Using Pictures Depicting App Icons to Conduct an MSWO Preference Assessment on a Tablet Device

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Abstract

Identifying preferred content on tablet devices may be important when using such devices in programming. This study included six adults with disabilities and examined using laminated picture cards depicting application (app) icons to conduct multiple-stimulus without replacement (MSWO) preference assessments of iPad content. Following identification of preference hierarchies, we conducted reinforcer assessments to validate preference assessment results by demonstrating that selected apps functioned as reinforcers. We identified preference hierarchies for all participants, and the highest preferred app functioned as a reinforcer for a vocational task in five out of six participants' reinforcer assessments.

Keywords MSWO · Preference assessment · Tablet device

Preference assessments are important and empirically demonstrated methods of identifying putative reinforcers for use in skill acquisition and behavior-reductive programming for individuals with disabilities (Virués-Ortega et al., 2014). Preference assessments have been used to assess preference for a variety of stimuli, including forms of social interaction (Clay, Samaha, Bloom, Bogoev, & Boyle, 2013), activities (Brodhead, Al-Dubayan, Mates, Abel, & Brouwers, 2016; Daly et al., 2009), and edibles (Paramore & Higbee, 2005). Researchers have also examined using different modalities within preference assessments—for example, pictures (Heinicke et al., 2016), videos (Brodhead et al., 2016), vocal descriptions, and tangible items (Conyers et al., 2002). Researchers have also conducted reviews of preference assessment methods, recommendations for practitioners, and

assessments of efficacy of preference assessments (Cannella, O'Reilly, & Lancioni, 2005; Virués-Ortega et al., 2014). Despite the large body of literature examining preference assessments, researchers continue to pose insightful calls for future research.

In recent years, high-tech items, such as tablet devices, are being used more frequently by individuals receiving behavior-analytic services (Hoffmann, Samaha, Bloom, & Boyle, 2017; Kagohara et al., 2013). One unique aspect of some high-tech items (e.g., tablet computers, iPods) is that they provide access to multiple stimuli (applications) within a single device (Hoffmann et al., 2017). As tablet computers are increasingly used in programing and reinforcement to promote positive behavior and support skill acquisition, it is important to identify aspects of the device that may increase the value of the device functioning as a reinforcer. For example, if an individual is provided access to the tablet, but the applications (apps) available are not preferred, it is unlikely that the tablet will function as an effective reinforcer. It may be important to conduct app preference assessments in order to rank apps and differentially provide access to apps based upon preference hierarchies. For example, an individual could be provided access to low-preferred apps for prompted responses but only obtain access to high-preferred apps for independent responses.

Recent studies have examined using high-tech devices in various forms of preference assessments (Brodhead et al., 2016; Chebli & Lanovaz, 2016). These studies used high-tech devices to assess preference for content outside of the

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device (Brodhead et al., 2016) or to assess preference for video content within the device (Chebli & Lanovaz, 2016). Unique problems may arise when assessing preference for content on high-tech devices. Because apps are stored within the device, and are accessed through a haptic digital interface, it may be difficult to move and shift around apps between pairings or presentations. Although the multiple-stimulus without replacement (MSWO) and paired-stimulus formats are both common methods of preference assessment, paired preference assessments may be more amenable for use in the tablet format because it is easy to move and display choices between two apps at a time (Nix, 2016).

One drawback of paired-stimulus preference assessments may be the time needed to conduct such an assessment. An alternative, the MSWO assessment (DeLeon & Iwata, 1996), is often more efficient than paired assessments, and research has demonstrated it is an accurate method for determining putative reinforcers (Daly et al., 2009). MSWO assessments require removing stimuli from an array before re-presenting stimuli for the next trial, which may be difficult when conducting a preference assessment on a tablet device. Further, due to the digital interface, it is time-consuming to move apps around on the tablet screen between presentations, resulting in downtime for the individual while the assessor gets the device ready for the next selection trial. In addition, it would likely be too costly and impractical in most settings to provide multiple tablet devices with a single app available on each device. One potential solution could be using picture icons to depict the apps available for selection. Researchers have examined using pictures to assess preferred items and activities (e.g., Graff & Gibson, 2003; Heinicke et al., 2016; Parsons, Harper, Jensen, & Reid, 1997); however, no published research to date has used pictures depicting digital content to conduct preference assessments with tablet computers.

The purpose of this exploratory study was to examine the effects of using app picture icon cards within an MSWO preference assessment conducted with digital content on an iPad. A second purpose was to further validate preference hierarchies by identifying if selected apps functioned as reinforcers using two- and three-choice concurrent-arrangement reinforcer assessments.

Method

Participants and Setting

Six adults (ages 19–34) with intellectual and developmental disabilities participated. All attended an adult employment training and day program and were included given they had a history of independently accessing high-tech devices such as tablets and did not engage in problem behavior that might interfere with sessions. Sessions were conducted in the

employment training center in empty conference rooms containing a table and four to six chairs. During sessions, one or two researchers and the participant were in the room.

Jordan was a 24-year-old male with autism spectrum disorder (ASD). Stan was a 25-year-old male with an intellectual disability (ID) and fetal alcohol syndrome. Charlie was a 19-year-old male with a traumatic brain injury and a speech-language impairment. Lily was a 34-year-old female with an ID. Ginny was a 21-year-old female with ASD and myopia. Barty was a 31-year-old male with an ID and obsessive-compulsive disorder. All participants communicated vocally in full sentences, except for Charlie, who used two- to three-word utterances to communicate. Ginny had a specific behavior plan that required a staff member to stay with her during every session; all other participants were unaccompanied by staff during sessions. Stan, Lily, and Ginny had a history of working in competitive employment. Jordan, Barty, and Charlie had participated in job sampling and could work independently in their employment center positions.

Staff reported that all participants had a history of using tablet devices such as iPads and that these devices were preferable leisure items. All participants demonstrated skills in independently navigating the device (i.e., touching, swiping, pressing the home button, adjusting volume, etc.). Although we did not systematically assess participant choice-making or discrimination skills, anecdotally, staff indicated all participants had a history of choice making for preferred and nonpreferred activities, food, and staff members.

Materials

We used an Apple iPad mini Version 3 loaded with several apps during the MSWO and reinforcer assessments. We did not control for high-tech device usage outside of experimental sessions; however, staff did not report any participants having access to a tablet during their daily routines at the day program. The specific iPad used in this study belonged to the research staff, and participants were only provided access during sessions. We used laminated 3 in. × 3 in. (approximately 7.5 cm × 7.5 cm) square icons depicting a colored picture of iPad apps during the MSWO and reinforcer sessions. Each square showed a different iPad app icon. We selected pictures for the icon cards from various websites (e.g., software sites, online app market). Icons used for cards exactly matched the icon depicted electronically on the iPad. A writing utensil, a black plastic bin for letter collection, and 8.5 in. × 11 in. (22 cm × 28 cm) papers were used during the reinforcer assessments for arbitrary responses.

Preexposure

Prior to implementing assessment procedures, participants (or caregivers) were interviewed by a researcher and asked a

series of questions about (a) the types of iPad apps that participants had experience using, (b) specific apps or types of apps participants liked, and (c) specific apps or types of apps participants disliked. This information was used on an individual basis to select the iPad apps that were included in the MSWO assessments.

Prior to the preference assessment session, we exposed participants to the laminated cards and the depicted app. The researcher placed one card on the table in front of the participant and said, “Take a look at this.” After the participant looked at or touched the card, the researcher immediately gave the participant the iPad cued up with the corresponding app, while the corresponding icon card remained on the table next to or in front of the participant. The participant then had 60-s access to the iPad with that app. Data were not collected on engagement with the device; however, anecdotally, participants engaged with the device and relevant app during the entire interval. At the end of the 60 s, the researcher asked for the iPad back, removed the icon card, and then repeated this process with a new icon card and corresponding app. This process continued until the participant was exposed to each of the eight iPad apps and corresponding icon cards.

MSWO

After the preexposure, the researchers conducted MSWO assessments based on procedures described by DeLeon and Iwata (1996) and Carr, Nicolson, and Higbee (2000). The eight app icon cards were spread out on the table facing the participant. Each card was equidistant from each other and the participant. The researcher said, “Pick your favorite” (Fahmie, Iwata, & Jann, 2015), and whichever icon card the participant selected, the researcher cued the iPad with that app and handed the iPad to the participant. The participant had 60-s access to the iPad app. During reinforcer intervals, the selected app icon card remained on the table in front of the participant. After the 60 s, the researcher removed the iPad and icon card, re-presented the remaining cards in a random format, and again asked the participant to select his or her favorite app. This was repeated until all items were selected. The entire preference assessment was repeated for a total of three times (Charlie, Jordan, and Lily) or five times for those whose preferences were undifferentiated after the initial three assessments (Stan, Ginny, and Barty). The researchers determined preference hierarchies by dividing the number of times an app was selected by the number of times the app was available for selection. The app with the highest percentage selection was used during subsequent two-choice and three-choice reinforcer assessment sessions, and the app with the lowest percentage selection was used during the three-choice reinforcer assessment sessions.

Reinforcer Assessments

Target Response Jordan, Barty, and Lily’s target response was trifold a letter-sized (8.5 in. × 11 in.; 22 cm × 28 cm) paper and placing the folded letter in an outgoing bin. Stan, Charlie, and Ginny’s target response was signing and dating a letter, then trifold this letter and placing it in an outgoing bin. Responses were selected based on staff input and participant ability. Staff reported that folding papers and writing were useful vocational skills for participants to practice during sessions. Following demonstration by a researcher, all participants independently demonstrated the target response and further prompting was not necessary. Responses were measured using event recording, which was converted to a cumulative number of responses per session. All data were recorded using paper and pencil.

Two-Choice Reinforcer Assessments The purpose of the two-choice reinforcer assessment was to examine whether participants would work to gain access to the tablet with the high-preferred app or work to gain access to no iPad or apps. Allocating responding to the task associated with access to the preferred app over working to access no programmed consequences would indicate that access to the preferred app functioned as a reinforcer. During these sessions, the participant was presented with a choice between two concurrently available work options. The tasks were identical; only the reinforcer differed. Prior to the sessions, the participant was preexposed to the relevant contingencies in the following manner. The researcher placed two stacks of papers in front of the participant, and a black bin for the completed folded letters was placed to the left of the two stacks. An icon card of the participant’s highest preferred iPad app was placed on the table above one stack of papers (from the participant’s view) to signal the consequence following completion of the task when a paper was selected from that stack. Nothing was placed on the table above the other stack of papers; this served as a control signaling that nothing would be provided following completion of the task when a paper was selected from that stack. The researcher modeled the arbitrary response using the stack of papers signaled by the app icon card and stating, “If you do this [modeled action], you get this [pointed to icon]. Now you try.” After the participant completed the task, he or she was immediately given 60-s access to the iPad cued up with that app and vocal praise (e.g., “Great working,” “Nice folding.”). Next, the researcher repeated the direction and modeled the arbitrary response with the other stack of letters. This time, however, the researcher stated, “If you do this [modeled action], you get nothing. Now you try.” After the participant completed the task, the researcher gave brief vocal praise (e.g., “Nice working.”) and set a timer for 60 s, during which time they sat in silence. The researcher ignored any bids for attention from the participant.

After the preexposure, the reinforcer assessment began. Throughout this and subsequent phases, programmed consequences were provided on a fixed-ratio 1 schedule (either 60-s access to the iPad or 60-s access to silence). The two stacks of letters and black bin were in front of the participant in the same manner outlined previously. The researcher told the participant, “Choose where you want to work,” and gestured to both stacks of paper. Once the participant made a selection, the researcher gave nonspecific vocal praise (e.g., “good”) and removed the other stack from the participant’s reach. After the participant completed the task, the researcher provided specific vocal praise (e.g., “Great folding,” “That’s nice working.”), removed the stacks of papers, and provided 60-s access to the corresponding contingency. That is, if the participant chose to work from the stack signaled by the app icon card, he or she was given the iPad cued with the app. If the participant chose to work from the stack without any icon card, he or she sat in silence for 60 s (i.e., no access to the iPad or apps). In order to identify any potential side bias, the order of the contingencies was randomly arranged after every trial, so that sometimes the right side and sometimes the left side corresponded with the iPad app. Five choice trials per session were conducted, and as such, session durations varied. A minimum of four sessions were conducted or until the participant demonstrated a clear pattern of responding, as determined by visual analysis of the data.

Three-Choice Reinforcer Assessments The purpose of the three-choice reinforcer assessment was to examine reinforcement effects of the high-preferred app when compared to access to the low-preferred app and access to no iPad or apps. If participants allocated work responses toward access to the high-preferred app relative to the low-preferred app and relative to nothing, further validity of the preference assessment hierarchy could be shown. During the three-choice reinforcer assessments, three stacks of letters and the black bin were placed in front of the participant. One stack had an icon card of the highest preferred app placed above it, another stack had an icon card of the lowest preferred app placed above it, and one stack had nothing placed above it. Preexposure to the corresponding contingencies for each of the three options occurred in the manner outlined previously.

After the preexposure, the researcher said, “Choose where you want to work,” gestured to all options, and provided the same types of vocal praise mentioned previously. The location of selections was randomly rotated following every choice trial in order to identify any potential side bias. The rest of the procedures (i.e., reinforcement schedule, number of trials per session, and minimum number of sessions) were identical to the procedures of the two-choice reinforcer assessment.

Interobserver Agreement

During all procedures, a second data collector independently collected data on all dependent variables during at least 60% of sessions across phases of the study for purposes of calculating interobserver agreement (IOA). IOA data were calculated by dividing the number of agreements by the number of disagreements plus agreements and multiplying by 100 to yield a percentage. IOA for all sessions was 100%.

Social Validity

After participants finished the study, they were surveyed regarding their participation for purposes of examining the social validity of the procedures. Participants could respond to three multiple-choice questions about their participation, as well as two open-ended questions where they could provide additional feedback on the study. Staff members at the employment center provided assistance with the completion of the assessment as needed through reading words aloud to participants and/or writing word-for-word answers provided vocally by the participants.

Results

MSWO Assessments

Figure 1 shows the results of MSWO preference assessments. We identified preference hierarchies for all participants. All participant hierarchies demonstrated differential preference across apps, with the exception of Stan, whose preference hierarchy was undifferentiated across the eight apps assessed. Jordan’s highest preferred app was Cyborg Run, and his lowest preferred app was Netflix. Stan’s highest selected app was My Talking Tom, and his lowest selected app was Amazon. Charlie’s highest preferred app was Spotify, and his lowest preferred app was One Clue. Lily’s highest preferred app was Candy Crush, and her lowest preferred app was Google Earth. Ginny’s highest preferred app was Pinterest, and her lowest preferred app was Slitherio. Barty’s highest preferred app was Pandora, and his lowest preferred app was Google Earth.

Reinforcer Assessments

Figure 2 shows the results of the reinforcer assessments. During Jordan’s two-choice reinforcer assessments, he allocated all responses toward the contingency that resulted in access to the highest preferred app. Likewise, during his three-choice reinforcer assessment, he allocated all responses toward the contingency that resulted in access to the highest preferred app. Charlie’s, Barty’s, and Ginny’s patterns of

Fig. 1 Results from the MSWO preference assessment using app icons. Data are plotted as the percentage of selection per iPad app for each participant

responding were identical to Jordan's for both the two-choice reinforcer assessment and the three-choice reinforcer assessment.

During Stan's two-choice reinforcer assessment, he allocated his responding toward the contingency that resulted in access to the highest preferred app. However, during his three-choice reinforcer assessment, he demonstrated variable responding between the lowest preferred and highest preferred app. In the first session, he responded more to earn the highest preferred app than he responded to earn the lowest preferred app. His number of responses toward the two apps varied for the next six sessions, until he demonstrated a clear pattern of responding toward the lowest preferred app for the last four sessions. These results are not surprising considering the undifferentiated results of Stan's MSWO, which would indicate very little difference in preference between the highest preferred and lowest preferred apps.

During Lily's initial two-choice session, she allocated more responses to access the control (no reinforcement) than responses to access her highest preferred app. After this first session, the researcher conducted an additional pre-session exposure to the contingencies, repeating the contingencies to her (e.g., "If you choose to work here [no icon card], you get nothing. If you choose to work here [icon card], you get the iPad.") to ensure that she understood the contingencies associated with each stack of letters. After the additional

contingency rehearsal, Lily responded exclusively toward the contingency associated with the highest preferred app for the remaining four sessions. During the three-choice reinforcer assessment, Lily engaged in some responses toward the lowest preferred app but eventually allocated all responses toward the contingency associated with the highest preferred app.

Social Validity

Table 1 reports participants' self-reported experiences with the study. Overall, participants reported being satisfied with their experiences participating in this study. Additionally, Table 2 shows the participants' responses to the questions about which apps they most and least liked working to earn. Responses generally corresponded with the actual apps to which they allocated their responding. It is noteworthy that Stan indicated that his lowest preferred app (based on his MSWO results) was the app he most enjoyed working to earn and that his highest preferred app was the app he least enjoyed working to earn. This response aligns with his responding during the reinforcer assessment, which showed that his preference for the apps seemed to shift during the study. Although the survey contained open-ended questions and space to respond, participants did not provide any additional feedback.

Reinforcer Assessments

Fig. 2 Reinforcer assessment results for all participants measured as the cumulative number of responses per session. Results from the two-choice concurrent arrangement are presented on the left of each graph, and

results from the three-choice concurrent arrangement are presented on the right of each graph

Discussion

This study examined the effects of using pictures depicting apps within an MSWO preference assessment conducted on a tablet device. Further, this study examined whether apps identified as preferred in the MSWO preference assessment reinforced a vocational task during subsequent concurrent-arrangement reinforcer assessments. Preference hierarchies were identified for all participants, and subsequent reinforcer assessments demonstrated that selected apps functioned as reinforcers for all participants. Four participants showed a

clear pattern of exclusively allocating work effort to the highest preferred app during both the two-choice and three-choice assessments. One participant, Lily, allocated a majority of her efforts to her highest preferred app.

One participant's results (Stan's) highlight the intricacies and complex variables involved in preference and reinforcing efficacy of digital content. When given three choices (highest preferred app, lowest preferred app, and control), Stan's results were quite variable compared with the other five participants. Stan's initial MSWO assessments did not indicate any strong preference; rather, he seemed to prefer accessing most of the apps. Interestingly, Stan's staff reported he liked watching videos on the iPad, and five of the eight apps included in his MSWO preference assessment provided access to video content. It may have been that Stan's results were undifferentiated because he generally preferred many of the apps presented. Future researchers could examine preference assessments conducted with multiple reportedly high-preferred apps compared to reportedly low-preferred apps. Future researchers could also

Table 1 Frequency of responses to "How would you rate your overall satisfaction with the research with the iPad Apps?"

Very dissatisfied	Dissatisfied	Neutral	Satisfied	Very satisfied
0	0	1	1	4

Table 2 Frequency of responses to (a) “Which iPad App did you most enjoy working to earn?” and (b) “Which iPad App did you least enjoy working to earn?”

Most enjoyed			Least enjoyed		
No app	Lowest preferred app	Highest preferred app	No app	Lowest preferred app	Highest preferred app
0	1	5	1	4	1

examine results from preference assessments including novel iPad content and reported favorite content.

Another interesting discussion based on Stan’s results surrounds preference for digital content shifting as sessions progressed. Stan’s preferences may have shifted during the three-choice sessions. Specifically, in the prior two-choice sessions, Stan had already accessed his highest preferred app (My Talking Tom), and perhaps further motivation for access to the app decreased over time (i.e., satiation/habituation). Thus, during the three-choice sessions, when now presented with the opportunity to earn reinforcement for a different app (Amazon), Stan’s preference may have shifted toward the Amazon app. Future research could compare reinforcer assessments for multiple high-preferred apps to multiple low-preferred apps in order to minimize potential satiation effects.

Another variable that potentially influenced results was the type of content provided (e.g., music, interactive games, promotional games). Specific to Stan’s results, the My Talking Tom app was a game that involved feeding and playing with a virtual character (the cat Tom). When the app was accessed, the ability to interact with the character was depleted and needed to be replenished by either waiting for a long duration between uses or by playing games and watching advertisements. Anecdotally, Stan did not appear to fully understand how to “play” the app and how to access further content. This may provide an example of the features and capabilities of an app influencing reinforcer value.

This study extends the literature by demonstrating that picture cards can be used to depict corresponding apps on a tablet device. Practitioners who use tablet devices and specific apps as reinforcers may be able to quickly and easily assess clients’ preferences by using picture cards in MSWO preference assessments. The results also highlight the importance of assessing preference for content on tablet devices and ensuring that preferred content is available when providing tablet devices as reinforcers. Although these procedures highlight one way to assess preferred content on a device, future developers and researchers could extend this line of research by developing easier methods for assessing preference for apps (i.e., develop and assess the efficacy of an MSWO app for assessing app preference).

This study demonstrates an initial foray into the topic of using pictorial icons to represent electronic content on a tablet device. Unlike previous research, which has demonstrated correspondence between pictorial preference assessments

and tangible (Graff & Gibson, 2003) and verbal assessments (Northup, George, Jones, Broussard, & Vollmer, 1996), this study did not compare the use of picture icons to assessment using the digital content itself. We recommend future researchers extend this study by examining correspondence between assessment using picture apps and actual digital content. Additionally, a comparison such as this could examine differences in implementation duration across both methods. Future researchers should time the duration of icon card MSWO preference assessments compared to tablet-only assessments. Although based on anecdotal clinical experience we concluded that app icon card positioning and representation is less time-consuming than electronic positioning and re-presentation during MSWO assessments, a timed demonstration is needed to provide empirical evidence.

A limitation of the current study is that we did not systematically assess participant choice-making or discrimination skills. Future researchers could systematically assess participant object- and picture-matching skills prior to implementing procedures such as this (cf. Clevenger & Graff, 2005). Another potential limitation was the absence of a treatment fidelity measurement. Treatment fidelity measures increase the internal validity of applied research by demonstrating that independent variables—in this case, administering an MSWO with app icon cards—are implemented with fidelity. When considering the future of preference assessment research, researchers could improve the quality of studies by including treatment fidelity measures. This study was conducted with adults with developmental disabilities who all communicated vocally and had a history of working independently without challenging behavior. Future researchers could examine these procedures with other populations, such as younger children, individuals with histories of challenging behavior during independent work, or individuals who use other types of communication. Additionally, future researchers could replicate this study in other settings, such as schools or in homes.

Implications for Practice

- Researchers and practitioners using high-tech items in programming with individuals with disabilities should assess participant/client preference for digital content.
- Increased use of high-tech items such as tablet computers increases the importance of identifying efficient preference assessment methods for digital content.

- Using picture icon cards to represent digital app icons is an effective way to conduct MSWO preference assessments for digital content.

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Compliance with Ethical Standards

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

Ethical Approval All procedures performed in this study were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Informed Consent Informed consent was obtained from all individual participants included in the study.

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