articles in the *Journal of Applied Behavior Analysis* (JABA), *Behavior Analysis in Practice* (BAP), *The Analysis of Verbal Behavior* (TAVB), and the *Journal of Contextual Behavioral Science* (JCBS) from January 2014 to October 2018 containing words for private events and autism. Private events included private events, thinking, emotion, and covert behavior

these respective outlets, however, can shed some light on the relationship between these rules and the scope of our applied subfield.

We used the same procedure to evaluate the percentage of articles in all aforementioned journals that mentioned "autism," a disorder that affects only 1%–2% of the population (Centers for Disease Control and Prevention, Autism Spectrum Disorder: Data and Statistics: Prevalence, retrieved November 5, 2018, from https://www.cdc.gov/ncbddd/autism/data.html). Despite autism affecting such a small percentage of the population, we found that 74% of articles published in JABA mentioned autism, compared to 16% of articles in JCBS. Therefore, JABA seems not only to generally exclude private events but also to allocate a considerable amount of applied research to a population with diminished language capabilities. Conversely, where JCBS regularly includes an account of private events, 84% of the research in that journal makes no mention of autism. These data do not prove that most behavior analysts do not consider

private events, but the data do show that, although private events are likely pervasive in most human challenges (Palmer, 2011), private events appear infrequently in behavior-analytic research housed within purely applied behavior-analytic journals. Although different journals can make different contributions to the totality of behavior science, there is no reason different journals should operate under potentially incompatible rules that in turn govern the scientific work of behavior scientists and, consequentially, the applied work of practitioners.

Bottom-Up and Reticulated Theorizing

Traditionally, generating theoretical accounts of complex human behavior has been accomplished by extrapolating from data obtained from more basic organisms (e.g., rats, pigeons; see continuity strategy in Dymond, Roche, & Barnes-Holmes, 2003). This is known as bottom-up inductive theorizing. *Bottom up* refers to establishing principles in more simple organisms and contexts and generalizing these principles to higher organisms and more complex topics, ideally through direct experimentation. *Inductive* theorizing may separate behavior science from other psychological sciences, where new theories emerge from data, rather than collecting data to test any given theory. We contend that rigid adherence to bottom-up theorizing may inhibit the applied subfield's ability to explain the behavior of the human organism as the highest order organism contained within, arguably, the most complex social (i.e., verbal) context. We support inductive theorizing in all its forms and suggest that other inductive approaches may need to be considered in our applied subfield. Skinner himself was not tied to bottom-up theorizing as evidenced by his ideas for cultural selection in relation to genetic and behavior selection (1966a; 1966b; 1969, Section 1; 1981a), thought as verbal behavior (1957), and the concept of happiness used to evaluate cultural practice (1976; i.e., the cultural construction of happiness is unlikely apparent in lower organisms). Skinner's own theory of rules as instructions (1969, pp. 146–157) was expanded beyond simply contingency-specifying events after rules were found to be products of verbal behavior, which, after repeated experience, could become insensitive to contingencies whether the participant was aware of the rule or not (Hayes, 1989).

In general, applied research has emerged from theoretical efforts to translate the development of behavior principles from basic experimentation. One example of this that could occur exclusively with humans is private verbal behavior. In the basic research journal of behavior analysis, the *Journal of the Experimental Analysis of Behavior*, 10 articles were found from 2014 to October 2018 that mention "private events," 36 that mention "thinking," and 15 that mention "emotion." This is considerably greater than the same topics found in JABA as mentioned previously, suggesting that we have developed or are developing a basic experimental account of private events, but this has not yet translated to research in our applied subfield. Conversely, 158 studies were published in JABA during this same time that contained the searched term "differential reinforcement." We use differential reinforcement as a case example of a procedure that was developed in direct translation from animal models, emphasizing the role of direct-acting contingencies on behavior. Once again, given the diminished language functioning associated with autism, it should come as no surprise that 132 of the identified 158 articles also contained the searched term "autism." Ironically, only one study was published in JCBS that contained the term "differential

reinforcement." This study was also conducted with individuals with autism (Belisle, Stanley, & Dixon, 2017) and showed that once individuals could derive relations (i.e., demonstrated verbal behavior), indirect functional assessments were less likely to identify an immediate consequential function of behavior.

An alternative rule to bottom-up theorizing has been suggested as a *reticulated inductive approach* to theory development. That is, theories should stem directly from data (i.e., be inductive), but the generation of data need not translate exclusively from basic experimental work with lower organisms and less complex contexts. Rather, in the reticulated inductive approach, data from all levels are used to develop inductive theories (Hayes, Long, Levin, & Follette, 2013; Villatte, Villatte, & Hayes, 2018; but see Barnes-Holmes, Kavanaugh, Barnes-Holmes, Finn Harte, Leech & McEnteggart 2018). A reticulated rule for theory development allows for hypotheses about what works as interpreted or abstracted from basic principles but does not require an absolute mechanistic reduction to lower level events. A staple of FC philosophy and RB is that events need not be mechanistically reduced if they allow for the prediction and influence of behavior (Biglan & Hayes, 1996). For example, a reticulated rule would permit self-observation or self-reported ratings, even if those behaviors cannot be independently verified as is required in an MB philosophy.

Within this reticulated approach to theorizing, it is scientifically legitimate for a person to observe private contingencies (i.e., private events; see Fernyhough, 2016) even if the component stimulus, response, and consequence (or S-R-S) parts of that contingency occur inside the body and are not available to be observed or manipulated by either the participant or an observer (Wittgenstein, 1958). Further, although a participant might talk mechanistically about the separate components of the contingency inside the body out of convenience (e.g., self-report, self-descriptions, self-reinforcement, self-punishment), no person can experience these component parts separately because of this lack of availability.[2] Rather, the individual experiences the language rule he or she constructs to describe this whole contingency (e.g., private emotions as contingency descriptors; Layng, 2017). However, delineating the component parts of an experienced contingency, private or public, and requiring verification of any model with observable external events is problematic only within a mechanistic account. Reticulated theorizing housed within FC would permit interpretation of familiar concepts, such as happiness, based on public indices of appetitive responding not only for people who do not have strong language repertoires (Green, Gardner, & Reid, 1997; Green & Reid, 1996; Ivancic, Barrett, Simonow, & Kimberly, 1997) but also for people with language-based problems where the behavior influence is more private, such as with bias (Hughes & Barnes-Holmes, 2011) or suffering (Hayes, Strosahl, & Wilson, 1999, 2012). Although it may be more useful to a unified science and conceptually systematic to relate such language-based data to basic principles as in bottom-up theorizing (Barnes-Holmes, Kavanaugh, Barnes-Holmes, Finn Harte, Leech & McEnteggart 2018; Barnes-Holmes, Hussey, McEnteggart, Barnes-Holmes, & Foody, 2016a), behavior scientists must remember they are using these rules to organize their behavior with their theories, rather than developing representations in the world as is aspired for within philosophies of absolute realism (Wilson, 2016). The higher philosophical rule of FC suggests that it is more important for a theory to be reliable and effective (i.e., work in

[2] See similar arguments for why the concept of self-reinforcement is problematic (Catania, 1975; Goldiamond, 1976).

experimentation) than to cohere with already-established basic behavior principles as would be required mechanistically or within an MB philosophy. It is possible that scientific rules adopted from reticulated theorizing, even though produced from empirical data, may not always be precise enough to participate in bottom-up theorizing (e.g., see acceptance and commitment therapy [ACT] "middle-level terms" that follow), so they should be "held lightly" (Wilson, 2016), as should all scientific data. However, research in contextual behavior science has begun to suggest the rules consistent with reticulated theorizing may be more successful once sophisticated language develops (Zettle, Hayes, Barnes-Holmes, & Biglan, 2016).

For example, ACT (Hayes, Strosahl, & Wilson, 2012) was developed as a "third-wave" behavior therapy attempting to undermine cognitive fusion (i.e., excessive responding to private rules and verbal relations) and experiential avoidance (i.e., private escape contingencies interfering with valued behavior or positive reinforcement opportunities). ACT, unlike most behavioral technologies, has achieved success in nontraditional domains, such as in treating theoretical entities including depression (Zettle & Rains, 1989; Zettle, Rains, & Hayes, 2011), anxiety (Forsyth & Eifert, 2007) and obsessive-compulsive disorder (Twohig, Hayes, & Masuda, 2006), among other clinically relevant disorders (Powers, Vörding, & Emmelkamp, 2009). Hooper and Larsson (2015) provide a book-length description of ACT's effectiveness as a technology, but it is not easily mechanistically reduced to foundational behavior principles or animal models of learning. The early success of ACT informed the development of relational frame theory (RFT) as a basic account of human language learning (Hayes, Barnes-Holmes, & Roche, 2001; Hughes & Barnes-Holmes, 2016a) and of rule-governed behavior including tracking, pliance, and augmentals (see Hayes, Strosahl, & Wilson, 2012, pp. 52–55). The success of ACT and the extensive basic experimental work in RFT (Hughes & Barnes-Holmes, 2016a) show the power of reticulated theorizing as an effective rule. The discipline of contextual behavior scientists did not simply dismiss ACT because the component parts of its successful work were not mechanistically understood. Rather, these scientists used the pragmatic success of ACT as a catalyst to guide basic experimentation in the fundamental building blocks of human language and cognition (see Zettle, 2016). Efforts have since been made, both theoretically and empirically, to describe common, middle-level terms in ACT such as by evaluating "values" as motivative augmentals developed through coordinated or hierarchical relational verbal networks (Barnes-Holmes et al., 2001; Plumb, Stewart, Dahl, & Lundgren, 2009). This line of research is a case example of applied research informing basic research strategies compared to the more mechanistic strategy requiring basic research to inform applications (e.g., Luciano et al., 2014). Once again, whereas interventions such as differential reinforcement have been most commonly applied in autism treatment, ACT has been most commonly used to treat the challenges experienced by the remaining 98% of the population. Although ACT is an appropriate case example, reticulating theoretical development would also allow behavior science to evaluate and to potentially adapt and adopt other treatment models that have shown to be effective, such as cognitive behavior therapy (Beck, 1976), functional analytic psychotherapy (Kohlenberg & Tsai, 1991), dialectic behavior therapy (Linehan, 1993), clinical behavior analysis (Kohlenberg, Tsai, & Dougher, 1993), clinical contingency analysis (Layng, Codd, & Andronis, 2018), and other clinical therapies (Guinther & Dougher, 2013). Incorporating such treatment models could extend the

scope and utility of our applied subfield even further. Critchfield and Reed (2017) systematically identify numerous treatment studies that do not honor different components of the original dimensions of behavior analysis (Baer, Wolf, & Risley, 1968) yet still show "potential to advance our behavior-theory driven understanding of socially important problems" (p. 151).

Verbal Behavior and RFT as Language-Learning Models

As mentioned previously, RFT was only forthcoming when scientists adopted rules consistent with FC and RB and reticulation rather than bottom-up theorizing. RFT also differs in theory from Skinner's *Verbal Behavior* (VB). The VB approach emphasizes the ongoing, public, direct interactions between speakers and listeners showing a largely point-to-point or mechanistic correspondence with the verbal operants described by Skinner (1957). We distinguish between the VB *approach* and Skinner's VB theory by considering the VB approach to be one example of Skinner's VB theory. Dymond et al. (2006) reviewed the most researched aspects of VB, showing that echoics, tacts, mands, and intraverbals were the most researched of Skinner's verbal operants. These operants, more recently termed the elementary verbal operants (e.g., Sundberg & Michael, 2001), emphasize the influence of direct contingencies on verbal behavior. Conversely, there seems to be a private, generative nature of human language learning where much language is learned in the absence of public, direct-acting contingencies. We contend that, although the foundational principles in RFT differ from the current VB approach, rules consistent with RB as an overarching philosophy favor adopting RFT as the stronger model to explain Skinner's VB theory of complex human language learning.

Pragmatically, VB approaches have had their greatest impact in explaining how some important forms of language were initially acquired by a speaker (e.g., echoics, mands, tacts, intraverbals, autoclitics; Dixon et al., 2007; Dymond et al., 2006) as opposed to the ongoing process for how this VB maintains and generalizes, or as opposed to the process for how more typical forms of language are produced after a longer process of direct verbal conditioning (Barnes-Holmes, Barnes-Holmes, & Cullinan, 2000, p. 71; Skinner, 1957, pp. 359–360). The success of the VB approach is apparent in the development of several language-learning assessments and curricula for children with autism, such as *The Verbal Behavior Milestones Assessment and Placement Program* (VB-MAPP; Sundberg, 2008), the *Assessment of Basic Language & Learning Skills–Revised* (Partington, 2006), and the *Promoting the Emergence of Advanced Knowledge Relational Training System–Direct Training Module* (PEAK-DT; Dixon, 2014), including research supporting their validity and efficacy with this intended population (e.g., Dixon, Belisle, Stanley, Rowsey, & Daar, 2015). However, as noted in Dixon et al.'s (2007) citation analysis, the research on the VB approach has again occurred almost exclusively with children with autism or related disabilities. In contrast, RFT offers alternative explanations for how language is acquired, developed, and maintained as opposed to the VB approach's more descriptive, categorical account of language. We refer readers to Table 1 for a list of sources to become better acquainted with RFT, its assumptions (or, we argue, rules), and potential applications.

Table 1 A nonexhaustive list of initial resources for applied behavior scientists to get acquainted with relational frame theory, theoretical advances, and clinical applications

Introductory		More Detailed		Applications	
Blackledge, 2003	"An Introduction to Relational Frame Theory: Basics and Applications"	Hayes, Barnes--Holmes, & Roche, 2001	*Relational Frame Theory: A*		*Post-Skinnerian Account of Human Language and Cognition*
Hayes & Stroshal, 2004	*A Practical Guide to Acceptance and Commitment Therapy*				
Törneke, 2010	*Learning RFT: An Introduction to Relational Frame Theory and Its Clinical Application*	Dymond & Roche, 2013	*Advances in Relational Frame Theory: Research and Application*	Rehfeldt & Barnes--Holmes, 2009	*Derived Relational Responding: Applications for Learners With Autism and Other Developmental Disabilities*
Fox, 2018	*An Introduction to Relational Frame Theory* (Foxy Learning)	Zettle, Hayes, Barnes--Holmes, & Biglan, 2016	*The Wiley Handbook of Contextual Behavioral Science*	Hayes, Stroshal, & Wilson, 2012	*Acceptance and Commitment Therapy (ACT): The Process and Practice of Mindful Change*

Note. Resources are listed in chronological order. Full references are provided in the reference list.

RFT[3] proposes that after a long process of verbal conditioning, humans demonstrate new verbal behavior without requiring direct reinforcement to occur (Barnes-Holmes et al., 2000; Healy, Barnes-Holmes, & Smeets, 2000). This view of language extends the VB theory of language to include derived responding, which is not directly taught, as a generalized, higher order operant like imitation. RFT extended the concept of equivalence or equality relations to the development frames such as coordination and equivalence, opposition, comparison, distinction, perspective (deictic), and so on and perhaps, more importantly, the transformation of stimulus functions from these relations. Transformation of stimulus function is a critical clinical concept because it demonstrates how a current stimulus condition can change one function (e.g., positive punishment or escape) to another function (e.g., Dougher, Hamilton, Fink, & Harrington, 2007; Gil-Luciano, Ruiz, Valdivia-Salas, & Suarez-Falcon, 2016).

[3] RFT extended the concept of stimulus equivalence (SE; Sidman, 1971, 1994; Sidman & Tailby, 1982) for relations of equality. Although arguments can be made that SE and RFT are not the same (Barnes & Roche, 1996), most agree that equivalence is the foundational relation upon which all other relations develop (Barnes & Roche, 1996; Barnes-Holmes, Kavanagh, & Murphy, 2016b; Hayes, 1991).

Outside of disability treatment, the RFT approach to language has been more useful in its application than the VB approach (Dymond & Alonso-Álvarez, 2010). For example, RFT-based procedures have led to empirically tested models of racial discrimination (Barnes-Holmes, Murphy, Barnes-Holmes, & Stewart, 2010; Dixon, Dymond, Rehfeldt, Roche, & Zlomke, 2003), depression (Hussey & Barnes-Holmes, 2012), and cue reactivity in obese subjects (Drake et al., 2010), among many other complex challenges faced by all people (Dymond, May, Munnelly, & Hoon, 2010). Thus, if we are to assume influencing complex behavior as our goal as applied scientists, then it appears language research strategies that adopt rather than omit RFT strategies are more likely to achieve this goal. An argument against the apparent success in RFT may be that basic experimental studies, such as those listed previously, do not intervene upon the challenging behavior (e.g., racism, depression, obesity). Consider, however, that the most prominent application of RFT is ACT, which has been shown to successfully intervene upon these behaviors, among others. ACT may be irreducible to the individual frames or relations that participate in the pathology of behavior challenges, but this is only problematic for scientists who subscribe to rules that are mechanistic or that require bottom-up theoretical approaches. The need to break the entire ACT context into component parts to obtain a coherent account is only a valid undertaking within a mechanistic truth criterion. From a pragmatic RB or FC perspective, the successful work demonstrated in ACT research should be enough to spur more ACT research in applied behavior science and ultimately the adoption of such procedures by behavior analysts. Another problem is that even though researchers have developed quite precise terms in RFT (e.g., derivation found in mutual or combinatorial entailment, transformation of stimulus function), a bottom-up model of ACT has not been developed. However, as noted previously, ACT is a case example of reticulated theorizing. Failure to adopt ACT despite its pragmatic utility, because of an absence of bottom-up theoretical models, represents the kind of rigid rule following that we are advocating against in this article.

One way for behavior science to become more consistent with RB and reticulated theorizing would be to include some of the skills potentially related to the private events that have been shown to influence the complex behavior of humans (e.g., RFT, ACT) in the task list developed by the Behavior Analysis Certification Board (BACB; Behavior Analysis Certification Board Fifth Edition Task List, retrieved November, 27, 2018, from https://www.bacb.com/wp-content/uploads/2017/09/170113-BCBA-BCaBA-task-list-5th-ed-.pdf). The task list provides a set of rules governing, or in some geographical areas restricting, actions of behavior analysts (see Association of Professional Behavior Analysts, Licensure and Other Regulations of ABA Practitioners, retrieved November 27, 2018, from https://www.apbahome.net/general/recommended_links.asp). Although the BACB task list is a document that was compiled by surveying the field of practitioners (Johnston, Mellichamp, Shook, & Carr, 2014), if the majority of the practitioners work in the field of autism, the list of skills in the field will reflect only that segment of behavior science. And this appears to be the case. In our review of the fifth edition of this BACB task list (effective January 1, 2022), only 3 of the 95 items—automatic functions (B-7), rule-governed behavior (B-13), and derived behavior (B-15)—conceivably mention private events. In addition, these items are represented under the "conceptual" rather than the "application" heading. However, this is not a criticism of the BACB. As mentioned previously,

research in our applied subfield has largely ignored private events, and clinical practice ought to extend directly from applied research. Nevertheless, we see a parallel between the seemingly restricted model of the BACB task list and the restricted research being published in our major journals. Unfortunately, if our applied scientists most regularly operate under methodological rules regarding private events, then our practitioners will be confined to methodological rules guiding intervention approaches. We use research published in JCBS to support the potential scope of our applied subfield if private events were included in an account consistent with RB and suggest that more research like this is needed in our major applied behavior-analytic journals to increase the scope of applied practice.

As it has happened, graduate training courses that move students toward board certification must tailor coursework to conform to the BACB task list. Although courses are likely to provide instruction on basic VB principles, it is less likely that training programs will provide instruction in RFT. The task list should delineate only the minimal requirements of a behavior analyst. However, as graduate training programs are the source that produces subsequent cohorts of applied scientists and practitioners, the absence of RFT instruction is immensely problematic, as most applied scientists will never adequately contact the currently most researched model of human language learning. Rules that applied scientists operate under are undoubtedly shaped by their verbal community (i.e., graduate training and the task list), thus adapting the rules that operate on applied scientists making use of RFT principles will undoubtedly require system-level adaptations. There is no assurance that practicing behavior analysts will have sufficient knowledge of RFT to utilize related technologies in developing interventions. Thus, there is no assurance that many practicing behavior analysts are equipped to influence behavior once clients become verbal. Changes in the scope of our applied science brought about by adapting our own verbal rules may necessitate systems-level changes to ensure coordinated advancement in the scope of practice and scope of competence of behavior analysts.

Summary

We have attempted to summarize the overarching philosophical assumptions, approaches to theory development, and application of behavior models, which are rules that may govern the behavior of applied behavior scientists. When rules correspond with contingencies in the environment, the rules are considered adaptive and may benefit the organism. We are now seeing that some rules adopted within part of our applied subfield, although adaptive in one domain (disability treatment), have not been broadly effective in other domains. Table 2 summarizes the philosophical, theoretical, and language barriers to a more progressive application in behavior science by contrasting what are described as adaptive and maladaptive rules. We contend that methodological approaches to private events, bottom-up inductive theorizing, and an account of language immediately consistent with Skinner's VB approach have been adaptively applied in disability treatment. A lack of success in other domains, however, may stem directly from rigid adherence to these rules. We have suggested that rules that are more flexible and consistent with Skinner's RB and FC may achieve greater success in application with most humans. This approach, given current research, would

Table 2 Exemplar maladaptive and adaptive verbal rules guiding the scientific behavior of applied behavior scientists

Barrier	Maladaptive Rule	Adaptive Rule
Philosophy	Mechanism:	Contextualism:
	"Behavior scientists must seek point-to-point correspondence with existing theory, reducible to component parts within a basic operant account."	"Behavior scientists must seek adaptations in context that are effective in altering human action toward human values."
	Methodological behaviorism:	Radical behaviorism:
	"Behavior scientists must only research observable, external stimulus events and their effect on observable public behavior."	"Behavior scientists must account for private stimulus events and behaviors when required to allow for the successful prediction and influence of all human behavior."
Language research	"Verbal behavior":	Relational frame theory:
	"Behavior scientists must interpret language development and influence as the ongoing interaction between speakers and listeners, including the speaker and listener existing within the same skin."	"Behavior scientists must interpret language development as directly reinforced and derived relational learning, including relations established by both speaker and listener behavior, with a specific focus on the transformative functions of language events."
Theory	Bottom-up theorizing:	Reticulated theorizing:
	"Behavior scientists must engage in research that extends from basic animal models to translational research that will eventually lead to impactful technologies that affect human behavior."	"Behavior scientists must engage in research at all levels, basic and applied, and continue to refine research in both domains based on results obtained in other domains of scientific inquiry."

necessitate the inclusion of private events, a reticulated approach to theorizing, and language-learning models consistent with RFT. None of these suggestions are necessarily novel, as all have been made in prior work, nor have complaints of applied behavior analysis's ineffectiveness been absent (Friman, 2017; Skinner, 1981b; Vyse, 2013). However, a functional analytic treatment of the application stagnation of our applied subfield (Dixon et al., 2018) may require treating this inaction as the result of rule-governed behavior. From there, we can develop procedures to intervene on our own behavior as applied scientists if so desired. Next, we briefly offer some implications that may stem from adopting the "alternative" rules that we have put forward for behavior science.

Implications of Adapting Our Rule-Governed Behavior

Given the ubiquitous nature of human rule-governed behavior, criticizing any given set of rules could create a division where any alternate set of rules appears as if "my rules are better than your rules." Historically, the rules formed between cultures, nations, races, and religions have created familiar divisions of conflict and sometimes even wars. Although one might expect such divisions to be less prevalent among scientists

where data serve as the collective arbiter for information, in the discipline of psychology, there are, currently, 54 divisions that are set the task of explaining human behavior (American Psychological Association, 2019). The division within the American Psychological Association that most closely aligns with the development of a behavior science is Division 25, Behavior Analysis. Although there have been impressive applications of behavior science principles such as reinforcement, punishment, extinction, generalization, and stimulus control developed by behavior analysis in other disciplines, the fact that there are so many divisions suggests that the rules developed by each of the respective divisions, including divisions within behavior analysis, may work more to hinder behavior science than direct it toward progress.

Given the human tendency for rule-governed behavior to create division in human activity, even within a science of behavior, it may be helpful to show how an alternative set of rules might lead to more unity in behavior science than division. It may be fair to say that the greatest potential division in behavior science comes from different rules or approaches to public and private explanations of behavior influences. Figure 2 is provided to roughly show how empirical explanations of public and private influences may intersect to provide a more complete and unified account of all human behavior. The square represents information found to come from public influences for behavior that, without any other influences, represents a purely methodological philosophy. The embedded concave triangle represents information found to come from private influences for behavior found in the more recent science of language and cognition approach. Together, these two figures represent the public and private explanations for behavior found in the RB philosophy. In very early verbal or language development, private influence may be represented by behavior that, after repeated trials, maintains without continuous public reinforcement (Ferster & Skinner, 1957, p. 1). However, as these skills move toward more complex language, there is a rapid increase in private influence among typically developing people (i.e., the concave curves of the triangle). Figure 2 suggests that at some point in verbal development, control over behavior may always involve private verbal behavior, a view put forward by Barnes-Holmes, Kavanagh, and Murphy (2016b) and that requires much more empirical research. The outside circle represents the assumption that, despite what is known about behavior, there is much more to know in behavior science for which there is no current empirical information. The rectangular band across both figures represents a biologic constant that allows for the public and private influence of human behavior to adapt within a complex social environment. The figure as a whole represents the unified FC approach, wherein research will determine the relative contribution of all parts of the influential contingencies to successfully work to address the wide scope of human challenges.

With the goal of bringing unified progress to behavior science, there are at least three immediate implications for adapting our own verbal behavior to include private events in our applied research and practice, to use reticulated approaches to inductive theory development, and to incorporate advances in RFT within and outside of disability treatment. First, in considering private language contingencies, their descriptions might be more conceptually described. Although the components of private, self-provided events cannot be observed, it is likely that private positive or negative, reinforcement or punishment contingencies occur very much like those observed in public. Rather than confining the term “automatic” or self-delivered contingencies to public or physical

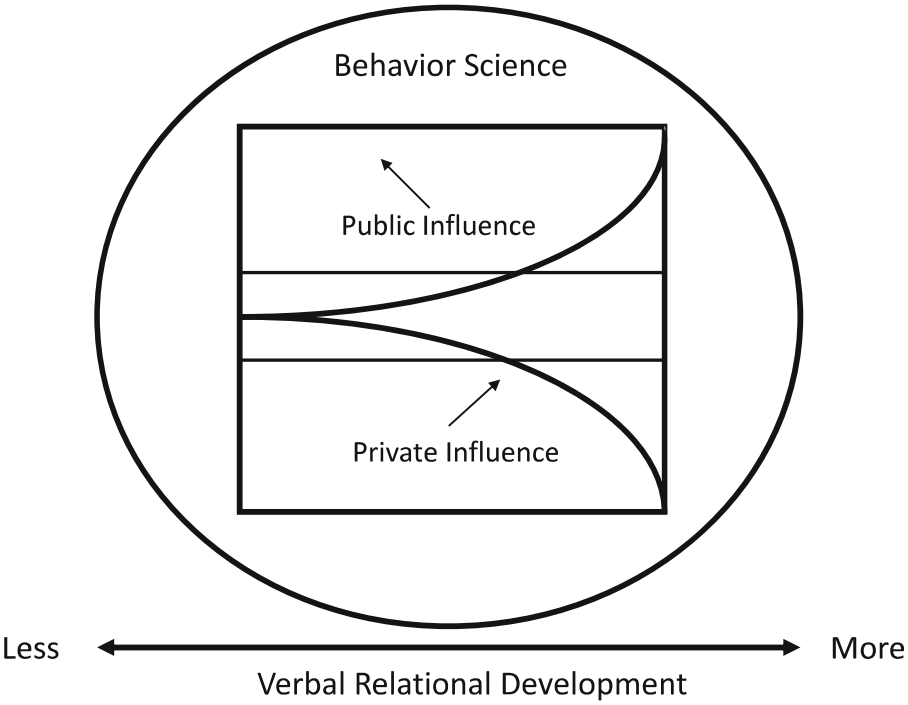

Fig. 2 A rough schematic of the public and private empirical influences for behavior across language skill in behavior science. The square represents public influences, and the embedded concave triangle represents private verbal influences. The relative contribution of each may be a function of language or verbal sophistication. The rectangle represents a biologic constant, and the circle represents all that is left to be discovered

stimulation (Vaughan & Michael, 1982; Vollmer, 1994), an account of automatic or private language contingencies might be made by taking what is already known about public contingencies and talking about private contingencies more conceptually. For example, explanations for private language activity of human identity or perspective (Hughes & Barnes-Holmes, 2016b, pp. 200–204; McHugh & Stewart, 2012) might be discussed more conceptually as automatic language positive reinforcement contingencies via self-preference, bias, or even narcissism. The motivation operation for strong but private escape or experiential avoidance contingencies (Hayes et al., 2004; Miltenberger, 2005) might be interpreted as automatic language punishment contingencies. The misery or suffering identified by so many responders might be interpreted as coming from a cycle of automatic language punishment contingencies and negative reinforcement language contingencies related to escape behavior (Friman, Hayes, & Wilson, 1998). Treatments such as ACT might be described as using language-based automatic negative punishment (escape extinction) contingencies to withhold escape responding via acceptance and mindfulness procedures (see Baer, 2014; Friman et al., 1998) and to differentially reinforce value-driven commitment behavior (Hayes, Strosahl, & Wilson, 2012; Wilson, Sandoz,

Kitchens, & Roberts, 2010). These treatments interpreted as automatic language contingencies are being shown as pragmatic solutions to escape or survive these automatic language punishment contingencies. Finally, it is possible that the private automatic language negative punishment (extinction) practice of denying a previous history of reinforcement (i.e., asceticism) may help a participant accept a private, automatic language punishment contingency (escape extinction) without experiencing a historic escape contingency and allow the opportunity for transformation to a more desirable positively reinforced response to occur. That is, practicing denial of preferred conditions (an automatic language negative punishment extinction procedure) may strengthen a person's ability to accept the appearance of unpreferred language conditions (an automatic language negative punishment escape-extinction procedure) given their shared negative punishment function. These are all treatments that would utilize functions familiar to any behavior analyst using language-based treatments.

To be sure, precise use of terms is an important and valued scientific activity, and efforts to create precision should be applauded rather than disparaged. But rather than bickering about whether a private event is an SD or a contingency, or whether untrained behavior is a phenomenon of generalization or entailment, it may be necessary to recognize that some private or automatic language contingency interpretations must be held lightly (Wilson, 2016) until more research can support them. However, even when less precise explanations are used to explain reliable and useful effects, this should not prevent behavior scientists from making interpretations about automatic language-based phenomena in the most conceptually systematic way possible. Describing private language behavior in terms of automatic contingencies may give behavior science a greater depth of understanding to other investigative disciplines.

Second and relatedly, redefining our rules in a reticulated model means that behavior analysts cannot ignore behavior science that occurs in other disciplines. For example, there is research in language and cognition coming from RFT that may be readily incorporated by a behavior-analytic provider (Implicit Relational Assessment Procedures, identity and perspectives, formative and motivative augmentals, etc.), and there is also other research on implicit processes that may be less easily consumed by behavior analysts (Proctor & Capaldi, 2012). If a research result reliably occurs, it stands to make useful contributions to behavior science and so deserves scientific appreciation. Behavior scientists may especially contribute to these areas by determining the function of complex but observed outcomes reported in other disciplines. For example, data from the evolutionary sciences may allow behavior analysts to address problems of psychopathology (Wilson & Hayes, 2018; Wilson, Hayes, Biglan, & Embry, 2014) or to support altruism for oneself and others (Wilson, 2015). Other examples may stem from advances in developmental psychology that capture the self-organization of behavior over the life span, such as from a dynamical systems perspective (Spencer, Thomas, & McClelland, 2009; Thelen & Smith, 1996). Marr (1992, 1996) has discussed how the ongoing interaction between the organism and its environment can create unstable and chaotic attractors that control behavior above and beyond immediate environmental contingencies. More recently, relational density theory (Belisle & Dixon, in

press) has also described self-organization specifically in terms of derived relational responding, which is an extension from a purely physical account of human behavior. Both of these theoretical inductive models may be difficult to validate if we are fused inflexibly to bottom-up inductive theorizing and single-case research designs but could be extended and used by our applied subfield if we can adapt our rule-governed practices to allow for analyses of behavioral complexity.

Third, incorporating advances in RFT may not only extend our scope considerably in application with other scientists and practitioners but also has the potential to even further improve our disability treatment models. A major advantage of RFT-based language-learning models is an emphasis on "higher order" generalized operants (Healy et al., 2000). Derived relational responding is likely an operant that increases in complexity through shaping by multiple exemplars, and each of the relational frames formed also constitute higher order operants of varying complexity. The target of RFT language-training models is not individual operants as may be targeted in traditional VB accounts (e.g., VB-MAPP); rather, it is the emergence of these higher order operants over time that, once learned, become topographically boundless. In order to study this phenomenon, longer term and larger sample research designs may be required as higher order operants are unlikely to emerge immediately after relatively short doses of training as are often used in single-case research designs. Prior research has shown that RFT-based instruction can lead to gains in IQ in typically developing children (Cassidy, Roche, & Hayes, 2011).

Recently, RFT-based instruction has been increasingly incorporated into packaged curricula that can be applied over a longer period of time with gains not only in individual skills but also in these higher order operants in application with children with disabilities. One example that has produced considerable research in this area is the PEAK Relational Training System (see Dixon, Belisle, et al., 2017, for a review of this research) that, in addition to teaching target skills, contains periodic assessments of higher order relational operant development (PEAK-E Pre-Assessment, Dixon, 2015; PEAK-T Pre-Assessment, Dixon, 2016). These assessments of higher order relating have been correlated with several measures of intellectual and language functioning (e.g., Dixon, Belisle, & Stanley, 2018), suggesting that these operants may play a critical role in language development. We mention this area of research to show that adapting our verbal rules as applied scientists may serve both to extend the scope of applied behavior analysis outside of disability treatment and also to improve considerably the applications of our applied behavior analysis within disability treatment.

General Conclusion

Prior work has already suggested that behavior-analytic research has not yet addressed challenges faced by most people. We believe that it can and should, but doing so will require adapting our own rules that guide our actions as applied scientists and practitioners. Dixon et al. (2018) extended this lament considerably by suggesting that many of our current technologies and models may not be adequately complex enough

to address these challenges. Rather than offering another full-length review of the current empirical shortcoming of our applied subfield, we have suggested that a functional shortcoming may be found in our own verbal rule-governed behavior as applied scientists. This is not to imply that all applied scientists follow all the rule-governed barriers that we have put forward here. Rather, there is clear evidence that these rules are the norm in our applied subfield and with larger systems within the field that may maintain rigid adherence despite restricted success. The set of alternative rules we have suggested includes consideration of private events, pursuing reticulated theorizing, and utilizing RFT as a language-learning model given the current state of empirical research on this topic.

The irony of putting forward new rules to replace old rules is not lost on us, and we encourage readers to evaluate any and all rules based on the probability that the rules will lead to successful outcomes consistent within a pragmatic approach to science. Rule following, however, is advantageous when rules are accurate and workable, and we have attempted to present the now-mounting evidence emerging from contextual behavior science and other sources that has shown (and is increasingly showing) the success that we can achieve by adopting these rules more generally. We have presented only three of a potentially infinite number of rules and barriers that, if flexibly adapted, can have immediate implications for our applied subfield. To be at the forefront of innovation, consistent with Skinner's RB, we must continuously adjust our environment and our rules as applied scientists to achieve successful work and to begin saving the world as we always intended to do.

Compliance with Ethical Standards

Conflict of Interest The authors declare that they have no conflict of interest.

Ethical Approval This article does not contain any studies with human participants performed by any of the authors.

Informed Consent No human participants were involved in the current study.

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