Free-Operant Field Experiences: Differentially Reinforcing Successive Approximations to Behavior Analysis through a ShaperSpace

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Abstract

Over the past few years an increasing number of schools and community organizations have developed transformative learning spaces referred to as "MakerSpaces" for research and training purposes. MakerSpaces are organizations in which members sharing similar interests in science, technology, engineering, and math (STEM) gather to work on self-selected projects. Proponents of MakerSpaces highlight the implicit benefits arising from participants' increased engagement with complex technical content in a voluntary, authentic context. We extend the MakerSpace concept to applications of training special education teachers to address the needs of students with Autism Spectrum Disorder (ASD). Applied behavior analysis (ABA) has vast empirical support for treating ASD. We believe the MakerSpace model provides a platform for developing a new generation of special education teachers. However, rather than making novel products, the focus is on shaping the behavior-analytic repertoires of special education teachers. In the field of ABA, the term "shaping" describes the differential reinforcement of successive approximations to a target behavior. Accordingly, we propose the name ShaperSpace to describe a novel clinical training approach to developing special education teachers who employ research-validated interventions for individuals with ASD. The supervision model described in this article is provided, not as a recommendation, but as an exemplar that has developed over four years' contingency shaping and continues to be refined. We appeal to the reader to consider the ShaperSpace as a starting point from which skills developed through free-operant field experiences will ultimately be shaped and selected by the naturally occurring contingencies of the environment.

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Can you tell me, Socrates, whether virtue is acquired by teaching or by practice?

Meno, 380 B.C.E

Introduction

Field experiences are considered one of the most influential determinants over preservice teacher development (Freeman, 2010; Glomb, Midenhall, Mason, & Salzberg, 2009; Wilson, 2006). Long considered an essential component of teacher education programs (Alger & Kopcha, 2009), practica experiences serve a variety of purposes, such as bridging research to practice (Simpson, 2006), and shaping effective teaching behaviors (Engelmann, 2004). In this way, field experiences serve as transducers between declarative knowledge and procedural knowledge (Baum, 2005). These field experiences serve as opportunities for practicing educators to refine their skills in the application of evidence-based practices. Ensuring that pre-service providers can select and implement appropriate interventions has been a difficult task but one that remains of high importance when specifically considering the soaring prevalence rates of children with autism (Garland, Vasquez, & Pearl, 2012). The National Professional Development Center on Autism Spectrum Disorders (2016) has identified 27 research-validated practices, of which the majority are rooted in principles of applied behavior analysis (ABA). The success of behavioral treatments (Reichow & Woolery, 2009) and the positive strides in health insurance reform have led to substantial increases in services provided to individuals with autism (LeBlanc, Heinicke, & Baker, 2012). These changes have led school districts to seek out teachers who are dually certified as Board Certified Behavior Analysts (BCBAs) to address the complex needs of this population (Mason, Perales, & Gallegos, 2013). Whether educators are dually certified or not, establishing a significant behavior-analytic foundation may be invaluable.

The Behavior Analyst Certification Board (BACB) has identified 115 minimum competencies to be addressed throughout the preservice training of behavior analysts. Included among these skills is the ability to design and implement the full range of functional assessment procedures, a procedure explicitly stated within the reauthorization of the Individuals with Disabilities Education Act when working with children who demonstrate problematic behavior in the classroom. However, “the meaning of *functional assessment* isn’t entirely clear in the context of the law” (Hallahan, Kauffman & Pullen, 2012, p. 223). Consequently, BACB credentials have become increasingly valuable among school psychologists, special education teachers, and teaching assistants (BACB, 2015). After all, behavior analysis itself is the natural science of learning.

At a time when psychology was dominated by trial-based research, Skinner (1938) had the prescience to examine responding under the individual’s own volition, a methodology he deemed “free-operant”. Vargas (2013) recounts the story of her father’s excitement upon discovering this novel procedure for studying behavior:

> I can easily recall the excitement of that first complete

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> extinction curve. I had made contact with Pavlov at last: here was a curve uncorrupted by the physiological process of ingestion. It was an orderly change due to nothing more than a special contingency of reinforcement. It was pure behavior (Skinner, 1956, p. 226).

Skinner's operant conditioning, which ascribes control to what happens after behavior occurs, was an extension of Pavlov's (1927) work on respondent conditioning, which explained behavior as the result of an eliciting stimulus. At the time, researchers largely described behavior as a response to a preceding stimulus. Through the use of his free-operant procedure, however, Skinner was able to demonstrate that largely our behavior is a function of what happens next. "In fact, most of our behavior in the routine affairs of everyday life is clearly operant, in that it *operates* or acts upon the environment to produce the satisfaction of our basic needs" (Keller & Schoenfeld, 1950, p. 49, emphasis in original).

As is often the case with laboratory procedures, transfer to the applied setting only came much later. Research on behavior-analytic intervention for individuals with severe disabilities first appeared in publication in the latter half of the 20th century (cf. Ayllon & Azrin, 1968; Lovaas, Schaeffer, & Simmons, 1965). These procedures were built upon the foundation of operant conditioning, but focused heavily on trial-based antecedent manipulation to elicit a particular skill before delivering a reinforcer.[1] Perhaps best known of these early methodologies is discrete trial training, a method of simplifying instruction to enhance children's learning (Smith, 2001). "Only at certain intervals is the response made possible. This is essentially the trial-by-trial procedure employed by Thorndike in his problem-box experiments" (Keller & Schoenfeld, 1950, p. 55). While effective at developing complex behavior, the treatment gains from these early efforts "have been specific to the particular environment in which the client was treated, substantial relapse has been observed at follow-up, and no client has been reported as recovered" (Lovaas, 1987).

Gradually, research began to appear on applied behavior analysis in the natural environment (Allen, Hart, Buell, Harris, & Wolf, 1964; Hart & Risley, 1975). These free-operant techniques emphasized reinforcing successive approximations over trial-based, antecedent manipulations. For instance, incidental teaching is the process in which the natural environment is strategically set up to include several reinforcing stimuli. These stimuli in return are used to elicit interactions from a learner utilizing operational training procedures. Access to these stimuli is only granted when correct behaviors are demonstrated, consequently reinforcing the behavior and producing a positive instructional sequence.

Research has long supported the use of incidental teaching to improve language skills in students with disabilities as it increases both skill acquisition and generalization (McGee, Krantz, Mason, & McClannahan, 1983). In a comparison of traditional teaching methods *vs*. incidental teaching McGee, Krantz, Mason, & McClannahan (1985) found that when teaching prepositional phrases to children with autism who had language delays, these students were better able to generalize preposition use across settings, materials, and teachers. Moreover, participants were more likely to spontaneously use speech during instruction. Allowing a learner to naturally gravitate towards reinforcing stimuli potentially increases motivation for accessing the reinforcer, providing an instructor the opportunity to shape targeted behaviors within a natural context (Anderson & Romanczyk, 1999).

Despite the many benefits of free-operant learning, these methodologies have only recently gained momentum in higher education, where instruction-based methodologies are still the norm (Boyce & Hineline, 2002). Presentational methods are often reinforcing to the instructor due to their relative efficiency and broad impact, but they often fail to exact long-term behavior change over the learner. Skinner (1957) observed that, "The considerable difference between a given state of affairs and the verbal behavior which it comes to control means that, to a listener, verbal behavior lacks the richness, complexity, and detail of 'direct experience'" (p. 127). Vargas (2013) is quick to acknowledge that "Unfortunately, presenting is *not* teaching.... Any definition of teaching must include the effect on student behavior" (pp. 4-5). Within the course of developing future educators, classroom-based field experiences become critical because they allow preservice teachers and behavior analysts to actively participate in the natural environment.

A commonly employed methodology for training preservice behavior analysts (PBAs) is behavioral skills training (BST), a trial-based training methodology that consists of four distinct component parts: instructions, modeling, rehearsal, and feedback. Researchers have found BST to be effective for training preservice behavior technicians (Lerman, Hawkins, Hillman, Shireman, & Nissen, 2015). The efficacy of BST has been so profound that the BACB explicitly recommends it for teaching the 115 skills in the task list. Despite its efficacy, however, we posit that BST, like the other trial-based methodologies that came before it, may ultimately restrict the student's repertoire to a collection of tricks (Baer, Wolf, & Risley, 1968).

Proliferation of the MakerSpace

Increasingly, attention is now being given to the phenomenon of *making* and MakerSpaces in current culture and educational research (See Vossoughi & Bevan, 2014). Educators and *make* advocates extoll the pedagogical affordances of making to include greater engagement with, and concomitant learning of, technologically complex production processes (e.g., Blikstein, 2013). Research indicates that students engage more readily, more intently, and in a more authentically interdisciplinary manner with make projects than classroom practice (e.g., L. Martin, Dixon, & Hagood, 2014; Vossoughi & Bevan, 2014); making being a more dynamic learning than can ordinarily be achieved through instruction-laden or lecture-based teaching.

MakerSpaces have been posited to positively influence learning in many ways. The literature is replete with examples of successful STEM identity trajectories nourished in childhoods rich with making and tinkering. For example, diSessa (2001), the physicist and educational researcher, explains that much of his understanding of physics was rooted in early tinkering with household electronics. Moreover, *making* has significantly shaped scientific success stories for individuals not commonly associated with the maker movement. A stark example of an uncelebrated tinkering trajectory is that of B.F. Skinner, the father of radical behaviorism, who was an avid childhood tinkerer (Skinner, 1985). Skinner's tinkering is a compelling example as he was a lifelong *maker*, whose making later translated directly to discoveries in the science of behavior. Foremost, his discovery of schedules of reinforcement was made possible by his making; namely, the graphs that rendered schedules of reinforcement more observable were discovered through the process of tinkering with the lever press equipment that then generated logarithmic graphs (Skinner, 1979). For Skinner making was so essential to the understanding of behavior that he required many of his students to manufacture operant conditioning chambers in order to better understand the principles of behavior (Skinner, 1979).

The Rat is Right

Lindsley (2013) describes working in Skinner's lab at Harvard, trying to reproduce reinforcement schedules from *The Behavior of Organisms* (1938):

> While a doctoral student at Harvard, I proudly went to Fred Skinner with a cumulative record of a rat's lever pressing, showing an extinction curve slightly different from the ones published in *The Behavior of Organisms* (Skinner, 1938). Charlie Catania (1991) has recently mentioned how we graduate students would compete with each other to try to find Skinner wrong. I expected Skinner to say, 'You didn't conduct the experiment right.' But no! Skinner said, 'The book's wrong! The rat knows best! That's why we still have him in the experiment!'

By deferring to the data Lindsley had generated, Skinner highlighted the pragmatic nature of behavior analysis. Rules and instructions are products of the history of reinforcement of the speaker, and will hold true to the extent that future contexts are extrapolated, interpolated, or stipulated by this history (Engelmann & Steely, 2004). Though rule governance is an effective means of efficiently conditioning behavior, the results are generally less precise than the control achieved through contingency shaping (Mason, 2015; Skinner, 1969).

Moreover, reliance on instruction-laden, lecture-based forms of teaching inherently lead to "hoping" for generalized control of the natural environment (Stokes & Baer, 1977). Hope is collateral behavior that results from a discriminative history of lack of control. In situations in which we have control, or can describe the relationship between environment and behavior, we have no use for hope.

The distinction between an antecedent and a discriminative stimulus is the degree of conditioning between the two. In teacher education, we can provide various antecedent strategies that allow us to hope for success: didactic instruction about effective teaching practices, placement in a classroom with a strong teacher to serve as a model, etc. Hopeful as these strategies are, however, they provide us no information about how the preservice teacher will perform in the future. In other words, we have no data to supplant the need to hope and provide for analysis.

In this sense, analysis is the antithesis of hope. As it relates to teacher education, how do we condition PBAs to rely on data rather than hope? How do we appropriately condition the PBA under the control of student performance, rather than superstition?

We propose free-operant field experiences as the solution to such problems. Incidental teaching in higher education takes a somewhat different form than that described in traditional research (Hart & Risley, 1975). Specifically, in contrast to the relatively immediate interactions of preschoolers, shaping composite repertoires at the university level requires multiple interlocking contingencies employed across temporally-extended patterns of behavior.

Incidental Teaching in Higher Education

Incidental teaching consists of the following steps, which have been extrapolated from Fenske, Krantz, and McClannahan (2001) to include a broader range of behavior: (1) Arrange the environment to manipulate motivating operations, (2) Allow the preservice teacher to identify the structural elements of the curriculum, (3) Specify reinforcement criteria, and (4) Differentially reinforce successive approximations to the target response. Here we describe each step as it applies to the ShaperSpace, which “permits the development of adaptive behavior that otherwise might never have been included in an organism’s repertoiry” (Keller & Schoenfeld, 1950, p. 186).

Arranging the Environment

The first step of incidental teaching is to arrange the environment to manipulate motivating operations. Everyday human interactions may be the subject of behavior analysis, but *applied* behavior analysis specifically emphasizes socially-valid techniques. To this end, the context we have established for training PBAs is a university-based verbal behavior laboratory to address the behavioral deficits characteristic of autism and other language disorders. This ShaperSpace is a 1,363 sq ft room containing a jungle gym with monkey bars and a swing, an exercise trampoline, a slide, a playhouse, and a collapsible tunnel. A toy shelf is located at the entrance to the space, and centered in the room are three rotating towers with clear bins full of age-appropriate toys. Along opposite walls of the laboratory are six 4’x7’ work areas, three on either side of the room. Each work area includes a rectangular table with three chairs, and is separated from the adjacent workstation by a toy shelf filled with opaque colored bins.

Most critical to the ShaperSpace are the eight children with autism and other language disorders who are invited each semester from the community to receive upwards of 75 hours of behavior-analytic intervention focusing on strengthening verbal behavior. This intervention is performed by graduate students accruing supervised field experience hours necessary to sit for the BCBA exam. The PBAs who volunteer their time to accrue hours in the ShaperSpace are assigned to work with a student for the duration of the semester. Ninety-minute sessions are conducted Monday through Thursday for approximately 13 weeks.

Given the relative short duration of services for children who participate in our program, we primarily focus on conditioning proportional levels of stimulus control over verbal behavior. Depending on the student’s present level of functional performance, this may include selection-based responding, topography-based responding, stimulus equivalence, or equitemporal reciprocity.

Individuals whose verbal behavior is under proportional levels of control are often described as fluent. In contrast, individuals whose verbal behavior is under disproportionate levels of control are frequently described as autistic. Our narrow, yet ambitious intervention efforts afford multiple opportunities for PBAs to develop a complex behavior-analytic repertoire based upon the 115 tasks identified in the BACB Fourth Edition Task List (BACB, 2012). Most importantly, it does so within the context of the natural environment.

His acquisition of a behavior-analytic repertoire is supported through the use of three documents: (1) the BACB Task List, (2) the BACB experience supervision form, and (3) one or more project plans (see Appendix A). Each weekly supervision period begins on Monday morning before the children arrive with two hours of group supervision. Prior to this meeting, PBAs have filled out their project plans, identified the Task List skills to be covered over the course of this project, and validated their intervention procedures through a self-identified behavior-analytic reading.

The Structure of Supervision

Skinner (1974) described creativity as multiple histories of reinforcement coming together to solve a novel problem. In this sense, group supervision fosters such creativity. The purpose of the group supervision meeting is to review each student’s progress towards their individualized objectives, and collectively discuss each other’s self-directed project. Within the context of addressing the long-term student goals, our PBAs are bound to encounter numerous obstacles. These may include addressing the student's behavioral excesses (e.g., aggression, stereotypy, tantruming, etc.), inadequate progress towards instructional objectives, difficulties establishing a discrimination, failure to generalize, among others. Prior to coming to the group supervision meeting at the start of the week, PBAs are expected to have selected a particular problem on which to focus for the week, and, with the help of the project form, engineer a behavioral solution to that problem.

To address these issues within the group setting, we strongly encourage a Socratic method of inquiry to accentuate the variables important to the behavior analyst (i.e., *Under what circumstances does the behavior tend to occur? What is the student doing in place of the target response?* Or, *What do you suppose is maintaining that behavior?*). This kind of inquiry points the PBAs toward solving the problem and promotes discussion amongst them, thereby allowing multiple opportunities to shape their verbal behavior as well.

Specifically, the group supervision meeting focuses on the first two blanks on the project form. While summarizing their student's overall progress, the PBA is expected to explain the problem they have encountered with a succinct, parsimonious statement. Here, it is the primary objective of the supervisor to ensure that: (1) The problem is conceptualized as a behavior problem; (2) The problem is socially significant; (3) The *size* of the project is appropriate, and similarly, that attention does not drift to other related projects; and (4) The objective describes the relationship between the PBA's behavior and the student's behavior.

The functional objective directs the PBA to focus on the end result of their respective interventions (i.e., *What is it that we want the student to do*?) and chain backward from there. An important component of the functional objective is describing the circumstances in which the student emits this response. Specifically, what will the PBA be doing to support behavior change? Additionally, both pre-current and prerequisite behaviors should be discussed, and the PBA may need to determine what approximations need to be reinforced to establish the context for the target behavior.

Specify Reinforcement Criteria

As part of developing their plan, the PBA should identify which skills from the BACB Task List they are going to address over the course of the project, and identify a behavior-analytic research article to support their use of a particular methodology. Using the article as a guide, PBAs are asked to create a fidelity of implementation checklist specifying the steps of their intervention (see Appendix A). Within the context of the group supervision meeting, supervisors may probe about the details of the checklist (*Tell me why you think that step is necessary?*), but refrain from giving explicit instructions (*Instead, you should….*).

Throughout the weeklong supervisory period, the supervisor uses this treatment fidelity checklist when directly observing teacher/child interactions as part of everyone's individual supervision. The objectives of this aspect of the supervision process are two-fold: (1) To measure fidelity as an independent variable (*Are they saying what they are doing*?), and (2) To measure fidelity as a dependent variable (*Are they doing what they are saying*?; Pinkelman, 2014).

The Shaping of a Behavior Analyst

At the end of each weekly supervision period, PBAs submit their project plan(s) and supervision forms, along with their notebooks and graphs for review. At this point, particular attention is paid to the last three blanks of the project form in conjunction with the recording procedures and data collected by the PBA. This aspect of supervision focuses on the selection of adequate recording procedures and visual analysis of the data. The supervisor may ask the PBA questions that focus on the data collection procedures, as well as the visual analysis and interpretation of the student's data.

Rather than yoking their activities through the use of prefabricated data-sheets and procedures, PBAs are encouraged to develop novel techniques for data collection and analysis. In other words, emphasis is placed on functional outcomes over structural processes. This aspect of the behavior-analytic repertoire is again developed through guided inquiry from the supervisor, the verbal community provided by other supervisees, as well as through direct contingency shaping through interactions with the student.

For instance, one group of supervisees worked together to develop a method of momentary time sampling in which they printed stimuli on index cards, laminated them, and then used grease pencils to record the occurrence of targeted behaviors throughout the session. Similarly, another PBA developed a pie graph, which only scarcely appears in the behavior-analytic literature, to display the relative rates of reflexive, symmetrical, and transitive stimulus control over her student's intraverbal repertoire. More important than the methodology employed is that the procedures are *behavioral* and the PBA is *analytic* in describing the results of the intervention, two current dimensions of ABA.

While this free-operant methodology provides the opportunity for great success, it also has the potential to fail. At this stage of supervision, it is not uncommon for PBAs to come into contact with the natural punishing contingencies of data-based decision making. For instance, a PBA may have collected frequency data to record tantrums, which is problematic because tantrums may vary in dimensions such as duration and magnitude. Consequently, the graph of this data may not accurately represent the amount of challenging behavior displayed by the student.

Learning within the ShaperSpace

To clarify the types of activities that go on in the ShaperSpace, we offer an example of a graduate student project. Katie was a public school teacher in one of the largest districts in the area. She had taught special education for five years and had recently completed a master's degree encompassing a course sequence designed to meet the content requirements to sit for the BCBA exam and approved by the Behavior Analyst Certification Board (BACB). District regulations, however, prevented her from accruing field experience hours in her classroom. So Katie volunteered her summer at the ShaperSpace to accrue 300 supervision hours.

She was assigned to work with Michael, a six-year-old boy with ASD who showed proficiency in the basic verbal operants, but whose intraverbal responding was insufficiently conditioned under abstracted stimulus control. During the group supervision session, Katie explained that Michael was making progress towards many of his objectives, but inconsistently responded to Wh- questions. The supervisor's inquiries induced group deliberation about the antecedents and consequences surrounding this behavior, and ultimately led Katie to re-examine the data she had collected for Michael. Specifically, the results of a relational operant analysis showed weak levels of responding to both symmetrical *where* (S^{Where}) and transitive *who* (T^{Who}) questions, in addition to intermittent responses to transitive *where* (T^{Where}) questions. To Katie, this begged the question: To what extent does fluency building of T^{Where} questions concomitantly enhance S^{Where} responding, due to the commonality of both being *where* questions, and/or T^{Who} responding, due to the commonality of both being combinatorially-entailed?

To address this problem, Katie developed a behavioral objective of conditioning abstracted stimulus control over Michael's intraverbal responses to Wh- questions. Her intervention, fluency building, stemmed from Cihon's (2007) synthesis of research examining the effects of precision teaching on intraverbal responding. From this article, she engineered a 16-item treatment integrity protocol to guide Michael's intervention. Katie's own fidelity checklist was used by the BCBA supervisor to provide her with feedback on her interactions with Michael throughout the week. Only brief coaching was provided on the treatment protocol prior to putting it into action. The goal was not to ensure that the "perfect" intervention was put into place prior to employing it, but to allow Katie to come into contact with the natural contingencies of running an imperfect plan. Consequently, the supervisor looked for specific deviations from the protocol throughout the week, and - again rather than offer suggestions - urged Katie to reflect on these digressions.

For example, Katie had initially planned to use an errorless learning procedure to condition stimulus control over T^{Where} responses. In practice; however, she ended up using a high-probability (high-p) request sequence across reflexive, symmetrical, and transitive stimuli respectively. The supervisor asked her first whether or not she was following the protocol as written to determine if she was aware of the departure from the protocol. He then inquired about the change in procedure: What caused it? Why had she initially selected errorless learning? Do the data support the use of the use of one error correction procedure over another? How would you describe Michael's acquisition of T^{Where} responses on your increased use of the high-p request sequence?

Finally, at the end of the supervision period, Katie turned in her data sheets and graphs. At this point she was asked to defend her selection of measurement systems and recording periods, and to describe the change in Michael's intraverbal responses to S^{Where}, T^{Who}, and T^{Where} questions in terms of level, trend, and variability. In completing this project, Katie demonstrated BACB competencies A-13, B-03, D-09, D-13, E-06, E-09, F-04, G-05, J-05, and K-04. The supervision form was then completed with Katie, and used as a basis for any final discussion of the project. Prior to leaving, she picked up a new project form to be completed by the start of the next supervision period.

Conclusion

The distinguishing characteristic that separates the ShaperSpace from other models of field experience is the same characteristic that separated Skinner (1938) from his predecessors: An emphasis on free-operant responding. The importance of free-operant learning in higher education has been recognized for decades, so it is somewhat surprising that this practice is only now emerging as a methodology for training behavior analysts. Keller (1968) accounted for free-operant learning in his personalized system of instruction, the components of which can be found in the ShaperSpace. Lindsley (1996) echoed this call for free-operant responding and credits his own students for advancing the field of precision teaching further than he could have alone: "I learned from my students and gave them the highest compliment by rapidly adopting their discoveries and distributing them nationwide in symposia and workshops" (pp. 212-213). Unfortunately, student learning is too often yoked by the "knowledge" of the teacher.

Both evolution and behavior are predicated on a cycle of repetition, variation, and selection (Baum, 2005). By differentially reinforcing free-operant responses, the ShaperSpace accelerates this evolutionary process of learning. To facilitate replication, we use inquiry-based instruction to make the critical features of teacher/child interactions more salient: Why were some of your exchanges with your student more effective than others? Describe the context(s) for the effective interactions, and contrast this with the context(s) for the ineffective ones.

Variation is achieved by emphasizing functional outcomes over structural form. For example as previously mentioned, rather than training the use of a particular data sheet, we ask PBAs to develop their own: Define the target response. Is your intervention designed to strengthen or weaken this behavior? Is the student's response topographically uniform? Will you be recording continuously? How will you record the occurrence of the target behavior?

Variation is critical when replication no longer works. When a current response no longer accesses reinforcement, previously established behavior may resurge. A response built through contingency shaping provides a history of approximations to serve as the basis for a novel solution (Lattal, 2016). Rule-governed behavior, on the other hand, is established without this contingency history. Consequently, when a rule-governed response fails to contact reinforcement there is no foundation for resurgence, and the development of a new solution may be arrested if not all together averted (Lattal, 2016).

Finally, selection is done not by the supervisor, but by the PBAs who come into contact with the natural contingencies of their behavior. Again, this can be facilitated through inquiry: What were the benefits of using duration over frequency recording? What were the costs? How might you decrease resistance to extinction in similar situations?

We now ask that the reader pause for a moment to recognize that the examples provided above are merely echoic and transcriptive behavior on our part to demonstrate some of the questions that we have asked our PBAs in the ShaperSpace. It would be a mistake to attempt to replicate these questions exactly as they are printed. Rather, in the event that this manuscript has produced any type of secondary conditioning over your own supervision practices, we suggest that you allow your own Socratic repertoire to be shaped by the natural consequences of inquisition, both productive and fruitless.

Ultimately, the ShaperSpace is based upon functional replication - by reverse engineering from outcome to methodology - in order to maximize variation and emphasize selection by consequences. Learning within the ShaperSpace is authentic, in that it affords direct contact with natural contingencies of teaching. Traditionally, PBAs have been restricted to mastering a particular skill set. The ShaperSpace differentiates learning by allowing students to progress at their own pace. By disseminating this model, we aim to further promote the development of behavior-analytic identity.

Throughout this paper it has been our objective to demonstrate how the ShaperSpace encompasses the seven dimensions of applied behavior analysis. The final dimension to be addressed is that of *efficacy* (Baer et al., 1968). Ultimately the purpose of the ShaperSpace is to strengthen environmental control over the behavior-analytic repertoire of the supervisee; to condition a discrimination over the human problems for which a behavior-analytic solution is appropriate. This perspective is shaped through the naturally-occurring contingencies that result from applying behavior-analytic interventions and acting as part of a verbal community.

As stated above, the ShaperSpace is *applied*, in that it addresses problems of demonstrated social significance. It is *behavioral*, in that addresses human problems as behavior problems. It is *analytic*, in that a change in the dependent variable results from the application of the independent variable, which is described with *technological* precision. Perhaps more so than instruction-based training methodologies, the ShaperSpace is *conceptually systematic*, in that the PBA-developed interventions arise from the theoretical base of behaviorism. Additionally, the *generality* of ShaperSpace activities is easily observed across multiple projects. But to what extent is a ShaperSpace *effective* in training novice behavior analysts? Well, how would you know? What would be your primary measure of efficacy? And for what change(s) in behavior might you be looking?

Notes

1. It should be noted that some applied researchers adopted free-operant methodologies early on (Ayllon & Michael, 1959; Ferster, 1958); however, these instances are the exception rather than the rule.
2. The PBA is asked to describe the student's behavioral excesses and deficits in behavior-analytic terms. BACB Task List item(s) characteristically assessed in this section include those listed under the following heading(s): *C. Behavior-Change Considerations; G. Identification of the Problem*
3. A goal stated in terms of how the PBA will modify the student's environment. BACB Task List item(s) characteristically assessed in this section include those listed under the following heading(s): *J. Intervention*
4. The manipulated variable in an experiment. The treatment or intervention that is employed to address the target behavior as measured by the dependent variable. BACB Task List item(s) characteristically assessed in this section include those listed under the following heading(s): *D. Fundamental Elements of Behavior Change; E. Specific Behavior-Change Procedures; F. Behavior-Change Systems*
5. The system for monitoring procedural integrity. BACB Task List item(s) characteristically assessed in this section include those listed under the following heading(s): *B. Experimental Design; K. Implementation, Management, and Supervision*
6. The measured variable in an experiment; used to determine the effects of the independent variable. BACB Task List item(s) characteristically assessed in this section include those listed under the following heading(s): *A. Measurement*
7. Definition of the target behavior in observable, measurable terms. BACB Task List item(s) characteristically assessed in this section include those listed under the following heading(s): *I. Assessment*
8. The schedule of observation and recoding periods. BACB Task List item(s) characteristically assessed in this section include those listed under the following heading(s): *H. Measurement*

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Appendix A: Project Form

Name: ________________________________ Date: ___________

Problem Statement[2]: ____
____

Functional Objective[3]: ____
____

Independent Variable[4]:
____

Procedures[5]:

1. ____
2. ____
3. ____
4. ____
5. ____

Dependent Variable[6]: ____

Response Definition[7]: ____

Recording Method[8]: ____