

Teaching complex behaviors with acoustic guidance

(overview essay)

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Abstract: *Misunderstanding of the principles of behavior and the overuse of aversive stimuli are common to many educational situations, including teaching complex behaviors to children with special education needs. Derived from behaviorism and studied by experimental analysis of behavior, applied behavior analysis uses dozens of evidence-based methods and techniques to teach new complex skills to variety of learners. This literature review presents selection of published studies of teaching complex behaviors by successive approximations and differential reinforcement. Teaching with Acoustic Guidance (TAG) method, which uses shaping as its major component, proved to be an effective intervention across educational settings. Examples from seven studies focusing on TAG application in general and special education settings are discussed.*

Keywords: *Applied Behavior Analysis, TAG, acoustic guidance, shaping, differential reinforcement*

1 Introduction

Behavior analysis is a science studying the principles of learning and behavior. (Cooper et al., 2014). The application of behavior analysis finds its use not only in therapeutic applications for individuals with special needs, but in the widest range of educational settings. Education is a planned and institutionalized learning process, however, shall not be perceived narrowly as school based. On the contrary, education shall be viewed broadly as a continuous lifelong journey (Peters, 1972).

As the goal of education is to change behavior of learners (so as to be able to perform certain tasks and avoid others), the study of human behavior provides the necessary information about the conditions, under which people are likely to learn and behave in certain way (Alberto, 2003). Education is an activity that can take many

forms (ex. formal, non-formal and informal) and is characterized by sets of behaviors labeled as learning and teaching. Teaching as any activity performed to bring about learning (Jarvis, 2010) regardless of the topography of the behavior. Learning, on the other hand, could be defined as behavioral changes, which are results of change in the environment of the learner (Vargas, 2013).

We could imply that learning may happen without teaching, simply because of changes in the immediate environment of the learner. However, teaching occurs only when it results in learning (on the side of the student). Despite this conceptual knowledge in education, many concrete educational activities are not designed with this fundamental distinction in mind. As Vargas (2013, p. 4) points out “Unfortunately, presenting is not teaching. You could present a brilliant lecture in an empty room.” As teaching is far more than transmitting information, teachers can benefit from training in applied behavior analysis to be better able to understand, predict and ultimately also effectively change socially significant behaviors of their students (Vargas, 2013).

Application of behavioral principles and techniques in educational settings has been researched since the 1960s. As described by Snow and Brooks (1974), behavior modification techniques research focused not only on problem behaviors, but also on educational achievements in schools. In the following decades, researchers studied many different strategies and techniques used in education that were derived from applied behavior analysis. For instance, research on academic achievement in schools proved the efficacy of peer tutoring with home-based reinforcement (Trovato and Bucher, 1980), the positive academic achievements and lasting effects of the Comprehensive Application of Behavior Analysis to Schooling (CABAS) has been analyzed by Selinske et al. (1991). Tackling problem behaviors in educational settings has been the focus of ABA research, as shown for example in the study of schoolwide intervention programs for prevention of bullying and positive behavior support (Ross and Horner, 2009).

Despite the positive research findings and wide range of applications of ABA principles in education, behavioral intervention has not become part of many teacher training curricula. This may be one of the reasons for the overuse of punishment and aversive stimuli in schools. As Skinner (1953, p. 405) pointed out “... the positive reinforcers available to schools and colleges are often used as the basis for conditioned aversive stimulation in the form of a threat of failure or dismissal.”

With better understanding of behavioral principles, education shall focus more on the use of strategies based on positive reinforcement, as stated by Vargas (2013, p. 10) “the only postcedents that build behavior are the positive ones.”

2 Teaching with Acoustic Guidance (TAG)

One of the successful strategies building new complex behaviors is based on the process of differential reinforcement and successive approximation. The term shaping, coined by B. F. Skinner, has been used to describe it. It has first appeared in Skinners' article entitled *How to teach animals* (Skinner, 1951). Shaping procedures have been naturally part of teaching for thousands of years. However, it has not been scientifically described prior to Skinner defining it (Peterson, 2004). Since that time, it became an integral part of many behavior analytic teaching strategies, including clicker training and educational packages such as TAG (TAGteach International, 2016).

Before first experimental studies involving shaping were conducted with human subjects, substantial amount of research accumulated in the animal world. Clicker training, i.e. the use and effects of an acoustic stimulus as a conditioned reinforcement in shaping procedures has been investigated in animal training (Gillis et. al., 2012; McCall and Burgin, 2002; Pryor et al., 1969). Following the success in teaching complex behaviors to animals, it slowly entered the human world and is currently used independently or as a part of educational packages such as TAG. TAG developed into a teaching tool that uses shaping extensively, next to other behavioral principles and procedures including task analysis, positive reinforcement, chaining and prompting. One of the main features of TAG is the use of acoustic stimuli to mark correct behaviors. It developed from a clicker training and is currently used in many educational situations and settings (Fogel et al., 2010).

3 Methods

We examined research articles on the use of TAG published in peer review journals within the last seven years. A literature search was conducted using online electronic databases (EBSCO, Medline, ProQuest and PsycINFO) and Google Scholar with 2010 year of article limitations. The key words used in the search for selection of articles included "TAG" and "TAGteach", "acoustic guidance", "tagger", "terminal behavior". Only empirical research articles in the English language with clearly described research methodology using own data collection and analysis were selected.

Despite the growing body of literature including book chapters on TAG (Holdamsbeck and Pennypacker, 2015; Gabler, 2013; Vargas, 2013) only seven studies on TAG were found published in peer review journals. These studies focused on the use of TAG in different teaching situations and with different populations. Four studies focused on behavioral coaching of high school football players, novice golfers and young dancers (Quinn et. al. 2015; Harrison and Pyles, 2013; Fogel et al., 2010, Stokes et al., 2010), two involved the use of TAG in teaching children with Autism

Spectrum Disorders (Persike et al., 2014; Pineda et al., 2014) and one study examined the use of TAG in teaching medical university students (Levy et al., 2016).

4 Results and Discussion

Most of the researchers studying applications of TAG argue that traditional teaching approaches rely heavily on aversive procedures. Teachers and coaches focus their attention on the behavior that is performed incorrectly and do not make use of teaching strategies based on the principles of operant learning (Levy et al., 2016; Quinn et al. 2015; Fogel et al., 2010).

Fogel et al. (2010) studied the use of TAG in a golf player with no previous experience with golf. The aim of the training was to teach a behavior not existing in the repertoire of the learner, i.e. swing with a golf club. Four out of five skill sets have been successfully taught within seven training sessions. This study is one of the very few that examined TAG only, without any additional interventions.

The next study (Stokes, et al, 2010) focused on high school footballers and evaluated the effects of several behavioral coaching strategies on line-pass blocking. Treatment conditions included descriptive feedback only, descriptive feedback combined with video feedback, and finally the two previous interventions together with TAG. The blocking behavior has been task analyzed and five participants with below the normative pass blocking performance were selected for the study. Video feedback and TAG were found to be the most effective procedures as all the players reached above the norm performance. On the other hand, descriptive feedback only did not result in increase of pass blocking behavior. Unfortunately, it is not easy to separate the effects of TAG from the other interventions, and therefore evaluate the unique effects of TAG. The second football study (Harrison and Pyles, 2013) focused on tackling behavior of three high school players. Again, two procedures were combined. Verbal instruction and TAG have been implemented with focus on successive approximations of the terminal behavior. The low performance at baseline increased sharply during shaping sessions and generalized to tackling of live ball carrier following terminal behavior acquisition. This study exemplifies the possible generalization of behaviors learned by TAG to natural environments.

Dancing skills have been taught with the use of TAG to four young students. Quinn et al. (2015) used a clicker as a conditioned reinforcer for successive approximations of three dance movements – turn, kick and leap. The necessity of pairing of the conditioned reinforcer (tagger) with other reinforcers is well described here. Due to the young age of the participants (6 to 9 years) more elaborate process of pairing the clicking with existing conditioned reinforcers was needed. Token economy had to be introduced after clicking sound proved not to be reinforcing by itself in the younger participant. In congruence with the previous studies, large improvement in

the target behavior occurred after the implementation of TAG training in educational settings.

Two studies examined the possible use of TAG with children with Autism Spectrum Disorders (ASD). The first study (Persicke, et al., 2014) showed that TAG may be used not only to build new behaviors, but also in reducing problem behavior, i.e. toe-walking. A four-year-old boy with ASD has been successfully taught an incompatible behavior to toe walking with the use of acoustic conditioned reinforcer. The second study involving children with ASD (Pineda et al., 2014) suggested that TAG may be a feasible method for teaching children with ASD to participate in neurofeedback training. However, this study lacks important information about the target behavior, implementation of TAG procedures and subjects involved.

The last study (Levy et al., 2016) implemented TAG in university course and compared TAG teaching of two surgical tasks with classical approach using demonstration alone. Twelve participants were allocated to the treatment group and twelve to a control group. Clicker has been used as the conditioned reinforcer to mark the correct execution of each step. Even though the final speed of the performance was similar in both groups, the treatment group outperformed the control group in the precision of the behavior learned.

One of the most important strategies that must be well implemented during TAG sessions is shaping. It is recommended to be used in instances, where the target behavior is not part of the repertoire of the learner. The two important skills to be learned by the practitioner are differential reinforcement, which means that reinforcement is delivered in instances of behavior increasingly closer to the terminal behavior and successive approximation, i.e. gradual change of the criterion for reinforcement. The behavior further away from the terminal behavior is being faded as it is not reinforced any longer (Cooper et al., 2014).

Prior to any shaping, the teacher must be able to clearly specify (1) the terminal behavior – what TB shall the student perform and currently lacks in her repertoire, (2) initial behavior – behavior that is already in the repertoire of the student and shares some important properties with the TB (ex. topography, force, rate, etc.) and (3) intermediate behaviors to be reinforced on the way towards TB (Alberto, 2003).

All the above-mentioned studies except Pindera et. al (2014) clearly described the initial behavior, called Point of success in TAG terminology. Terminal or target behavior to be shaped and task analysis that clearly marked intermediate behaviors to be reinforced were also presented. This corresponds with the BID (break it down) rule and Tagpoint selection in TAG methodology (Fogel et al., 2010).

Task analysis included as few as four (Harrison and Pyles, 2013) to maximum of ten steps in Stokes et al. (2010). When performing task analysis and selecting the points of success, it is necessary that practitioners follow the WOOF criteria. That means each step or approximation must be well defined (W), observable and

measurable (O), teachers shall focus on one aspect of the behavior at a time (O) and step described by five words or less (F) (Quinn, et al, 2015).

Another necessary decision for the practitioner is the selection of a device emitting a brief, distinct and uniform audible stimulus, i.e. the Tagger (TAGteach International, 2016). Different devices have been used based on the environmental properties and noise levels. Fogel et al. (2010) used clicker as the tool to deliver immediate feedback and marked the correct form of each step of the behavior being shaped. In more noisy environments a bullhorn siren has been used as the audible stimulus following correct execution of the target behavior (Stokes et. al., 2010). Harrison and Pyles (2013) shaped with the use of megaphone beep to indicate skill completed correctly.

Some of the studies also followed the so called three-try rule (Quinn et al., 2015; Fogel et al., 2010), which means moving the learner quickly forward in case an approximation point has been reached. However, it also means the learner shall be redirected to easier task in case he is not successful in tagpoint production for three successive times. Finally, majority of the studies recommended TAG training for the practitioners (teachers, coaches, etc.) prior to implementing TAG in their teaching.

5 Conclusion

Teaching with acoustic guidance seems to be a promising method originally developed for teaching the general population and may find its application in wide variety of educational situations including special education. It is based on the principles of behavior elaborated by B. F. Skinner and relies heavily on correctly applied strategies of (1) successive approximation towards the terminal behavior and (2) differential reinforcement. These two strategies are the main components of shaping, which may be used in teaching difficult and complex tasks to variety of learners, including those with special education needs.

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