Using PowerPoint 2016 to Create Individualized Matching to Sample Sessions

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Abstract

Discrete-trial-training procedures, particularly matching to sample (MTS), are often used to teach children with autism and/or intellectual disabilities. An example is touching a picture that corresponds to a spoken word. When conducted in a “tabletop” manner, the teacher must arrange several pictures on a table, provide the spoken word, and present response consequences, all while maintaining procedural integrity and collecting data. Using computer programs can greatly reduce the burden on practitioners, but many do not have the access, funding, or time to use complex and expensive software. This report serves as a guide to making MTS tasks that have many of the benefits of computerization using Microsoft® PowerPoint™ 2016, a program that many practitioners have basic knowledge of, and access to. Past papers have described the use of PowerPoint™ for whole classroom instruction. This report expands the use of PowerPoint™ to present individualized instruction that detects child responses and presents consequences based on those responses.

Keywords Discrete-trial training · Matching to sample · Computerized instruction · PowerPoint

Discrete-trial-training procedures are widely used to teach early language skills to students with autism and other developmental disabilities. One discrete-trial procedure—matching to sample (MTS)—is often used to teach receptive language skills (Green, 2001; Leaf, McEachin, & Harsh, 1999). In a typical version of the task, on each teaching trial, the child hears a spoken word and selects, from two or more pictures, the one that corresponds to the spoken word. For example, the goal might be to teach three words: spoon, knife, and fork. On each trial, the teacher presents an array of the three pictures

and one spoken word. If the spoken word is spoon, and the child touches the spoon, a reinforcer is delivered. If she touches the picture of the knife or the fork, the teacher does not deliver a reinforcer. In this example, the spoken word, *spoon*, is the sample stimulus, the three pictures shown are the choice stimuli, and touching is the discrete response that produces a consequence. The next trial might have knife or fork as the spoken word, but the same three pictures would be shown. This is an example of teaching a conditional discrimination, in that the correct response depends on which spoken word is presented.

In the classroom, MTS procedures are typically presented in “tabletop” format. Tabletop procedures for receptive MTS vary, especially in stimulus-presentation order (Petursdottir & Aguilar, 2016). Some studies present the spoken word and choice stimuli simultaneously on each trial, some present the spoken word before the choice stimuli, and others show the choice stimuli before presenting the spoken word. Regardless of the variations in procedures, presenting a long sequence of trials can be cumbersome and time consuming. Ensuring implementation fidelity requires that the teacher follow a written session protocol that includes a prearranged sequence of trials. Ideally, spoken words are presented in a quasirandom order,

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and the positions of the choice stimuli are evenly distributed across trials (Green, 2001; Grow & LeBlanc, 2013). That is, the teacher must place specific pictures in specific positions for each trial. These features help prevent the development of undesired stimulus control, such as position bias or stimulus bias. In brief, executing discrete-trial instruction well requires considerable training, practice, and even stamina.

One of the many advantages of using computers for MTS tasks is that the teacher is not required to attend to a protocol while physically manipulating the choice stimuli on each trial, and trials can be presented more rapidly. A second advantage is that the pronunciation of the spoken words can be the same, regardless of who is conducting the session. To promote generalization to novel speakers, however, several different audio files, with the same words spoken by different people, may also be used.

There also are advantages to automating the detection of the learner's response (see Saunders, Hine, Hayashi, & Williams, 2016, for an extensive discussion). If a response is detected via a touchscreen, for example, it is easier to maintain a consistent, unambiguous response definition. It can also reduce inadvertent experimenter cuing, as in the case of a learner who attends closely to the teacher's reaction as he moves towards the selection of a specific stimulus. Removing the need for the teacher to determine whether the response is correct decreases the likelihood that inadvertent cues are given.

Despite the potential benefits, many teachers do not have access to software programs, the coding experience, or the time, to create computerized MTS tasks. This brief technical report describes an option that is likely available to most teachers—a method for presenting discrete trials via Microsoft® *PowerPoint*™. The goal is to provide practitioners who know how to prepare presentations with *PowerPoint*™ 2016 with a guide to making MTS sessions.

The method takes advantage of *PowerPoint*™'s hyperlink function to present a virtually infinite number of spoken word sample stimuli in random order, detect a touch to a specific stimulus on the screen, and present differential consequences depending on which choice stimulus the child touched.

This strategy allows teachers to achieve many of the procedural-fidelity and efficiency benefits of computerization. Using *PowerPoint*™ also eliminates the need for many materials that take up space in classrooms and are difficult to transport from place to place. Instead of a stack of materials, teachers have almost everything they need in a small device. We use small touchscreen equipped laptops that cost approximately \$250 and can be used for many other purposes.

Previous articles have summarized ways to use *PowerPoint*™ for projected lessons to teach reading skills to

entire classrooms via sound files, animation, slide transitions, and clip art (Blum, Parette, & Watts, 2009; Parette, Blum, Boeckmann, & Watts, 2009; Coleman-Martin, Keller, Cihak, & Irvine, 2005). These applications, however, do not detect individual child responses and present consequences based on those responses. The current article extends the literature by describing the use of *PowerPoint*™ to create MTS tasks that incorporate many features necessary for individualized instruction (Holland, 1960; Keller, 1968).

Procedure for Making Sessions

Formatting Slides for a Trial

We begin with a brief overview of the building block for a session: the four slides that compose each trial. These four slides as a unit are customized for each trial. Figure 1 shows an example; our figures and tables illustrate two-choice tasks for conciseness and simplicity. Three or more choices also can be used.

The Start Slide is blank with a black rectangle at the center. The spoken word is presented through the speakers (instructions for recording audio are presented later). A touch to the rectangle presents the Choice slide via hyperlink. Directions for hyperlinking appear later.

The Choice Slide presents the array of pictures, a cat and hat in our example, and the spoken word that corresponds to the correct picture. Correct responses are hyperlinked to the Reinforcer Slide. Incorrect responses are hyperlinked to the ITI Slide only.

The Reinforcer Slide can be decorated differently on each trial. Because there is no response to the screen during the Reinforcer Slide, use the Timing menu to set the duration of this slide and continue to the next trial. Use of the timing menu will be described later. Note that, although the program provides the option of incorporating reinforcer slides, teachers may also deliver consequences exactly as they would within a tabletop task (e.g., praise, edibles, tokens). That is, the reinforcer slide can serve as a cue to the teacher to deliver the child's preferred reinforcer.

The ITI Slide is blank without sound. Use the Timing menu to have *PowerPoint*™ continue to the next trial after a specified number of seconds.

Trial Table Sheet

Create a trial table, shown in Fig. 2, before making a session. A table allows the person making the session to see where

Fig. 1 An example of an audio to picture MTS task. The top row shows a trial during which the participant made a correct response, and the bottom row shows an incorrect response

stimuli will appear across trials, which makes it easier to vary the stimulus location. Additionally, a table is useful as a score sheet for collecting data during the session. *PowerPoint™* does not store data on the accuracy of responses, so users must use hard-copy Trial Tables to record responses. The teacher marks the stimulus selected on each trial to calculate accuracy and highlight response locations to detect biases towards a particular picture or side of the screen.

How to Use *PowerPoint™* Features

Organizing Slides in Clipboard Figure 3 shows an example of an MTS task using spoken words and pictures in a *PowerPoint™* presentation. The sequence of slides is on the left-hand side of the screen in the Clipboard. The order of slides is important because *PowerPoint™* moves through slides in a forward progression.

Name:
Date:
Spoken word to picture MTS
Cat/Hat

Trial	Audio	Top Left (TL)	Top Right (TR)	Bottom Left (BL)	Bottom Right (BR)	S+	Response 1= correct 0= incorrect	Notes
1.	Cat	Cat	Hat			TL		
2.	Hat		Hat	Cat		TR		
3.	Cat	Cat			Hat	TL		
4.	Cat	Hat		Cat		BL		
5.	Hat			Hat	Cat	BL		
6.	Hat		Cat		Hat	BR		
7.	Cat	Hat	Cat			TR		
8.	Hat			Cat	Hat	BR		

Fig. 2 An example of a trial table showing eight trials of a two-choice, audio to picture MTS task. Trials are shown across rows from left to right. The position of the correct stimulus on each trial is shaded

Fig. 3 A diagrammatic representation of the Clipboard. The Clipboard is found on the left side of the screen in *PowerPoint™* and is used to organize slides. Each trial for a session includes four types of slides, which we call the Start Slide, Choice Slide, Reinforcer Slide, and ITI Slide

Four slides make a single MTS trial¹ as described above. These four slides can be selected as a unit, and copied, pasted, and edited for each trial in a session. Figure 3 shows three trials, each with a different correct choice. Responses produce different consequences, dependent on accuracy, via hyperlinks (described later).

Recording an Audio File² is a four-step process, shown in Fig. 4.

1. Under the Insert tab, to the far right, is a small dropdown menu marked by a speaker and the word Media. Under Audio, there is the option to record any sound, including spoken words.
2. A menu will appear with a place to name the file and a record button. To create a sound that repeats every 2 s, when recording, leave 2 s of silence before saying each word.
3. To stop recording, press the blue stop button.

4. Listen to the recording by pressing play. Then, either re-record or press okay.

Formatting an Audio File Upon inserting an audio file, a small speaker icon will appear on the slide as shown in Fig. 5. To reuse the audio file, copy this icon and paste it into the next slide to use that sound file.

1. Clicking on the speaker icon will cause the Audio Tools menu to appear at the top of the screen.
2. In Audio Tools is the Playback tab, where Audio Options is located.
3. Under Audio Options, select “sound start automatically,” “be hidden during the show,” and “loop until stopped.”

Inserting a Hyperlink allows clicking on any visual stimulus, including clipart and text boxes, to produce a jump to another slide. To access the Insert-Hyperlink option, right click on the visual stimulus on a slide, which produces a drop down menu. Figure 6 shows the Insert Hyperlink menu.

1. To the left of the menu is the “Place in This Document” option. Selecting this option shows a list of all of the slides in the current document (i.e., slide show).
2. The slides are numbered corresponding to the slide numbers in the Clipboard.

¹ Because *PowerPoint™* moves in a forward progression, it is not possible to use a slide for incorrect responses. If there were a slide for incorrect responses, *PowerPoint™* would show it following feedback for a correct response.

² There is also an option to insert sound in the Timing menu found under the Transitions tab. We do not suggest using this option to play sound on the Start and Choice Slides, because the sound will not repeat. Audio selected for a transition will only play once, when the slide first appears.

Fig. 4 A diagrammatic representation of the steps necessary to record audio in *PowerPoint*TM. This is done through the Media menu found under the Insert tab as shown

3. Choose which slide *PowerPoint*TM will jump to when the stimulus is selected. To preview each slide to the right of the Insert Hyperlink menu, select it.
4. After selecting the slide that *PowerPoint*TM will jump to, press OK. Remember to update Hyperlinks when slides are copied and pasted to create additional trials.

Fig. 5 A diagrammatic representation of the steps necessary to format a sound file. After making a sound file, set it to loop until a response is made and *PowerPoint*TM moves on to another slide. The audio icon can also be hidden during the presentation

Fig. 6 A diagrammatic representation of the steps necessary to make a hyperlink. The Insert Hyperlink feature allows an object to act as a hyperlink to another slide. To access the menu, right click on the desired visual stimulus to create a link

For example, referring to the trials shown in Fig. 3:

If on trial 1, the cat is the correct answer:

1. Hyperlink the black rectangle to Slide 2 (Choice Slide 1)
2. Hyperlink the cat to slide 3 (Reinforcer Slide 1)
3. Hyperlink the hat to slide 4 (ITI Slide 1)

If on trial 2, the hat is the correct answer:

1. Copy and paste the previous four slides
2. Right click on the black rectangle in slide 5 (Start Slide 2), choose the Edit Hyperlink option, and hyperlink it to slide 6 (Choice Slide 2)
3. Right click on the hat in slide 6 (Choice Slide 2), and edit the hyperlink to move to slide 7 (Reinforcer Slide 2)
4. Right click on the cat in slide 6 (Choice Slide 2), and edit the hyperlink to move to slide 8 (ITI Slide 2)

Advance Slide In the Timing menu under Transitions is an option to advance slides by a click or after a designated number of seconds, as shown in Fig. 7.

1. De-select the option for *PowerPoint™* to move on after a mouse click.
2. Select the option for *PowerPoint™* to move on after a certain time has passed.

Preparing Children to Use the Touchscreen Task

For some children, it will be important to practice using the touchscreen before instruction in the MTS task, so that the need to correct the child's touch topography does not interfere with instruction. If a child touches the screen in a sweeping motion, for example, it will automatically move to the next slide regardless of programmed hyperlinks or timing. Thus, we ensure that children practice clean touches to stimuli on the screen, and learn not to touch a blank screen, prior to instruction (see Saunders, Johnston, Thompkins, Dutcher, & Williams, 1997, for an example of preparing students for computer training; further information is available from the authors).

Discussion

Other Uses

In this article, we focused on spoken-word-to-picture MTS tasks. *PowerPoint™* also can be useful for MTS tasks with visual sample stimuli, using many of the features described above. For example, in an identity-matching task, the child selects a stimulus at the edge of the screen that is identical to a visual sample stimulus shown in the center of the screen. Similarly, the procedures can be adapted to an arbitrary-

Fig. 7 A diagrammatic representation of the steps necessary to have slides move on without a response. The Timing menu found under the Transitions tab has the option for *PowerPoint*TM to move on after a designated time

matching task, such as selecting a printed word that corresponds to a picture. The only changes would be the following:

- Do not use an audio file (no spoken word).
- Replace the black square with the visual sample stimulus; the child touches the visual sample instead of a black square to present the choice stimuli.
- On each Choice Slide, place the visual sample stimulus in the center of the screen and do not program a hyperlink for that stimulus.

*PowerPoint*TM can also be used for expressive, or naming, tasks. Instead of using hard-copy flash cards to present pictures or words for the child to name, the teacher can move through individual slides using the keys. Using *PowerPoint*TM frees teachers from having to carry and organize large numbers of flash cards.

In this report, we focused on the logistical benefits of using *PowerPoint*TM to teach tasks often presented via tabletop, including procedural integrity, less cumbersome for the teacher, detection of discrete responses to stimuli, and fewer materials to carry and/or keep organized. It is important to note that we have presented only a means of automating tabletop MTS procedures. We have not discussed sophisticated, computerized instructional programming, because the literature contains many examples of specific teaching methods.

One aspect of the procedures described here is worth mentioning, however, for terminological reasons. In the methods

we have described, the sample stimulus is presented first, and touching the sample produces the choice stimuli (when the sample is auditory, the child touches a black rectangle that accompanies the sample). Touching the sample is typically referred to as an “observing response,” implying that the child observes the sample stimulus. It is important to note, however, that the term can be misleading. Unless the child makes a different “observing response” to each sample, it is unclear whether s/he discriminates the samples. Assuming otherwise might be the cause of many teaching failures.

Compliance with Ethical Standards

Conflict of Interest Author Carol Cummings declares that he/she has no conflict of interest.

Author Kathryn J. Saunders declares that he/she has no conflict of interest.

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

References

- Blum, C., Parette, H. P., & Watts, E. H. (2009). Engaging young children in an emergent literacy curriculum using of Microsoft® *PowerPoint*TM: Development, considerations, and opportunities. *Research, Reflections and Innovations in Integrating ICT in Education*, 1, 41–45.

- Coleman-Martin, M. B., Heller, K. W., Cihak, D. F., & Irvine, K. L. (2005). Using computer-assisted instruction and the nonverbal reading approach to teach word identification. *Focus on Autism and Other Developmental Disabilities*, 20(2), 80–90.
- Green, G. (2001). Behavior analytic instruction for learners with autism: Advances in stimulus control technology. *Focus on Autism and Other Developmental Disabilities*, 16(2), 72–85.
- Grow, L., & LeBlanc, L. (2013). Teaching receptive language skills. *Behavior Analysis in Practice*, 6(1), 56–75.
- Holland, J. G. (1960). Teaching machines: An application of principles from the laboratory. *Journal of the Experimental Analysis of Behavior*, 3(4), 275–287.
- Keller, F. S. (1968). Good-bye, teacher. *Journal of Applied Behavior Analysis*, 1(1), 79–89.
- Leaf, R., McEachin, J., & Harsh, J. D. (1999). *A work in progress, behavior management strategies and a curriculum for intensive behavioral intervention*. New York: DRL Books Inc..
- Parette, H. P., Blum, C., Boeckmann, N. M., & Watts, E. H. (2009). Teaching word recognition to young children who are at risk using Microsoft® PowerPoint™ coupled with direct instruction. *Early Childhood Education Journal*, 36(5), 393–401.
- Petursdottir, A. I., & Aguilar, G. (2016). Order of stimulus presentation influences children's acquisition in receptive identification tasks. *Journal of Applied Behavior Analysis*, 49(1), 58–68.
- Saunders, K. J., Johnston, M. D., Tompkins, B. F., Dutcher, D. L., & Williams, D. C. (1997). Generalized identity matching of two-dimensional forms by individuals with moderate to profound mental retardation. *American Journal on Mental Retardation*, 102(3), 285–291.
- Saunders, Hine, Hayashi, & Williams. (2016). Adventitious reinforcement of maladaptive stimulus control interferes with learning. *Behavior Analysis in Practice*, 9(3), 223–229.