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Effects of Instructive Feedback on Gustatory Relations

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by

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Abstract

Title: Effects of Instructive Feedback on Gustatory Relations

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Differentiating tastes is important for safety reasons; being able to discriminate flavors could prevent an individual from eating unsafe items. The association of taste, color, and texture of different foods is important for safety reasons as it provides a base knowledge of safe foods. As some people with autism have problems communicating what they see, hear, touch, feel, or taste, the association of color, texture, and taste will promote healthy choices. Most of the research on tact acquisition has focused on visual stimuli. However, this study attempted to teach children to tact gustatory stimuli and evaluated the effects of instructive feedback on the color and texture of the flavored-foods tasted with different probes. With black-out goggles, two children diagnosed with autism participated in the study. One participant was able to differentiate the different flavors taught while the other participant was not. Regarding to the secondary targets, both participants were able to reach mastery criteria on the probes where the participants did not have to taste anything. Findings suggest that teaching gustatory tacts may be feasible for children with autism. Future research and implications are discussed.

Keywords: autism, instructive feedback, primary targets, secondary targets, gustatory tacts.

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Dedication

English:

This thesis is dedicated to my parents and sister, who, even from a distance, are a very important part of my life, always believing and pushing me when I did not think it was possible. Thank you for 25 years of love and support. I cannot wait to hug you again.

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Aquesta tesis està dedicada als meus pares i germana, que, fins i tot a la distància, són una part molt important de la meva vida, sempre creient i empenyent-me quan no pensava que seria posible. Gràcies per 25 anys d'amor i suport. No puc esperar a abraçar-vos de nou.

Introduction: Effect of Instructive Feedback on Gustatory Relations

Individuals with autism spectrum disorder (ASD) often show deficits in social interaction and verbal skills. Moreover, they frequently engage in repetitive and stereotypical behavior, have a narrow interest in situations or topics, and have difficulty with activities that have no rules or structure (DSM-V, APA, 2013). Individuals with ASD who have deficits in their communication skills present specific traits that differentiate them from individuals diagnosed with communication disorders. These specific traits include unusual speech patterns and echolalia (Boesch et al., 2013). Another trait that could appear in individuals with ASD, even though it is not unique, are problems with hypersensitivity (i.e., more sensitivity compared to typical individuals when seeing, hearing, touching, or tasting) and hyposensitivity (i.e., less sensitivity compared to typically developed individuals when seeing, hearing, touching, or tasting; Marco et al., 2011). According to Mayer (2017), individuals with ASD often respond atypically (e.g., elopement, aggression, negative vocalizations) to sensory stimuli.

Researchers developed effective treatments to minimize the impact of ASD on individuals' lives by increasing language, social, and adaptative skills while decreasing harmful or inappropriate behaviors. The science of Applied Behavior Analysis (ABA) developed these treatments. ABA focuses on research-based approaches to improve socially significant behavior (Cooper et al., 2020). Scientists in this field have helped, for over three decades, to develop different programs for

early intervention (LeBlanc et al., 2006). There are different interventions used to develop verbal behavior in individuals with ASD (e.g., natural environmental teaching; Halle, 1982; pivotal response training; Burke & Cerniglia, 1990), but for this study, the most relevant intervention is discrete-trial teaching (Smith, 2001). Lovaas (1987) conducted an experiment with two groups of children with autism. One group used behavioral interventions, and the other one was the control group. Results showed that the group participants with intensive behavioral treatment were more successful than the control group. In the behavioral intervention group, 47% of the participants were able to succeed in public school, 40% of the group went to language delayed classes, and only 10% went to special classes for children with disabilities. The control group showed that 10% of the participants were able to succeed in public school, 43% went to language delayed classes, and only 53% went to special classes for children with disabilities. Behavior analytic procedures can increase other socially significant behaviors, such as verbal behavior (e.g., Aravamudhan & Awasthi, 2020).

Skinner (1957) defined verbal behavior as "behavior reinforced through the mediation of other persons" (p. 2). Skinner believed that language is learned based on reinforcement principles. When we are children, correct utterances are reinforced positively by others, making children more likely to communicate with others through time. To have verbal behavior, a speaker must emit the verbal response, and a listener reinforces the speaker's verbal response. Verbal behavior

can be vocal (e.g., emitting a sound vocally) or nonvocal (e.g., exchanging a picture). This verbal behavior analysis has enabled researchers and practitioners to leverage reinforcement principles to teach language skills to children with autism, who would not have learned them otherwise (Sundberg & Partington, 1998).

Skinner's analysis of verbal behavior also introduced a taxonomy for verbal behavior, comprised of "verbal operants," which are classes of utterances grouped according to common antecedents and consequences. Some of the verbal operants relevant to this paper are echoic, intraverbal, and tact. Echoic operants have point-to-point correspondence between the stimulus and response under the control of verbal stimulus and in the same modality as the stimulus (formal similarity; Skinner, 1957, p. 55). For example, the professor says, "milk," then the student says, "milk." Intraverbal behavior is a class of verbal operants regulated by verbal discriminative stimuli and has no formal point-to-point correspondence (Skinner, 1975, p. 71). For example, when a teacher says, "What color is chocolate ice cream?" the learner says "brown." Another relevant operant for the current paper is listener response to conditional discrimination of more than one antecedent stimuli. This operant's response is nonverbal, and the listener has to identify objects, actions, people, or locations, or the function, feature, or class of an object (Sundberg & Partington, 1998). For example, a teacher shows an array of three edible items to a learner and says, "grab the peach jellybean." The child reaching out to grab the jellybean is a listener response. A tact is a class of verbal operants

"evoked by a particular object or event or property of an object or event" (Skinner, 1957, p. 82). For example, when a plane flies overhead, a child may look up and say "plane" due to the visual stimuli of the plane flying. Experimenters often teach tacts of visual stimuli, but individuals can also tact private events, responses and stimuli that can only be observed by the person who is experiencing them, like fatigue, headache (Skinner, 1975) based on public accompaniments (Stocco et al., 2014), such as olfactory stimuli (Dass et al., 2018), auditory stimuli (Hanney et al. 2019), tactile stimuli (Belisle et al. 2018), and so forth. For example, in this study, a gustatory tact would be saying the name of the flavor when the participants taste the food.

Talking About Sensory Stimuli

We know that individuals with autism can have problems communicating (Wing & Gould, 1979). While individuals with autism do not identify the smell and taste the same as neurotypical individuals (Bennetto et al., 2007), they also have difficulties expressing what they sense. Most of the research done in individuals with autism focuses on acquiring intraverbals, tacts, and mands of stimulis that can be observed by at least two people (public events); the area of the other sensations (private events) have received little attention in the research literature in the area of how individuals with ASD communicate these private events (Dass et al., 2018).

Sundberg and Partington (1998) stated that visual stimuli tacts were the most common tacts taught to children with autism. However, other tacts are equally

important for an individual with autism to be able to express. They presented guidelines to teach tacts for different stimuli important for an individual's day-to-day living: auditory, tactile, olfactory, and gustatory. They also mentioned the importance of individuals being able to tact "private events." Despite the paucity of research in this area, these are critical skills for individuals with autism. For example, if an individual hears an ambulance, they may move out of the way. If the individual touches a vegetable that is too soft, they can throw it in the trash. If the individual smells something burning, they can make sure that they can respond fast to the smell. If the individual tastes spicy food, they can ask for milk or something that will relieve the burning sensation. If the individual is feeling pain, they can ask for medicine or for somebody to stop hurting them.

Although some articles establish the importance of tacting tactile sensations (e.g., Kern et al., 2007; Marco et al., 2011; Sundberg & Partington, 1998), there is barely any research that deals with teaching other sensory stimuli (Hanney et al., 2019). Gustatory stimuli are one of the sensory stimuli that have had less research for individuals with ASD. Individuals with ASD need to communicate about tastes since we create many social interactions when food is involved (Kittler et al., 2016). For example, if a nonverbal child is in an ice cream shop, they may not get the flavor of ice cream they want if they do not know the flavors' names. Moreover, individuals with ASD need to tact gustatory stimuli because it would be beneficial for their health; if something does not taste right, it could be unsafe to eat it.

Communicating about sensory stimulation and perception helps understand what the individual needs, for protection, and to reduce confusion; communicating about sensory and perception stimulation is also important to express comfort (Bogdashina, 2004).

Kern et al. (2007) examined the experience of auditory, visual, tactile, and gustatory sensory stimuli among individuals with autism, ages 3 to 56-years-old. The investigators found that individuals with ASD exhibited aberrant or unusual responses to sensory stimuli, including auditory, visual, gustatory, and tactile stimuli, when comparing them to the Childhood Autism Rating Scale (CARS; Schopler et al., 1986), a scale to identify autism and the disorder's severity, and the different sensory stimuli. The researchers agreed that sensory problems should be a characteristic of ASD.

Bennetto et al. (2007) studied the sensory problems in gustatory and olfactory awareness sensitivity for individuals with autism. Researchers compared 21 participants with autism with 27 neurotypical individuals for gustatory and olfactory identification. The researchers found that participants with autism were less accurate in identifying sour and bitter tastes than neurotypical individuals when asked to taste something, but there was no difference between groups in identifying sweet and salty. They also found that, in general, participants with autism were less likely to identify the smell of the item presented than neurotypical individuals when the researchers asked them to smell something. These two studies (i.e., Kern et al.,

2007; Bennetto et al., 2007) found that individuals with autism respond to tastes and smells differently from neurotypical individuals.

Two research groups have explored methods for teaching gustatory tacts. Hayes et al. (1988) investigated equivalence-based instruction comparing teaching visual and gustatory stimuli. The study had two experiments. Twelve participants, undergraduate students, participated in the first experiment. The sessions lasted 45 min, and the two experimental conditions were visual and gustatory stimuli; researchers assigned half of the participants to one condition, visual stimuli, and the rest to the other, gustatory stimuli. The researchers asked the participants to point to the comparison stimulus that matched the sample stimulus. A red light turned on if they picked the wrong stimulus, and a green light turned on when participants picked the correct stimulus. The lights were the only feedback the participants received during the experiment. Depending on the subjects' condition, the materials were nine Mandarin characters for the visual stimuli and three different liquid solutions in opaque bottles that the researchers sprayed on the participant's tongue for the gustatory stimuli.

There were two phases: training for A-B and A-C sets and testing B-C sets. For the visual condition, the training phase consisted of giving the participants a card with a visual stimulus from Set A (the sample stimulus) followed by two cards from Set B (the comparison stimuli) and asked to point to the comparison that went with the sample for nine correct trials to constitute the A-B set. The researcher

conducted A-C set in the same way as A-B set. For the gustatory stimuli, the experimenter sprayed the liquid sample solution on the participant's tongue, and, before spraying the other solutions, the participant needed to match with the sample and asked to point to the comparison that went with the sample for nine correct trials to constitute the A-B set. The A-C set was conducted in the same way as A-B set. After training was complete, the researchers started the testing phase. They wanted to see if the participants would pair the B-C set for the visual and gustatory conditions. In this phase, the participants had to match samples from Set B to samples from Set C the same way as the researcher trained the participants but correlating the B-C set never taught (Hayes et al., 1988). This concept is known as transitivity association, that is when someone trains two separate relationships to another person (e.g., first relation: raspberry and strawberry, second relation: raspberry and blueberry), then the two another relation is tested without being trained (e.g., untrained relation: strawberry and blueberry). If the participant learns the untrained relation, transitivity is acquired (Fields et al., 1984).

Experiment 1 showed that the participants acquired the equivalence class in both conditions (visual and gustatory) (Hayes et al., 1988). However, gustatory relations were learned more quickly than the visual, which contradicted previous thought that the visual modality is easier to learn. Experiment 2 replicated Experiment 1 within subjects. The researchers selected three participants from each group randomly from Experiment 1. The only difference between the two

experiments, other than the subjects, was that the participants who had received visual samples in Experiment 1 now received gustatory samples and vice versa. As in Experiment 1, all participants acquired transitivity; however, transitive relations for gustatory stimuli occurred without errors (Hayes et al., 1988). In both experiments, the participants acquired transitivity when taught with visual and gustatory stimuli, but the participants learned the targets more rapidly when using the gustatory stimuli.

Mckeel and Matas (2017) conducted a similar experiment to Hayes et al. (1988) about equivalence classes and gustatory stimuli. The participants were different from one experiment to the other. Mckeel and Matas used Promoting the Emergence of Advanced Knowledge (PEAK; Dixon, 2015). PEAK is an assessment that combines ABA, and derived relational responding, which helps individuals create a relation between stimuli. The experimenters delivered the assessment to three adults with autism to teach gustatory sensory using transitivity equivalences. Within two multiple baselines across participants (the first one with three participants and the second one with two), the researchers presented different stimuli. The experimenter scored the results using PEAK programming and scoring system. The procedure started with a baseline, symmetry training, transitive test, symmetry training, and a transitive test. The researchers used the PEAK pre-assessment to evaluate the participants' acquisition of equivalence classes. Moreover, the researchers presented a pre-assessment for gustatory stimuli.

For symmetry training, participants matched the taste of particular edibles with a picture (A-B relation). Moreover, the researchers separately taught the participants to match the spoken word with the same picture shown to match the taste (B-C relation). Finally, when the participants mastered the symmetry relations, the researchers started the transitivity test to see if the participants could match the taste with the spoken word (A-C relation). Results showed that the participants could match the taste with the spoken word using the PEAK equivalence module. This study also showed that gustatory relations could also be learned in a different way other than verbal to visual or visual to visual. In both studies (Hayes et al., 1988; Mckeel, & Matas, 2017), participants learned untrained gustatory relations, as they used match-to-sample in an equivalence class; other teaching arrangements could produce similar results. Another widely used procedure used to teach gustatory tacts is Instructive Feedback (IF), the opportunity to learn secondary targets without instruction.

Instructive Feedback (IF)

IF involves the presentation of additional stimuli to instructional targets (Werts et al., 1991). In IF, the experimenter directly teaches primary targets using standard teaching procedures (e.g., prompting fading, reinforcing, correcting errors) and presents additional information that may or may not be related to the primary targets. There is no prompting, reinforcement, or even a response requirement related to the additional information. Research has shown that secondary targets

related to the IF can be acquired (Dass et al., 2018; Grow et al., 2017; etc.). For example, an experimenter presents an image of a dog. When teaching the learner to tact a dog, the teacher asks, "What is this?" The learner says, "dog." Every time the learner says "dog," either prompted or independently, the experimenter says, "Yes, and the dog says woof woof." After mastering the primary target (i.e., "dog"), the experimenter asks, "What does a dog say?" If the learner says, "woof woof," that would mean that the learner acquired the secondary target without any direct instruction procedure.

There have been several studies exploring the effectiveness of IF. Werts et al. (1995) evaluated the literature on IF from 1990 to 1995. The researchers found that IF is effective for preschool-aged to adult participants, with or without disabilities, and with different prompting and teaching methods. Werts et al. encouraged the use of IF for teachers to help learners acquire more targets in less time. In 2018, Albarran and Sandbank conducted a literature review on IF between 1995 and 2017, finding that across all the studies they examined, an average of 64% of the participants acquired secondary targets from the IF. They concluded that even though IF is not well known to ABA practitioners, the literature review showed that IF is an effective technique to increase the learning repertoire for individuals to acquire more targets simultaneously.

As Werts et al. (1995) and Albarran and Sandbank (2018) described in both literature reviews, IF is an effective and efficient way to learn two targets at the

same time. The researchers used several types of prompts used to acquire both targets (primary and secondary) to ensure the positive effects of IF. Reichow and Wolery (2011) studied the use of progressive prompt delay (PPD) with or without IF in three children with autism and one child with developmental delays who were 3 to 7-years-old. The results showed that PPD without IF was as effective as PPD with IF. However, they also found that even though PPD without IF was as effective as PPD with IF, the latter was twice as efficient since the number of words learned in this study was double when compared to PPD without IF. They concluded that extra information without any previous instruction supports efficiently acquire two targets in children with autism. When learning through IF, the acquisition of targets depends on the individual's age, learning skills, impairments (e.g., low cognitive functioning, attention deficits), and other variables that can affect the learning process.

To see the difference between an individual's age and impairment, Delmolino et al. (2013) conducted two studies with children with autism with lower cognitive functionalities. The participants were older (between 5 and 13 years old) and with more impairments than the study participants by Reichow and Wolery (2011). The primary target was tacting (i.e., learner saying the name of an object verbally when the experimenter presented the image and asked, "What is it?"), The secondary target was intraverbal (i.e., the experimenter presented verbally the object's function every time the learner said the primary target). The first study

showed that out of the four participants, just one of them acquired the secondary targets in a timely manner when using IF. The other three required more teaching sessions to acquire the IF targets. In Study 2, the researchers paired the only participant who acquired the secondary targets, and another participant enrolled in the same school program. The results showed that in Study 2, the acquisition of IF targets within dyad instruction were not consistent. Delmolino et al. concluded that in Study 1, the use of IF to learn primary and secondary targets simultaneously was more efficient for the participants than learning the targets separately. Results from Study 2 were not consistent for the two participants. Overall, Delmolino et al. concluded that the results from the use of IF for children with autism varied across other studies (e.g., Reichow & Wolery, 2011). The researchers explained that different factors could have made these results differ from other studies, such as the participants' level of impairment (Delmolino et al., 2013). So, it is important to look at all of an individual's factors to see if IF would be effective or not since we could see that with individuals with older age and with more impairments, IF would not be the most appropriate program to implement.

Haq et al. (2017) discussed causes of variability in outcomes when conducting instructive feedback in children with ASD. Some possibilities that could alter the efficiency and efficacy of instructive feedback are the timing of instructive feedback and reinforcement delivery. Another possibility is the timing of the secondary targets (e.g., antecedent-based vs. consequence-based instructive

feedback). Results depend on the teaching procedures that the researchers exposed to the learners and individual response patterns. Based on these variations, Haq et al. wanted to explore response patterns under different instructive feedback variations for two children with ASD. The researchers used a multiple baseline design across sets. The baseline and control conditions were equal (i.e., without providing feedback). To make the instructive feedback more efficient, the researchers used an attending prompt with antecedent instructive feedback for one participant and an echoic prompt with another when giving the instructive feedback. At the end of the research, they conducted a probe for the secondary target for both participants. The authors concluded that the efficacy of the instructive feedback could depend on the individual's behavior when conducting instructive feedback (e.g., attending, antecedent instructive feedback, echoic behavior).

Experimenters should know the individual's learning skills before implementing any type of treatment to ensure the planned intervention is the best concerning the individual's skills. At the same time, it is also important to know whether individuals can learn the secondary target quickly enough when the experimenters assign the targets versus when they do not assign the targets. Werts et al. (2003) evaluated the acquisition of IF targets when introducing them after trials on any set versus after a given target and the acquisition of IF during teaching versus after mastery. Researchers taught four participants in two dyads, in a

classroom. Participants were supposed to say the outlined state's name as the primary target behavior, and the instructive feedback was a word that defined the state (e.g., New York, megalopolis). They used a multiple probe baseline design across three sets of behaviors and replicated the same design for the four participants with probe and instruction conditions. Werts et al. concluded that the participants acquired the instructional target behavior and the secondary target behavior either when they were assigned or when they were not assigned to a target, so it would not be necessary to use IF for a specific target.

Werts et al. (2003) showed that whether assigning the IF to a target or not, the rate of secondary target acquisition was the same. Other than assigning the IF to a target, there are other variables that researchers were interested in investigating. For example, Nottingham et al. (2017) wanted to see if IF's presentation would influence secondary target behavior acquisition in the trial. The researchers compared different conditions in two children with ASD who were 3 and 5-years-old. The conditions were the presentation of the secondary target in the antecedent and consequence portion of trials, the presentation of two secondary targets in the consequence portion of trials, the presentation of one target during the consequence portion of trials, and the no presentation of secondary targets. Nottingham et al. did not encounter differences in learning between the location or the number of secondary targets. All the conditions under the presentation of IF were more

efficient, acquiring the two targets, than the one without secondary targets presented.

These three studies (Haq et al., 2017; Nottingham et al., 2017; Werts et al., 2003) showed that the timing of presenting the IF target, whether before or after the trial is presented, should not affect the results. If the presentation of the IF affects the results, it could be because of other variables unrelated to the teaching procedure of IF (e.g., alternating canine, dog, and puppy as secondary target). However, most of the studies supported the efficiency and efficacy of IF for individuals with or without disabilities. In most of the articles, the primary target was visual stimuli, and the secondary target as auditory stimuli (e.g., visual tact: plant, verbal IF: plants have leaves; Dass et al., 2018). Belisle et al. (2018) and Hanney et al. (2019) taught tacting sensations to their participants, and IF was proved to be effective in several research studies (Dass et al., 2018; Grow et al., 2017; etc.). IF could also be an effective way to each tacts for other sensory stimuli (e.g., gustatory stimuli).

Teaching Tacting of Sensations with IF

Dass et al. (2018) extended the research beyond tact training and secondary targets. They evaluated the effects of discrete-trial teaching with prompts while integrating secondary targets and multiple exemplar training using olfactory stimuli. The participants were three children with ASD between 5 and 6-years-old. The primary targets were food tacts (e.g., strawberry, lemon, garlic, popcorn), and

the secondary targets were the category the primary targets belonged to (i.e., fruity, citrus, stinky, and yummy). Dass et al. measured the percentage of correct item tacts after using the prompts to evaluate the primary targets. The researchers did not collect data on the secondary targets' correct responses, but they recorded yes or no if the student emitted an echoic response after implementing instructive feedback. Before implementing the experimental design, the experimenters ran a pre-test to ensure that the participants could not tact the olfactory scents or the category from the scents. The pre-test was done the same way as the baseline. For teaching the primary and secondary targets, the experimenters presented a bottle that the participants had to smell and asked, "What is it?" When the learner responded (prompted or independent), they delivered the instructive feedback (secondary target) to say under what category the item smelled like. For this treatment, they used tokens in exchange for preferred edibles.

Dass et al. (2018) included a control condition that followed the same guidelines as the pre-test and baseline. They conducted two types of probes throughout the entire study: a category tact probe, in which they evaluated whether the learners knew the category of the scents from the bottle, and a category matching probe, in which they evaluated whether the learners knew how to match the same scent from a bottle from different scents. The authors also looked at maintenance after 2 and 4 weeks with the same guidelines as the baseline. The results of this research suggested that researchers could use discrete-trial teaching

for teaching olfactory scents since (i.e., private events) all the participants acquired mastery criteria and were able to generalize. Moreover, the participants acquired the, and they were able to sort the scents taught in categories of fruity, citrus, stinky, or yummy.

Dass et al. (2018) emphasized that visual stimuli are not the only tacts children with ASD should learn. The other sensory stimuli like olfactory (Dass et al., 2018), tactile (Belisle et al., 2018), auditory (Hanney et al., 2019), and gustatory stimuli are also important to learn and study. At the same time, research has shown that IF can be an effective and efficient way for individuals to learn two targets at the same time (e.g., Werts et al., 1995; Albarran and Sandbank, 2018; etc.). Dass et al. showed that IF can be acquired when teaching private events (i.e., tacting olfactory stimuli), not just public events, to individuals with ASD. Overall, Dass et al. showed that IF could improve the efficiency of learning private events. For these reasons, this study evaluated the effects of instructive feedback on learning intraverbals related to gustatory stimuli.

Method

Participants

The study participants were two Caucasian children diagnosed with ASD by a psychologist. Ariadna was 4 years and 9 months old female who had been receiving behavioral intervention for three years, and Fernando was 5 years and 1 month old male who had been receiving behavioral intervention for two years when they started their participation in the present study. All participants demonstrated skills commensurate with Level 3 of the Verbal Behavior Milestones Assessment and Placement Program (VB-MAPP; Sundberg, 2008). To be included in the study, the participants had previously demonstrated mastery of 150 to 200 tacts, answered to 25 or more different "wh" questions, and identified at least 40 different receptive objects or pictures. Additional prerequisites included: complying with an instruction to put on black-out goggles, accepting food when somebody feeds them, and chewing and swallowing when asked to take a bite. Participants who have feeding disorders, such as refusing food or expelling food from the mouth when eating, or those with severe problem behavior, such as aggression towards themselves or others, were not included in this study. All participants were able to speak and understand English or Spanish and tact and identify at least nine colors.

The participants were recruited from local agencies providing autism treatment. The experimenter consulted the case managers to identify potential candidates for the study. After candidates were nominated, the experimenters met

with each child's parent or caregiver to explain the purpose of the study and procedures. An informed consent form was given to caregivers to sign to allow their child to participate in the study (Appendix A). Next, the experimenters asked the caregivers to provide a list of food allergies and restrictions, as well as to mark a table of different types of foods they consent to give to their child, indicating most to least preferred (Appendix B).

Setting and Materials

The experimenter conducted the study in a local autism treatment center or the participant's home. The sessions took place in the autism treatment center's kitchen or the participant's home kitchen. There was a table and a chair in the room, and the fewest distractions possible (e.g., objects, people, noise). Additional materials for the study included printed datasheets, pens, a video camera (GoPro7), opaque containers to place the food, the food purchased, and a choice of water and/or crackers to be presented between trials for the purpose of cleansing the palette.

Edible items were purchased pre-packaged from a supermarket to minimize experimenter contact with the food, and each food was stored in a different container to avoid cross-contamination. The food was stored per the packaging instructions for a week after it was opened. After a week, open food was thrown out and replaced. Each flavor category included three different foods (e.g., chocolate

ice cream, chocolate jellybean, chocolate milk) comprising different textures (i.e., creamy, crunchy, liquid, chewy) from Ariadna (Table 1), and Fernando (Table 2).

Measures

This study had three primary dependent variables: flavor-tacts (directly taught targets), color-intraverbals (IF targets), and texture-tacts (IF targets). The secondary dependent variables were flavor-intraverbals (IF reverse intraverbals), color-intraverbals (derived color intraverbals), receptive-flavor (derived listener relations), and novel food-tacts (novel exemplars generalization). For the primary targets, the dependent variables were the percentage of correct flavor tacts in response to the question "What does this taste like?" (e.g., "guava," "peach"), fill-ins about the association between colors and flavors (Coconut-flavored foods are usually [white]"), or questions about the texture of the food consumed (i.e., “How does it feel?”). The experimenter scored a correct response if the participant independently (i.e., without prompting) said the name of the flavor, color, or texture (depending on the question asked) within 5 s of swallowing the food that was presented on that trial. The experimenter scored an incorrect response if the participant answered with the name of a flavor, color, or texture other than the one presented on that trial (e.g., said "blueberry" when presented with peach-flavored food), was prompted by the experimenter, or did not respond within 5 s of swallowing the food.

For the secondary targets, the dependent variables were the percentage of correct responses to questions between colors and flavors (i.e., “What color do you think this is?”), or (e.g., "What do red foods often taste like?"), between receptive identification and flavor, making a choice from an array of colors that corresponded to a flavor (i.e., "Which one is chocolate?"), or with novel food items from the taught flavors responding to the question "What does this taste like?" The experimenter scored a correct response if the participant independently said the color, flavor, or pointed to the exemplar consequent to the question within 5 s of the question's presentation. The experimenter scored an incorrect response if the participant answered with a different color, flavor, or pointed to a different exemplar than the one expected on that trial, or did not respond.

Interobserver Agreement

A second observer collected data during a minimum of 33.3% sessions across baseline, teaching (primary targets), IF probes (secondary targets), and generalization probes when sessions were taking place or though video. The experimenter compared the data from the first and second observers using the trial-by-trial method (Cooper et al., 2020). If both observers scored a trial as correct or both observers scored a trial as incorrect, an agreement was scored. If one observer scored a correct response and the other scored an incorrect response, a disagreement was scored. The experimenter divided the number of agreements by the total number of trials and multiplied by 100 to obtain a percentage of

interobserver agreement. Mean agreement during baseline was 100% for Fernando and 93% (range; 77.78% to 100%) for Ariadna. Mean agreement for intervention phase was 99.92% (range; 99.92% to 100%) for Ariadna, 99.14% (range; 88.89% to 100%) for Fernando. Mean agreement for probes was 98.7% (range; 88.89% to 100%) for Ariadna, 98.47% (range; 88.89% to 100%) for Fernando.

Treatment Integrity

A second observer collected data on the therapist's behavior during a minimum of 33.3% of sessions across baseline, treatment, probes, and generalization conditions. Treatment integrity is the degree to which the intervention is implementation as planned (Gresham et al., 1993). To measure treatment integrity, this study used a checklist (Appendix C) describing all the steps needed to make sure that the sessions were conducted accurately. If the experimenter errored on a step, it was scored as incorrect. To calculate treatment integrity, the experimenter divided the number of correctly implemented steps by the total number of steps from the checklist and multiplied by 100. Treatment integrity during baseline was 96.8% (range; 90.9% to 100%) for Ariadna, 98.2 % (range; 92.85% to 100%) for Fernando. Treatment integrity for intervention phase was 98.95% (range; 91.67% to 100%) for Ariadna, 98.33% (range; 93.33% to 100%) for Fernando. Treatment integrity for probes was 96.4% (range; 87.5% to 100%) for Ariadna, 97.9% (range; 92.3% to 100%) for Fernando.

To train the therapists to implement the procedures, the primary experimenter conducted role-play sessions with all research assistants who were selected to run sessions or collect data. The research assistants were graduate students who are Registered Behavior Technicians® and demonstrated 100% accuracy on the treatment integrity checklist before they can run sessions or collect data for this study.

Experimental Design

A multiple probe across responses design (Horner & Bear, 1978) was used to evaluate the effects of instructive feedback on the acquisition of flavor tacts and color intraverbals among children with autism. Three targets were taught in each tier of the design and the intervention was replicated in three tiers which were introduced in staggered fashion. We examined whether the independent variable's introduction created a change in the dependent variable while the other tiers remain unchanged. IF and generalization probes were conducted in random order after each teaching session.

Pre-experimental Assessments and Training

The participants were given the Expressive Vocabulary Test (EVT-3; Williams, 2019) and Peabody Picture Vocabulary Test (PPVT-5; Dunn & Dunn, 2019) in order to obtain norm-referenced measures of their language skills. The experimenter evaluated if the participants were able to keep their eyes closed for up to 30 s at the experimenter's request, and if they were able to tolerate wearing

black-out goggles for up to 10 min. If they were able to wear the goggles and comply with closing their eyes, the experimenter chose the goggles, because, even though it was the most intrusive strategy, there was less risk of opening their eyes and look at the food. If a participant exhibited problem behavior that is out of the ordinary or expressed discomfort during this portion on the pre-assessment, the experimenter dismissed the participant from the study. This did not occur for any participant.

Target Identification

We selected nine flavors, each associated with a different color, from a questionnaire filled out by the participants' caregivers (Appendix B). The teaching taregts were counterbalanced across participants.

To ensure the participants could not identify the flavors prior to the start of the study, the researchers gave a portion of each of the generalization foods during the pre-assessment and asked, "What does it taste like?" During the pre-assessment we also evaluated whether the participants would reject consuming any of the foods and, if that occurred, did not include those foods for the participant. We asked questions about the color of a flavor without any visual stimuli present to ensure the selected targets were unknown (i.e., “What color are chocolate-flavored foods?"). If the participant erred in two out of two trials for each flavor and color, we included that flavor in the study. We also confirmed that each participant was able to tact all the colors targeted in the study using neutral non-food stimuli. If the

participant was able to tact the flavor or the color of a flavor, the target of that color was removed and another one was tested. For example, if Ariadna was able to identify peach, that flavor was removed from the possible targets. Moreover, a target could also be removed if the participant was not able to identify the taste but was able to identify the color.

Training to Familiarize Participants with Procedures

In this study, we put food into the participants' mouths while their eyes were closed or they were wearing black-out goggles. This presented a potential choking hazard if the participant received food with a texture they were not anticipating. It is possible that when an individual anticipates liquid entering their mouth, they form their lips and tongue in a different way than they would if they were anticipating something crunchy, for example. To mitigate the risk of this occurring, we conducted one training session to familiarize the participants with the procedures used in this study. We presented four foods (different from the flavors/foods targeted during the study), each with a different texture (i.e., creamy, crunchy, liquid, chewy) in four identical opaque cups. Without a blindfold or black-out goggles and with eyes open, we asked the participant to consume the food and told them the associated texture (e.g., "The next food will be liquid"). In all subsequent sessions we told the child which texture to expect priot to each trial so they could ready their mouths for the food that was about to be presented. There were no occurences of coudhing or gagging during any experimental session.

Procedures

Sessions

The experimenter conducted sessions one to four times a day, 1 to 5 days a week. A total of nine flavor tacts were taught to each participant throughout the study, with three flavors targeted at a time. When the participant reached mastery for one set of three flavors, the experimenter introduced the next set. To facilitate generalization of the flavor tacts by training sufficient exemplars (Stokes & Baer, 1977), three different foods, each with a different texture (e.g., peach yogurt, peach juice, peach jellybean), were used in teaching sessions for each of the targeted flavors. A fourth food with the same flavor (e.g., peach chips) were reserved for generalization probes. The experimenter presented each exemplar one time per session, resulting in a total of nine trials per session. In other words, three were different textured foods for each of three different flavors, presented each session, resulting in nine trials. A 30 s break occurred after each trial so that the flavor could dissipate before the next trial. During these inter-trial intervals, the experimenter offered a piece of cracker or water to the participants to aid in cleansing their palette. If the experimenter conducted multiple sessions within the same day, we gave a break of up to 10 min between sessions. If the participant indicated that they wanted to take the blindfold off at any point between trials, the experimenter complied with the request. For example, we complied with the demand when Ariadna indicated at the goggles were too tied and she wanted to take them off.

Stimulus Preference Assessment

To identify possible reinforcers for each of the participants, we asked the caregivers, case managers and/or therapists to generate a list of toys or activities the participants preferred. The therapeutic team or caregiver indicated that both participants were reinforced by praise or tokens; therefore, we conducted a brief reinforcement assessment to confirm. The participants displayed undifferentiated response patterns during the reinforcer assessment, thus, we used praise to reinforce correct responding.

At the beginning of each research day, the experimenters conducted a Multiple Stimulus Without Replacement preference assessment (MSWO; DeLeon & Iwata, 1996) to identify preferred stimuli to present in between sessions. The experimenter presented three to four toys and instructed the participant to pick one. When the participant picked a toy, they were allowed to play with it for 20 s. The experimenter removed that item from the array. Again, the experimenter said, “Pick one" and repeated the procedure until there was only one item remaining. We repeated the MSWO two more times before starting the session (Conine et al., 2021).The first two or three items selected were used as the preferred item for the subsequent sessions. We did not use edibles as reinforcers between trials because they could interfere with the study (e.g., participants could be satiated from eating, flavors from previous bites may be retained in the mouth during trials).

Baseline

We conducted a baseline phase to determine the level of correct responding to the flavor tacts (primary targets), color-intraverbals, flavor-intraverbals, texture-tacts (secondary targets), and the derived relations with the primary and secondary targets prior to implementing the intervention. The experimenter asked the participant to close their eyes or wear black-out goggles. If the participant had to wear black-out goggles, then the experimenter asked the participants how many fingers the experimenter was showing to the participants up to three times to ensure they could not see the color of the exemplar presented. Each trial began with the experimenter describing the texture of the food to be delivered (e.g., "This food is going to be chewy"). The experimenter then asked the participant to open their mouth and put a spoon with a bite-size portion of food in their mouth. The experimenter told the participant to taste the food. After the participant finished the food, or 5 s had passed the experimenter asked, "What did it taste like?" If after having the food in the mouth and answering, the participants indicated that they wanted to spit out the food, the experimenter brought a paper towel at the participants' lips and told them they could expel the food into the paper towel without taking the black-out goggles off or opening their eyes. For example, Ariadna did not want to swallow any of the jellybean exemplar, so she stated, after answering the questions, to the experimenter that she wanted to expel the food. There was not corrective feedback, reinforcement, or prompting implemented in the

baseline phase. We provided praise about once a min for appropriate sitting and attending behaviors.

Teaching with Instructive Feedback

Teaching sessions were conducted in the same manner as baseline, with a few additions: prompts, instructive feedback, reinforcement for correct responses, and error correction. After asking, "What did it taste like?" the experimenter delivered an echoic prompt. Prompts began at 0 s and were faded using a progressive time delay procedure (Neitzel & Wolery, 2009). Once the participant stated the name of the flavor, the experimenter provided praise and instructive feedback (e.g., "Yes, that is pineapple! Usually, pineapple flavored foods are the color yellow"). The participants were not required to repeat this information, but the experimenter recorded whether the participant echoed it. Correct responses to the primary targets were consequated by the identified reinforcer (praise or tangible item).

At the start of the study, we used praise as a consequence for correct responding for Fernando and praise plus tokens for Ariadna. In session 56, we introduced 30 s access to a toy contingent on correct responses for Fernando because he was not making progress. At the end of the session, the participants accessed the items identified by the MSWO.

If the participants erred by tacting a flavor other than the one presented on a particular trial, the experimenter implemented an error correction procedure.

Specifically, the experimenter did not provide attention to the participant for 5 s, then presented the same food, asked the question again, and immediately prompted the correct tact. After prompting the response, we presented the same food and waited for an independent response. If an independent response did not occur, then we prompted again, and presented again until an independent response occurred. There was no limit of attempts for error correction, so, an independent response was required to move to the next trial. However, the maximum amount of times were had to re-present error correction for the same tiral was three in one ocasion with Fernando.

Each set was considered as mastered when the participant scored 88.89% or above across three consecutive sessions.

Probes

Probes for all indirect relations were conducted in random order during the baseline phase and then subsequent to each teaching session, with the exception of the Novel Exemplars probes, which were conducted once in baseline and once after mastery of each set of targets. If a participant did not meet the mastery criterion for the Novel Exemplars probes, we conducted direct training of the tacts for the novel targets if the participant displayed some generalization, but only erred on specific exemplars. This occurred for Ariadna for the Set 2 targets. If a participant did not demonstrate any generalization, we taught a second set of targets of the same flavors. This occurred for Ariadna for the Set 1 targets.

All probes were conducted in the same manner as baseline, with no prompts or programmed consequences. Praise was delivered for appropriate attending behaviors about once a minute ("I love how hard you're working!"). If a probe data point was above chance levels during baseline, we re-tested it again to ensure there was not an increasing trend. The exception was the IF Texture Tact probes; we expected to see some learning occur in baseline because we were already presenting the IF for texture, due to the potential for choking on unanrticipated food, as described above.

The mastery criteria for the probes was one session at 88.89% or above. The experimenter conducted teaching targets sessions followed by a probe session until all the probes were at mastery levels.

Instructive Feedback Probes. The experimenter asked several types of questions to determine mastery of the secondary targets related to the IF presented during the teaching sessions.

IF Texture Tact Probes. The experimenter presented foods taught with different textures for the participant to taste and said, “What does this feel like?” A correct response was scored if the participant said the corresponding texture name (e.g., “crunchy”). These sessions comprised nine trials, with each question asked three times per target.

IF Color Intraverbal Probes. The experimenter presented fill-in-the-blank sentences to the participant, stating the name of the taught flavor and pausing for

the participant to fill in the associated color (e.g., "Coconut-flavored foods are usually _____"). A correct response was scored if the participant said the corresponding color name (e.g., “white”). These sessions comprised nine trials, with each question asked three times per target.

IF Flavor Reverse Intraverbal Probes. The experimenter asked what flavor is typically associated with a particular color (e.g., "What do red foods often taste like?") without any food present. A correct response was scored if the participant said the corresponding flavor name (e.g., “cherry”). These sessions comprised nine trials, with each question asked three times per taught flavor.

Derived Relations Probes. The experimenter tested several different types of relations to determine whether the participants derived any skills other than the directly taught primary and IF secondary targets.

Derived Color Intraverbals. In these probe trials, the participant took a bite of a previously taught food and the experimenter asked, "What color do you think this is?" These sessions comprised nine trials, with three foods for each of the three flavors presented once each session, and each flavors had three different exemplars.

Derived Listener Relations. The participants did not wear a blindfold for these probes. The experimenter presented an array of nine similarly textured foods representing each flavor taught in the study (e.g., cherry jellybean, coconut jellybean, lime jellybean) and said, “Which one do you think is lime?” These sessions comprised nine trials, with three trials for each of three flavors.

Novel Exemplars Generalization Probe. The experimenter presented a novel exemplar of each of the foods (i.e., not used during teaching sessions) and asked, "What did it taste like?" For example, if the participant learned to tact the favor "peach" when presented with peach-flavored jellybeans, peach juice, and dried peach pieces, the experimenter presented peach yogurt and asked, "What did it taste like?" A response was scored as correct if the participant said the corresponding flavor name (e.g., “peach”). These sessions comprised nine trials, with each novel food presented three times.

COVID-19 Safety Precautions

Due to the use of gustatory stimuli in this study, the participants did not wear masks because they were eating. However, the experimenter took precautions recommended by the Centers for Disease Control and Prevention (CDC) for protection against transmitting Covid-19 (CDC, 2020). The experimenters wore masks throughout the entire sessions. The participants were able to wear a mask or a face shield if they chose to do so during breaks. The research assistants and participants washed their hands prior to and after each session, for at least 20 s, and immediately after any time their hand touched their face. To limit the spread of the virus, the only people allowed to enter the room were the research assistants and participant, and the researchers cleaned and disinfected the room before and after each session. Before starting every session, the research assistants took the participant’s temperature and asked the caregiver if the participant showed any

symptoms prior to starting the session. The caregivers got to select one of three options for the experiment's location: at an autism treatment center with research assistants conducting sessions, at the participant's home with research assistants conducting sessions, or at home with the caregiver conducting sessions while the experimenters coaching via video conferencing. In the case a caregiver opted for the telehealth option, parent training sessions would have been necessary. Furthermore, all meetings with the caregivers (e.g., informed consent, debriefing) were held over a video-conferencing application, emails, or text messages. If the caregiver preferred to schedule a meeting face-to-face, both parties were wearing a mask and with six feet apart from each other when possible.

Results

Due to the COVID-19 pandeminc, data collction has not been completed in this present manuscript, however data collection is currently ongoing.

Ariadna

Figure 1, 2, and 3 show data for Ariadna.

PPVT-5 & EVT-3

During the PPVT-5 to assess Ariadna's receptive vocabulary, she scored 104 standard score: a true score between the range of 101-107. When Ariadna was examined, she was 4 years and 10-month-old, but had a test-age equivalent of 5 years and 2-month-old. Ariadna scored as well or better than 61% of examinees of her own age.

During the EVT-3 to assess Ariadna's expressive vocabulary and word retrieval, she scored 105 standard score: a true score between the range of 101-109. When Ariadna was examined, she was 4 years and 10-month-old, but had a test-age equivalent of 5 years and 3-month-old. Ariadna scored as well or better than 63% of examinees of her own age.

Teaching Targets (flavors)

During the teaching targets, after the participant consumption of a food exemplar, the experimenter asked to the participant "What does it taste like?" and the participants needed to respond with the appropiate flavor (e.g., pomegranate, banana, root beer). Ariadna scored 0% for Set 1, 0% for Set 2, and 4.28% for Set 3

during baseline. Once teaching sessions started, she mastered the Set 1 teaching targets in 9 sessions, the Set 2 teaching targets in 11 sessions, and the Set 3 teaching targets in five sessions. Si

Since Ariadna did not generalize novel foods from Set 1 (i.e.., guava, caramel, and pistachio), we taught her another set of exemplars for Set 1. During baseline she scored 0% of correct responses. Once teaching sessions started again, she mastered Set 1 teaching targets in seven sessions.

IF Texture Tact Probe

During the IF Texture Tact probe, after the participant consumption of a food exemplar, the experimenter asked to the participant "What does it feel like?" and the participants needed to respond with the appropiate texture (i.e., chewy, crunchy, creamy, liquid). For the texture targets, Ariadna scored 55.56% for Set 1, 55.56% for Set 2, and 66.67% for Set 3 during baseline. When teaching sessions started, she demonstrated 100% after eight teaching sessions, on the second time we presented this probe for Set 1. For Set 2, she demonstrated 88.89% after 12 teaching sessions, on the fourth time we presented this probe. For set 3, Ariadna scored 77.78% of correct responses after six teaching sessions, on the first and second time we presented this probe.

IF Color Intraverbal Probe

During the IF Color Intraverbal probe, after the participant consumption of a food exemplar, the experimenter asked to the participant "What color do you

think this is?" and the participants needed to respond with the correspondent color (e.g., green, beige, pink). For the first Set 1, Ariadna scored 0% during baseline, when teaching sessions started, she acquired 100% of correct responses after four teaching sessions, on the first time, we presented this probe. Ariadna scored 0% during baseline for Set 2, and she acquired 100% of correct responses after five teaching sessions, on the first time we presented this probe. For set 3, Ariadna scored 44.44% of correct responding during baseline; she acquired 100% of correct responses after three teaching sessions, on the first time we presented this probe.

IF Flavor Reverse Intraverbal Probe

During the IF Flavor Reverse Intraverbal probe, the experimenter asked to the participant "What do [color] foods often taste like?" and the participants needed to respond with the correspondent color (e.g., yellow, brown, red). For the first Set 1, Ariadna scored 0% during baseline, when teaching sessions started, she acquired 100% of correct responses after five teaching sessions, on the first time we presented this probe. Ariadna scored 0% during baseline for Set 2, and she acquired 100% of correct responses after 11 teaching sessions, on the third time we presented this probe. For set 3, Ariadna scored 0% of correct responding during baseline; she acquired 100% of correct responses after five teaching sessions, on the first time we presented this probe.

Derived Color Intraverbal Probe

During the Derived Color Intraverbal probe, after the participant consumption of a food exemplar, the experimenter asked to the participant "What color do you think this is?" and the participants needed to respond with the correspondent color (e.g., green, beige, pink).For the first Set 1, Ariadna scored 22.22% during baseline, when teaching sessions started, she acquired 100% of correct responses after 11 teaching sessions, on the fourth time we presented this probe. Ariadna scored 33.33% during baseline for Set 2, and she acquired 100% of correct responses after nine teaching sessions, on the second time we presented this probe. For set 3, Ariadna scored 11.11% of correct responding during baseline; she acquired 100% of correct responses after four teaching sessions, on the first time we presented this probe.

Derived Listener Relation Probe

During the Derived Listener Relations probe, an array of nine exemplars was presented in front of the participants. Then the experimenter asked to the participant "Which one do you think this is [flavor]?" and the participants needed to point to the correct container. For the first Set 1, Ariadna scored 11.11% during baseline, when teaching sessions started, she acquired 100% of correct responses after ten teaching sessions, on the third time we presented this probe. Ariadna scored 0% during baseline for Set 2, and she acquired 100% of correct responses after 12 teaching sessions, on the third time we presented this probe. For set 3,

Ariadna scored 22.22% of correct responding during baseline; she acquired 100% of correct responses after seven teaching sessions, on the second time we presented this probe.

Novel Exemplars Generalization Probe

During the Novel Exemplars Generalization probe, a novel food exemplar from the targeted foods was given to the participants. Then the experimenter asked to the participants "What does it taste like?" and the participants needed to respond with the appropriate flavor. Through the baseline phase in Set 1, Ariadna scored 0% correct. After acquiring mastery criteria for the teaching targets and probes, she scored 0% of correct responses when presented untaught exemplars of the taught flavors. When we taught again other set of exemplars of Set 1, Ariadna scored 100% of correct responses. During the baseline phase in Set 2, Ariadna scored 0% correct. After acquiring mastery criteria for the teaching targets and probes, we conducted the novel food exemplars, which she scored 66.67%. For set 3, Ariadna scored 22.22% correct responses during baseline, and she scored 100% correct responses after acquiring mastery criteria for the teaching targets and probes.

Fernando

Figure 4, 5, and 6 show data for Fernando.

PPVT-5 & EVT-3

During the PPVT-5 to assess Fernando's receptive vocabulary, he scored 87 standard score: a true score between the range of 83-92. When Fernando was

examined, he was 5 years and 4-month-old, but had a test-age equivalent of 4 years and 4-month-old. Fernando scored as well or better than 19% of examinees of his own age.

During the EVT-3 to assess Fernando's expressive vocabulary and word retrieval, he scored 93 standard score: a true score between the range of 89-98. When Fernando was examined, he was 5 years and 4-month-old, but had a test-age equivalent of 4 years and 10-month-old. Ariadna scored as well or better than 32% of examinees of his own age.

Teaching Targets (flavors)

During the teaching targets, after the participant consumption of a food exemplar, the experimenter asked to the participant "What does it taste like?" and the participants needed to respond with the appropiate flavor (e.g., pomegranate, banana, root beer). Before starting teaching sessions, Fernando scored 0% in Set 1 of correct responses for the teaching targets during baseline. Once teaching sessions started, Fernando mastered the Set 1 teaching targets in 34 teaching sessions. Fernando also scored 0% in Set 2 and Set 3 of correct responses during baseline.

IF Texture Tact Probe

During the IF Texture Tact probe, after the participant consumption of a food exemplar, the experimenter asked to the participant "What does it feel like?" and the participants needed to respond with the appropiate texture (i.e., chewy, crunchy, creamy, liquid). For the first Set 1, Fernando scored 11.11% during

baseline, when teaching sessions started, he acquired up to 55.56% of correct responses after 22 teaching sessions, on the sixth time we presented this probe. Fernando scored 11.11% for Set 2, and 22.22% for set 3 of correct responding during baseline.

IF Color Intraverbal Probe

During the IF Color Intaeverbal probe, after the participant consumption of a food exemplar, the experimenter asked to the participant "What color do you think this is?" and the participants needed to respond with the correspondent color (e.g., green, beige, pink). For the first Set 1, Fernando scored 0% during baseline, when teaching sessions started, he acquired 100% of correct responses after 11 teaching sessions, on the third time, we presented this probe. Fernando scored 0% for Set 2, and 33.33% for Set 3 of correct responding during baseline.

IF Flavor Reverse Intraverbal Probe

During the IF Flavor Reverse Intraverbal probe, the experimenter asked to the participant "What do [color] foods often taste like?" and the participants needed to respond with the correspondent color (e.g., red, green, white). For the first Set 1, Fernando scored 0% during baseline, when teaching sessions started, he acquired 100% of correct responses after five teaching sessions, on the first time we presented this probe. Fernando scored 0% during baseline for Set 2, and 0% for Set 3 of correct responding during baseline.

Derived Color Intraverbal Probe

During the Derived Color Intraverbal probe, after the participant consumption of a food exemplar, the experimenter asked to the participant "What color do you think this is?" and the participants needed to respond with the correspondent color (e.g., green, beige, pink). For the first Set 1, Fernando scored 0% during baseline, when teaching sessions started, he acquired up to 66.67% of correct responses after 28 teaching sessions, on the eleventh time we presented this probe. Fernando scored 22.22% during baseline for Set 2, and 0% for Set 3 of correct responding during baseline.

Derived Listener Relation Probe

During the Derived Listener Relations probe, an array of nine exemplars was presented in front of the participants. Then the experimenter asked to the participant "Which one do you think this is [flavor]?" and the participants needed to point to the correct container. For the first Set 1, Fernando scored 11.11% during baseline, when teaching sessions started, he acquired 100% of correct responses after 12 teaching sessions, on the third time we presented this probe. Fernando scored 0% during baseline for Set 2, and 22.22% for Set 3 of correct responding during baseline.

Novel Exemplars Generalization Probe

During the Novel Exemplars Generalization probe, a novel food exemplar from the targeted foods was given to the participants. Then the experimenter asked

to the participant “What does it taste like?” and the participants needed to respond with the appropriate flavor. Through the baseline phase in Set 1, Fernando scored 0% correct. During the baseline phase in Set 2, Fernando scored 0% correct.. For Set 3, Fernando scored 0% correct responses during baseline.

Discussion

The findings that have been observed thus far suggest that using DTT for teaching flavor tacts, while incorporating IF for the color and texture was effective for one participant (Ariadna). For the other participant (Fernando), teaching flavor tacts was not as effective since he did not reach mastery criteria after 34 sessions. However, Fernando could associate the colors with the flavors when asked without any instruction for him to taste something. The present study focused on the importance of teaching children with autism to tact gustatory stimuli, as children need to tact stimuli that are not just visual. To our knowledge, this study was the first to focus on the relation between gustatory tacts, colors, and textures. Even though only one participant was able to identify all flavor exemplars, both participants could identify and state what color usually the flavor foods were.

This study has demonstrated that practitioners could teach gustatory tacts to some children with autism who have a well-established tacting repertoire (level 3 on the VB-MAPP). The participants acquired the secondary targets without any visual stimuli and any direct teaching. However, the participants did not reach mastery criteria on all probes. Fernando reached mastery criteria on the probes that did not require him to engage with gustatory stimuli (i.e., taste and respond to food). None of the participants echoed the IF statement publicly, but they acquired the IF of the color typically associated with each flavor (e.g., most peach flavor

foods are color orange). This may be due to the participants exctensive learning history with visual stimuli generally and colors specifically.

During baseline, Ariadna demonstrated some correct responding to the IF Texture probes. This was likely due to the fact that the experimenters gave the IF texture every trial during baseline due to the risk of choking. This exposure may have led Ariadna to learn about the texture before we started intervention on the primary targets. Given the high baseline responding, we did not re-test her performance during follow-up. After baseline, Ariadna was able to acquire the teaching targets in no more than 11 session per tier. From all three tiers, Ariadna acquired the IF color intraverbal probe (i.e., "Tangerine-flavored foods are usually ____?) first (i.e., she met mastery criteria of 88.89% or above). One possible explanation is that, from all the probes, the IF color intraverbal probe had a more direct answer, which was more similar to the IF given after each response during teaching sessions. Ariadna reached mastery criteria for the rest of the probes in different orders depending on the randomization of the probes. When Ariadna mastered all the teaching targets and probes from Set 1 (i.e., guava, caramel, pistachio), we conducted the novel food exemplars probe, which she scored 0%. Thus, she was unable to generalize to other exemplars from the same flavor. It is possible that the lack of generalization was related to the timing of the probes. That is, Ariadna may have performed more accurately if we conducted a teaching session before the novel food exemplar probe. Instead, we conducted the Novel

Food Exemplars probe after a teaching session and a probe from Set 2. When we conducted a teaching session before the Novel Food Exemplar for Set 2, Ariadna was able to accurately tact the flavors associated with the exemplars. However, even though Ariadna did not generalize the untaught flavors from Set 1, she learned a new color that she did not have in her repertoire (beige) and generalized the color beige in other exemplars other than the caramel flavor. Specifically, she said to the therapist that crackers were the color beige.

The lack of generalization observed in the Novel Foods Exemplar probe in Set 1 may be due to insufficient training exemplars (Stokes & Baer, 1977). The experimenters retaught Set 1 with three new exemplars for each flavor and Ariadna was able to generalize the flavor to the novel foods. For Set 2, since Ariadna could discriminate some flavors in the untaught exemplars from the Novel Food Exemplars probe, we decided to teach the novel exemplars to ensure she identified all of the flavors. For Set 3, after the teaching session she was able to demonstrate the identification of the flavors from the novel exemplars.

The purpose of the study was to teach Ariadna to identify new flavors and associated colors of the specific flavor. She was able to acquire (insert specifics here). Additionally, Ariadna's caregiver reported that the study gave her more exposure to novel foods and this helped her at home to try new foods that Ariadna refused to try prior the study.

Ariadna had the highest percentage of correct responses on the IF Texture Tact probe during baseline. Potentially due to the exposure of the IF Texture statement prior every trial. To eliminate the potential pre-exposure with the IF Texture statement, we presented the IF Texture probe to Fernando within the first 5 sessions of each tier. Conducting the IF Texture Tact probes earlier in the study helped baseline levels to be closer to what we would expect with no pre-exposure. When we started teaching the primary target, Fernando did not acquired mastery criteria (88.89% or above) quickly. However, he reached mastrery criteria on the first or third presentation of the probes that did not require any type of food consumption (IF Flavor Reverse Intraverbal, IF Color Intraverbal, and Derived Flavor Listener Relations).

Given the lack of target acquisition, the experimenters implemented several modifications to Fernando's reinforcement system. Fernando appeared to be very motivated by the crackers that were presented in between trials, which could have competed with additional social reinforcers delivered for correct responding. Therfore, we changed the consequence to a piece of cracker for correct responding and a sip of water for incorrect responding during the teaching sessions. However, this modification did not result in higher levels of correct responding. Next, we decided to provide him with 30-s access to a toy for every correct response during the direct teaching sessions. In addition, we also introduced a token board in which he could earn a preferred edible (i.e., cracker and/or gummy) at the end of the

session (Appendix D). The next modification was introducing two booster sessions at a 0-s prompt delay, but the data were still very variable.

After modifying different aspects of the intervention to contrive motivation for Fernando, we decided to reduce the exemplars to one of each flavor, facilitating the discrimination between flavors. After reducing the number of exemplars Fernando was able to quickly learn the flavors taught (i.e., lime, cherry, and coconut). We also terminated probe sessions for the Derived Color Intraverbal, and IF Texture Tact probes after 11 and 10 sessions, respectively, because he did not reach the mastery criteria. However, Fernando could tact the flavor taught (i.e., lime, cherry, and coconut) with the color of corresponding foods.

Anderson et al. (2018) mentioned that allowing children to be in contact with different sensory characteristics of the food and exposing them to the unwanted food could help the children to be able to try and eat new, nonpreferred food. This study exposed the participant to new flavors and food exemplars. Since they were wearing black-out goggles, they were not aware of what they were going to eat, which eliminated the option for the participant to reject the food before trying it. If the participant did not want to swallow the food, the experimenters praised the participant for trying the food presented to them. The participants in the present study did not have feeding problems. However, Ariadna was reported to be a picky eater by her mother. During the study, the mother reported the interest and willingness of the participant to try new food outside of the study (i.e., she tried

cheese mashed potato, which she was not willing to try before the study). Thus, this study could help individuals with restricted food interests have more exposure to different foods and textures, leading to more variety of food ingested.

Visual stimuli tacts are the most common stimuli used to teach children with autism (Sundberg and Partington, 1998). Other researchers used olfactory (Dass et al., 2018) and auditory stimuli (Hanney et al., 2019) to teach children with autism to tact non-visual stimuli. Hayes et al. (1988) compared visual and gustatory stimuli to teach equivalence classes. Even though the participants acquired mastery criteria with both methods, the participants in the gustatory stimuli group acquired the equivalence class faster than the group with visual stimuli.

We extended Dass et al.'s (2018) study by focusing on the acquisition of gustatory targets. In addition, we added the IF to see if the participants could acquire the two secondary targets (color and texture) through questions directly asking the secondary target and derived relation questions. To our knowledge, this was the first study that attempted to directly teach food flavors to children with ASD with IF regarding the characteristics of the primary target.

Limitations

One of the limitations that this study was the lack of full generalization to the untaught novel exemplars. One possible explanation is that we did not include enough exemplars for each flavor to promote generalization. However, there are other variables that could have affected the results. Each exemplar and brand can

have a stronger or weaker taste of the supposed flavor, so it is understandable that when the participants tried new exemplars, the resemblance of the flavor was not similar enough to what we taught them. For example, pistachio ice cream, pistachio fudge, and pistachio syrup had an strong pistachio flavor. Nevertheless, when we presented the untaught flavor exemplar (pistachio macaron), the flavor was not as strong as the other exemplars, which lead Ariadna to not recognize the flavor. Furthermore, it could also be that some exemplars were similar enough for the participants to confuse flavors (e.g., guava and strawberry).

A second limitation is that we could not control for other variables that could affect the participants ability to discriminate different tastes. For example, it could be that in some sessions, the participants were congested. It is not known if this variable would affect the taste of the participant or not. We did not find any noticeable difference, but the taste could have been affected.

For a third limitation, there are additional variables that may affect a participant's ability to discriminate gustatory stimuli. For example, particularly related to Fernando, it is possible that even though participants had food in their mouths, they were a) not adequately attending to the different flavors (or were only attending to general flavors such as sweet, salty, or bitter), b) did not have contact with the stimuli for an adequate amount of time (i.e., swallowed early) and/or c) were distracted by other stimuli in the environment.

A fourth limitation could be that the participant could have had more or less gustatory cells or taste buds. Depending on how many gustatory cells a participant had, they could be a supertaster who could taste much more different flavors or a non-taster whose most food might seem plain (Prescott et al., 2001). We did not test taste buds or gustatory cells, which could have been one of the problems since we cannot determine how strong the participant tastes.

A possible fifth limitation would the consecutive time spent in the study with each participant. Ariadna and Fernando both started approximately at the same time. However, due to scheduling conflicts, Fernando's sessions were scheduled twice a week. In contrast, the caregiver had scheduled Ariadna's sessions four times a week. The difference of sessions per week could explain why Fernando's data were more variable than Ariadna's data. However, after a month and a half of conducting sessions, both participants started attending four times a week, and there were no significant changes for any of the participants.

Another possible limitation could be that the error correction could be reinforcing for the participant. As expressed in this study, the error correction we used was to present the food, use a 0 s prompt time delay, and then present the food for an independent response. This error correction results in a higher amount of food ingested for the participant, and in some cases, this could lead the participant to err “on purpose.” If the participant prefers food reinforcers (i.e., selects food

over social reinforcers or other activities), the error correction procedure presented in this study might not be the most appropriate to conduct.

A final limitation involves the randomization of the stimuli. In the present study, we had nine trials, and each flavor was presented three times, with different exemplars, but the order of the flavors was randomized every three flavors. With this type of randomization, the participant could have guessed the flavors asked for each tier based upon guessing or process of elimination. For example, the participant could have had a pistachio flavor in the first trial, and then they could have known that the second and the third trial will not be pistachio, and they can guess the other two flavors. They could have also said the same flavor every three responses, and they would get at least 33.33% of correct responses.

It is important to note that being as not all data has been collected, it is possible that we do not have a clear understanding of all potential limitations of the study. As data collection is completed, it is a possibility that additional limitations may arise and give us a better understanding of the findings.

Future Directions

Future studies should consider assessing and teaching tacting general flavors (e.g., salty, fruity, sweet, sour) instead of specific food flavors. Teaching a broader spectrum might facilitate the acquisition of the different flavors and might lead to less confusion for the participants. The present research tried to separate similar flavors (i.e., pomegranate and guava, peach and pineapple) into different

tiers and sets of stimuli. The counterbalance aimed to differentiate exemplars that may contain similar gustatory stimuli (i.e., pomegranate yogurt and pomegranate yogurt, pistachio ice cream, and caramel ice cream). A participant might be more likely to differentiate general flavors (e.g., salty, fruity, sweet, sour) since the response does not need to be specific. Then, having similar flavor foods will not be a limitation.

Future research should also evaluate whether the participant is a supertaster or non-taster, with more or less gustatory cells or taste buds. It is a possibility that participants who are categorized as "non-taster" would not have the necessary abilities to acquire the different tacts and secondary targets. According to Zhao and Tepper (2007) in North America and Western Eropean countries 25% of the Caucasian populations are defined as supertaster, 45% average tasters, and the other 30% of the Caucasian populations are characterized as non-tasters. Discovering whether the participant has enough gustatory cells could be a pre-requisite before introducing this kind of instruction, but we are rarely privy to their experience with the gustatory stimuli. A participant who is a supertaster might acquire the tacts of the different flavors more efficiently. At the same time, a non-taster with fewer taste buds could engage in undifferentiated (an inaccurate) responding regardless of teaching strategies. If the experimenter tests the taste buds of the participant prior to starting the study, it would be easier to eliminate speculations about private events.

Because the study's purpose involved gustatory stimuli (e.g., identifying different flavors), the variable of session timing and exposure to the different stimuli may be especially important. That is, the greater the frequency of sessions, the faster the acquisition of targets. In the present study, Ariadna participated from the beginning 3 to 4 days a week throughout most of the study, while Fernando, the first month and a half, participated in study 1-2 days a week. For this study, the more contact the participants had with the food and less space between sessions, the greater the skill acquisition. Therefore, it would be important for future research to have approximately the same amount of time between sessions for all the participants.

Future research should also consider another error correction procedure if the participants are very motivated by food. Another error correction may involve providing the prompt vocally without presenting the food. If the participant is very motivated by the food, giving another piece of the food when they answer correctly could motivate the participant to answer correctly.

Future directions for this study should also be that instead of randomizing the flavors every three trials, the experimenter should randomize the order of the three flavors with the nine trials, making it more complicated to guess the next answer. For example, on several occasions, Fernando repeated the same answer up to 3 times until the flavor was the correct one. It is possible that the type of randomization reinforced this type of guessing for Fernando. Varying the

randomization could ensure that this type of guessing in not adventitiously reinforced, which may also motivate the participant to engage in different attending skills.

The last future research should be the inclusion of a preassessment that involves having participants do a matching sample task for the exemplars of flavors to ensure the participants are perceiving the flavors the same way. For example, Fernando was not able to distinguish among other exemplars, so if we would have had this type of pre-assessment we might have known that he was not able to discriminate and associate all the examplars from the same flavor as one category. Future studies could make the participant try three types of flavored foods, and then give the participant an exemplar that has the same flavor as one of the exemplars consumed. Then the participant would have to say which one was the same flavor. Another way to test if the participant is able to recognize different exemplars from the same flavor would be if the experimenter give the participant two samples and then ask if they had the same or different flavor.

Implications for Practice

Individuals with autism can benefit from learning to tact flavors, helping them express and distinguish what flavors they like and/or when a flavor might not taste like the actual flavor. Teaching the defined procedure in the present study might be time-consuming, depending on the client. For example, Ariadna mastered nine flavors in the same length of time that Fernando mastered one set. For

Ariadna, the flavors were less common due to her previous knowledge. However, this study helped her to expand her repertoire. For Fernando, the flavors were more common due to his previous learning history. However, even though he had difficulties acquiring the flavor of the targeted foods, he quickly acquired the IF for the colors, which will help in the future to identify flavors when presented with thorough visual stimuli.

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Table 1

Flavor Counterbalance Table for Ariadna

Color		Syllables	Chewy	Liquid	Crunchy	Creamy
	Set 1	**[9]**				
Green	Pistachio	4	Fudge	Liquid	Macarons	Ice cream
Beige	Caramel	3	Soft candy	Syrup	Rice cakes	Ice cream
Pink	Guava	2	Laffy taffy	Juice	Pastry	Yogurt
	Set 2	**[7]**				
Purple	Prune	1	Dried	Juice	Cookies	Yogurt
White	Coconut	3	Jelly bean	Milk	Chips	Ice cream
Orange	Tangerine	3	Jelly bean	Juice	Meringues	Marmalade
	Set 3	**[9]**				
Brown	Root beer	2	Jelly bean	Soda	Hard candy	Ice cream
Red	Pomegranate	4	Jelly bean	Juice	Seeds/arils	Yogurt
Yellow	Banana	3	Jelly bean	Juice	Chips	Pudding

Note. Ariadna's counterbalance table of food exemplars and texture. Note that the words in red are the novel food exemplars.

Table 2

Flavor Counterbalance Table for Fernando

Color		Syllables	Chewy	Liquid	Crunchy	Creamy
	Set 1	**[6]**				
White	Coconut	3	Jelly bean	Milk	Chips	Ice cream
Green	Lime	1	Jelly bean	Syrup	Meringues	Jello
Red	Cherry	2	Gummy	Juice	Chips	Jello
	Set 2	**[6]**				
Orange	Peach	1	Jelly bean	Juice	Chips	Yogurt
Pink	Guava	2	Laffy taffy	Juice	Cookies	Yogurt
Beige	Caramel	3	Soft candy	Syrup	Rice cakes	Ice cream
	Set 3	**[6]**				
Purple	Prune	1	Dried	Juice	Cookies	Yogurt
Brown	Root Beer	2	Jelly bean	Soda	Hard Candy	Ice cream
Yellow	Pineapple	3	Jelly bean	Juice	Chips	Yogurt

Note. Fernando's counterbalance table of food exemplars and texture. Note that the words in red are the novel food exemplars.

Figure 1

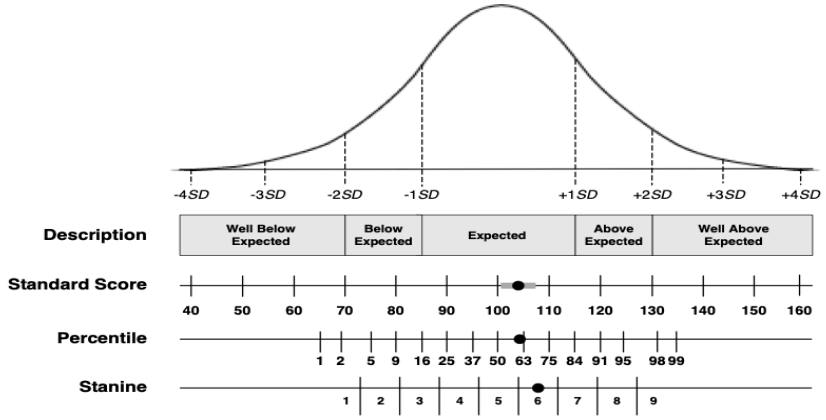
Score Summary PPVT-5

Score Summary

Basal Item	Ceiling Item	Total Errors	Raw Score
12	149	42	107

Standard Score	90% Confidence Interval	Percentile	NCE	Stanine	Description	Age Equivalent	GSV
104	101 - 107	61	56	6	Expected	5:2	476

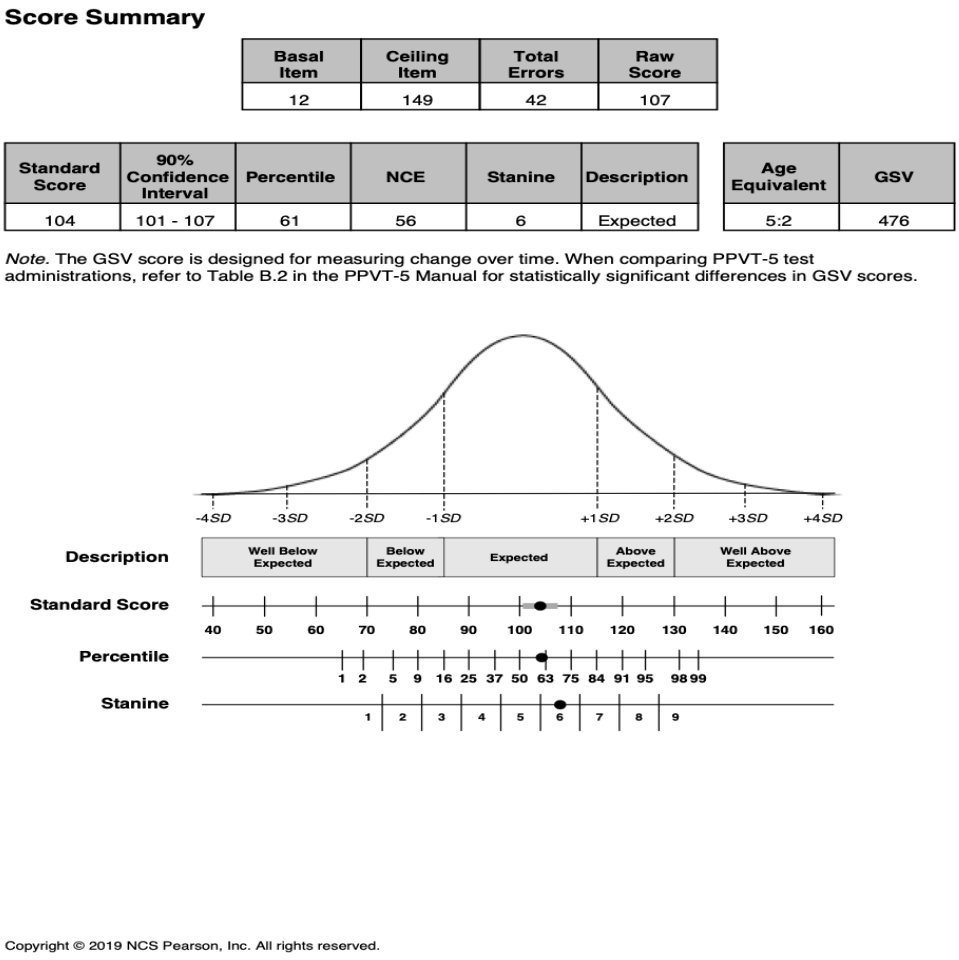
Note. The GSV score is designed for measuring change over time. When comparing PPVT-5 test administrations, refer to Table B.2 in the PPVT-5 Manual for statistically significant differences in GSV scores.



Note. Ariadna's results comparing her scores to standard score. From *PPVT-5: Peabody picture vocabulary test* (5th ed), by Dunn, L. M. & Dunn, D. M., 2019, NCS Pearson. Copyright 2019 by NCS Pearson.

Figure 2

Score Summary EVT-3



Score Summary

Basal Item	Ceiling Item	Total Errors	Raw Score
12	149	42	107

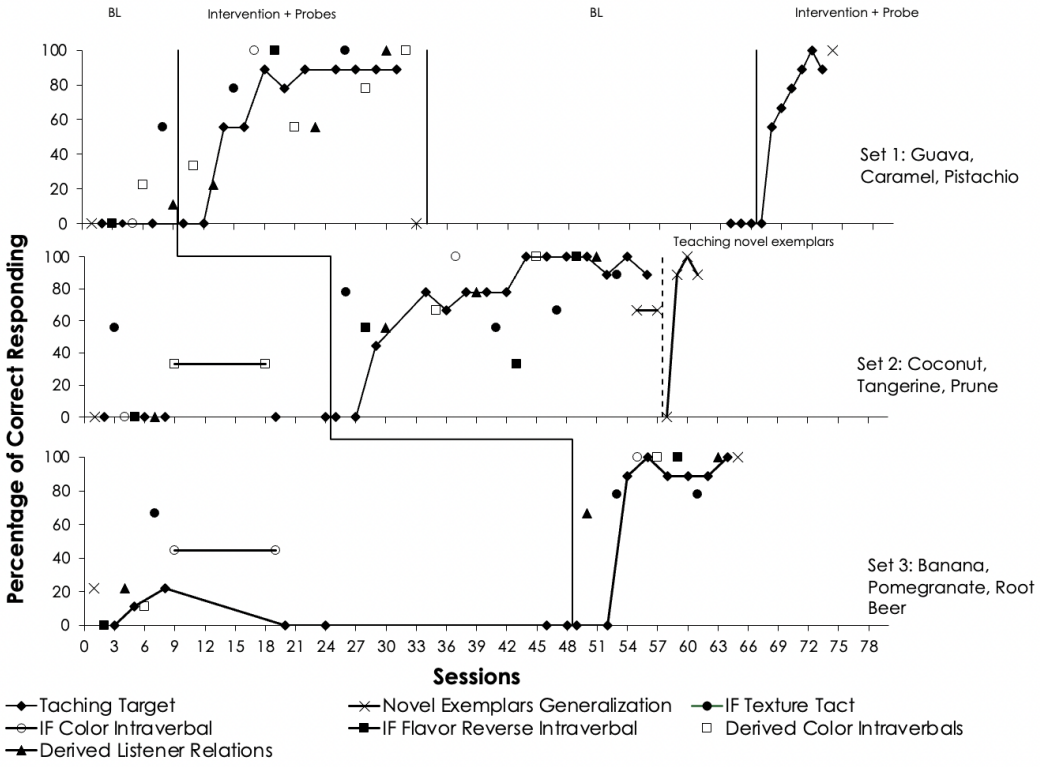
Standard Score	90% Confidence Interval	Percentile	NCE	Stanine	Description	Age Equivalent	GSV
104	101 - 107	61	56	6	Expected	5:2	476

Note. The GSV score is designed for measuring change over time. When comparing PPVT-5 test administrations, refer to Table B.2 in the PPVT-5 Manual for statistically significant differences in GSV scores.

Note. Ariadna's results comparing her scores to standard score. From *EVT-3: Expressive Vocabulary Test* (3rd ed.), by Williams, K. T., 2019, NCS Pearson. Copyright 2019 by NCS Pearson.

Figure 3

Acquisition of Primary and Secondary Targets



Note. Percentage of correct responses for primary target, secondary target, and generalization probes for Ariadna.

Figure 4

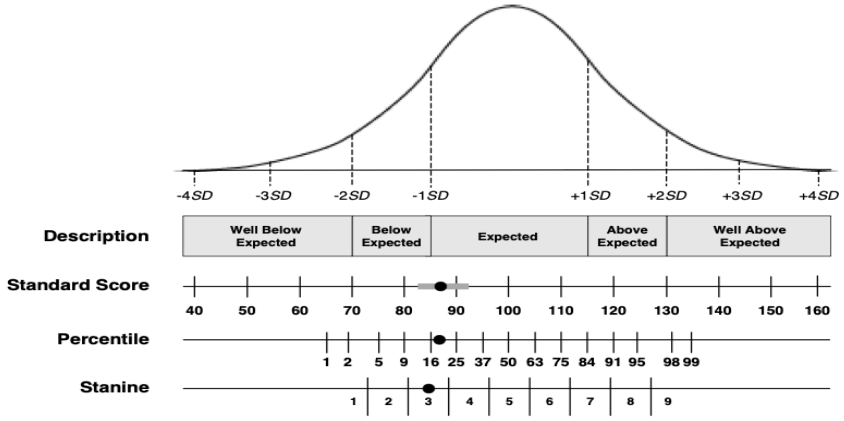
Score Summary PPVT-5

Score Summary

Basal Item	Ceiling Item	Total Errors	Raw Score
21	130	41	89

Standard Score	90% Confidence Interval	Percentile	NCE	Stanine	Description	Age Equivalent	GSV
87	83 - 92	19	32	3	Expected	4:4	470

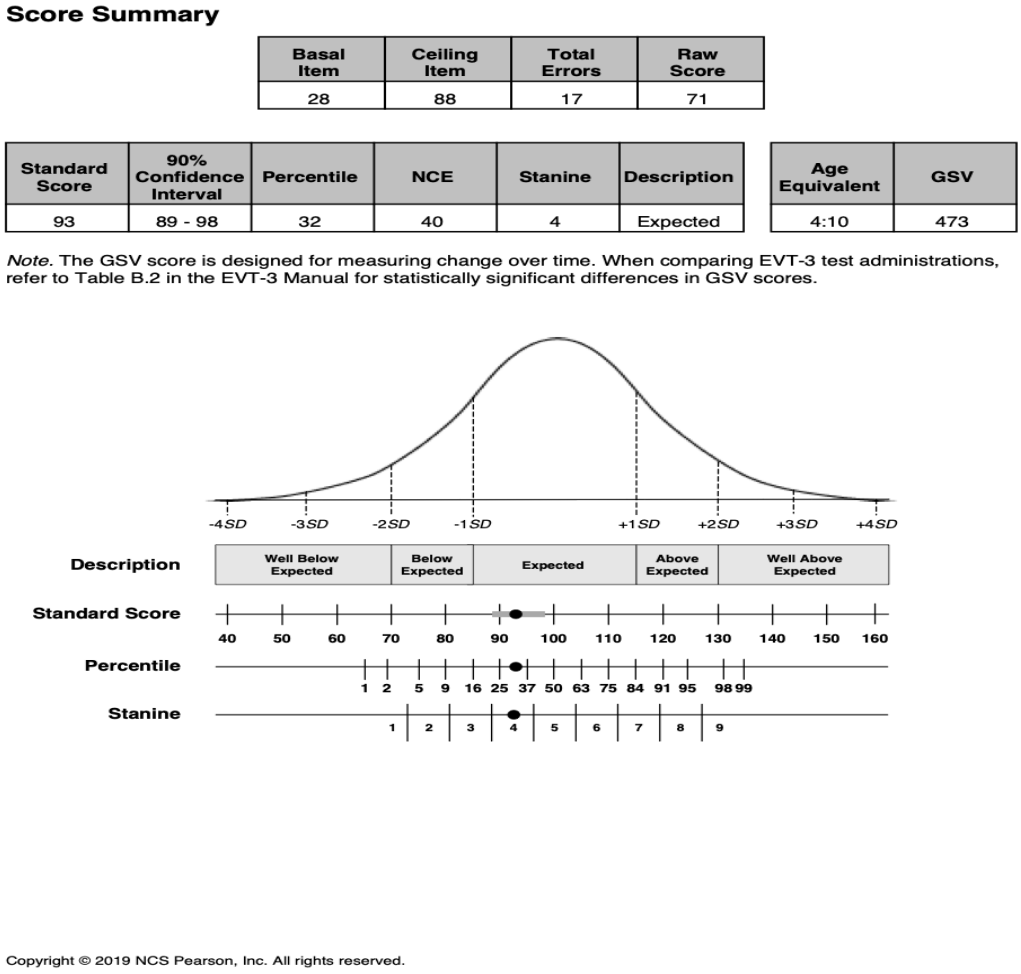
Note. The GSV score is designed for measuring change over time. When comparing PPVT-5 test administrations, refer to Table B.2 in the PPVT-5 Manual for statistically significant differences in GSV scores.



Note. Fernando's results comparing her scores to standard score. From *PPVT-5: Peabody picture vocabulary test* (5th ed), by Dunn, L. M. & Dunn, D. M., 2019, NCS Pearson. Copyright 2019 by NCS Pearson.

Figure 5

Score Summary EVT-3



Score Summary

Basal Item	Ceiling Item	Total Errors	Raw Score
28	88	17	71

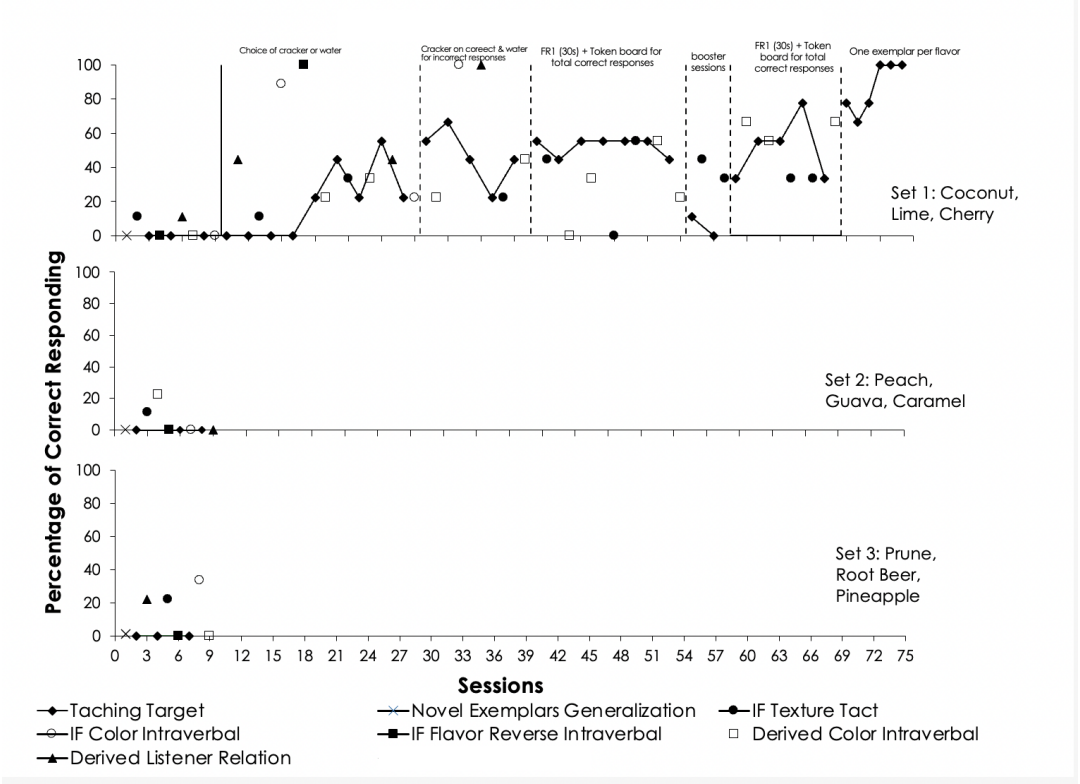
Standard Score	90% Confidence Interval	Percentile	NCE	Stanine	Description	Age Equivalent	GSV
93	89 - 98	32	40	4	Expected	4:10	473

Note. The GSV score is designed for measuring change over time. When comparing EVT-3 test administrations, refer to Table B.2 in the EVT-3 Manual for statistically significant differences in GSV scores.

Note. Fernando's results comparing her scores to standard score. From *EVT-3: Expressive Vocabulary Test* (3rd ed.), by Williams, K. T., 2019, NCS Pearson. Copyright 2019 by NCS Pearson.

Figure 6

Acquisition of Primary and Secondary Targets



Note. Percentage of correct responses for primary target, secondary target, and generalization probes for Fernando.

Appendix A

Informed Consent

Informed Consent

Please read this consent document carefully before you decide to participate in this study. The researcher will answer any questions before you sign this form.

Study Title: Effect of Instructive Feedback on Gustatory Relations

Purpose of the Study:
The purpose of this study to teach children to label the flavor of foods and pair flavors with their matching colors. For example, we might teach your child to label chocolate pudding as tasting like chocolate and to choose a brown food when asked to pick chocolate.

Procedures:
Your child will come to a research room or join an online call, or the researcher will come to your house for 1-3 10-min sessions. We will ask your child to wear a blindfold. Then the therapist will give your child a cup with some food in it. When the food item is received, the therapist will ask "What does that taste like?" teaching them to say the right flavor until your child can distinguish the flavors by himself or herself. After every time your child will answer the correct color the therapist will say "Yes, that is (flavor of the item) flavor! Foods that tase like (flavor of the item) are usually (color of the item)." The second part where the therapist is saying the color of the food flavored item will not be taught. After your child identifies the flavors of the food items, the therapist will ask for the color of the food flavor without seeing them, and we will probe different ways to see if the flavor and color of the food item was generalized in different circumstances. Your child will be videotaped during the entire session.

Potential Risks of Participating:
The risks of participating in this study are minimal. Your child will be asked to sit at a table, eat eatable food and answer questions. All sessions will be observed. Prior tasting any food items to your child we will ask you to select from a table of foods, the food items that your child would like. To prevent choking we will conduct training sessions without having a blindfold and we will describe the texture of the food to ensure your child knows what to expect when they are blindfold. If you or your child ever feel uncomfortable, you can let the research team know at any time and we will terminate session.

Because of COVID-19, there may be other risks of in-person sessions. To reduce these risks as much as possible, we will take these safety precautions:

- Meetings with you before and after the study (such as consent meeting, debrief meeting) will be conducted over Zoom or another video conferencing platform. Before we start sessions, we will ask you to sign a "declaration of compliance with COVID-19 protective measures" issued by Florida Tech.
- Before each session, we will give you a quick call to complete a screening questionnaire. If we, you, or your child are experiencing any symptoms, we will cancel that day's session. If you have already completed a screening with your child's autism center for that day, we will not conduct an additional screening.
- Sessions will still be conducted in person, but we will maintain distance between the experimenter and your child as much as possible. Additionally, barriers may be placed between the experimenter and your child.
- Whether we are in your home or in another building, we will conduct sessions in a private room allowing for 6 feet of distance between each individual in the room. There will never be more than 3 people in the room (your child and a maximum of 2 researchers). For example, if a second research assistant is present, they may be in another room or they may sit distanced from the experimenter and your child. If you have an area in your home that is partially or fully outdoors, we would be happy to consider running sessions there, as well.
- The experimenter will wear a mask and gloves. Your child will not be required to wear a mask or face shield, but we would be happy to help him or her wear a mask during sessions if you would like.
    - We will supply masks for your child if needed, and we will bring our own supply of hand sanitizer to sessions.
    - If your child refuses to wear a mask, we will place a clear plastic shield on the table between the experimenter and your child.
- If possible, we will avoid providing your child with snacks during the session. We will avoid handling items your child will touch (e.g., toys) as much as possible, and vice versa.

- Before and after each session, surfaces (e.g., chairs, table), door handles, and research materials (e.g., video camera, iPad, teaching materials) will be disinfected. The same set of research materials will not be used for each child – we will keep items such as binders and office supplies separate.

Potential Benefits of Participating:
If your child cannot distinguish the different flavors from different foods or distinguish what flavor might it be depending on the color of the item, this puts your child at risk of eating unsafe items. The association of taste and color of different foods is important for safety reasons as it provides a base knowledge of safe foods. Your child could gain new communication skills, improving your relationship, and the capability to express what your child likes and wants could make decrease problem behavior. Results from your child's learning could help us learn how to teach other children to communicate and distinguish food items.

Compensation:
No compensation will be given for participation in this study.

Confidentiality:
Data and other documents will refer to your child only using your made-up name. Data and references will not include personally identifying information. Your child's de-identified data may be shared and discussed within a university lab group for the purpose of student learning. The researchers will take care to not identify you during these times. Scanned data and documents will also be stored on a university-owned secure cloud storage that is password protected and HIPAA compliant. These materials will be destroyed after 3 years. Only the investigators involved in the study will have access to these materials.

Voluntary participation:
The participation in this study is completely voluntary. There is no penalty for not participating. The decision to participate or not will not have any impact on you in any aspect of your life.

Right to withdraw from the study:
You have the right to withdraw from the study at any time without consequence.

Whom to contact if you have questions about the study:
Dr. Katie Nicholson
Email: cnicholson@fit.edu
Phone: (321) 674-8330

Whom to contact about your rights as a research participant in the study:
Dr. Jignya Patel, IRB Chairperson
150 West University Blvd.
Melbourne, FL 32901
Email: Fit_irb@fit.edu
Phone: (321) 674-8104

Agreement:
I have read the procedure described above. I voluntarily agree to participate in the procedure and I have received a copy of this description.

<If research participants do not receive a copy of their informed consent form, they should then receive an informational sheet including at least the title of your study, along with the your name and contact information, along with the contact information for the IRB.>

Participant: _____ _____
Date

_____ _____
Signature of parent/guardian Date

Principal Investigator: _____ _____
Date

Co-Investigator: _____ _____
(If PI is not present) Date

CONSENT TO VIDEO AND AUDIO RECORD FOR A MINOR

Project Title: Effects of Instructive Feedback on Gustatory Relations
Primary Investigator: Natalia Arasa Bonavila, Graduate Student
Co-investigator: Katie Nicholson, PhD, BCBA-D; Sandhya Rajagopal, Graduate Student; Melissa Montalvo, Graduate Student; Julianne Fernandez, Graduate Student; & Abbi Lee, Graduate Student

Purpose and use of recording:
The primary purposes of recordings are data collection, interobserver agreement, and treatment integrity.
Other purposes may include the following:
Training purposes for staff and other professionals
Presentation at professional conferences

Specific identifiers that will be recorded:
Your child's first names may or may not be used in recordings. (Last names will never be stated.)
Recordings will include full facial features and bodies of your child.

People who will have access to the recording(s):
The primary investigator, co-investigator and research assistants will be the only people that have access to the video recordings, unless consent is given otherwise. Even if consent is given to use recordings for training or professional presentations, no other people will have direct access to the recordings. Recordings will be used for viewing purposes only.

Storage procedures, the storage location, and the duration of storage:
All recordings will be stored on a secure cloud-based storage program (i.e., box.com). Recordings will be deleted from the device (camera or audio recorder) within 24 hours of recording and placed in electronic storage. Video cameras containing recordings will be stored in a secured location such as an office, closet, or locked storage container.

Procedures for controlling access to and use of the recordings:
Videos will only be used in the manner in which consent is given. Should the consenting individual give permission for us to use videos for training purposes or professional presentations, external use of videos will be limited to viewing only. Copies of videos will not be made or provided to anyone.

When and how recordings will be destroyed:
All videotapes will be destroyed after a period of five (5) years by permanently deleting them from the storage location (i.e., hard drive or cloud-based storage).

I, _____, consent to the use of video and audio recordings of me and/or my child for the following purposes (please check all that apply):

_____ Data collection purposes

_____ Training purposes

_____ Professional presentations

_____ I do not give my consent to be recorded for any purpose

_____ _____
Signature of parent/guardian Date

_____ _____
Print name of participant Date

_____ _____
Signature of Witness Date

Appendix B

Caregiver's Survey

Child's Name:

Name of caregiver filling out this survey:

Please list any food allergies or dietary restrictions your child has.

In this study, we will give your child foods that he or she will enjoy eating (e.g., fruit, pudding, yogurt, jellybeans, juice, ice cream). We do not want to give your child foods that he won't like. To help us get an idea of what your child may like, please fill out the following chart. To the best of your ability, please estimate how much you think your child will enjoy consuming foods with the following flavors, with 1 being the least enjoyable and 5 being the most enjoyable. You can also indicate if you don't want your child to have a particular flavor or if you're really not sure how your child will like a particular flavor.

Note: If you indicate that you do not want your child to have a particular flavor, we will never present any foods containing that flavor during the study. If you indicate that you are "not sure" whether your child will like a particular flavor, we may give your child a sample of it to try to see if he or she likes it. We will never give any foods to your child that you list in the allergies/food restrictions section above. For example, if you think your child will like the flavor vanilla, but can't consume dairy, we may give your child vanilla flavored jellybeans, but we will not give your child vanilla yogurt. After reviewing the information that you provide to us in this survey and conducting a brief assessment with your child to confirm that he or she will eat the selected foods, we will give you a finalized list of foods for your approval before we start any research sessions.

Flavor			LEAST enjoyable				MOST enjoyable
Chocolate	I don't want my child to have foods with this flavor	Not sure	1	2	3	4	5
Maple syrup	I don't want my child to have foods with this flavor	Not sure	1	2	3	4	5
Root Beer	I don't want my child to have foods with this flavor	Not sure	1	2	3	4	5
Caramel	I don't want my child to have foods with this flavor	Not sure	1	2	3	4	5
Almond	I don't want my child to have foods with this flavor	Not sure	1	2	3	4	5
Peanut	I don't want my child to have foods with this flavor	Not sure	1	2	3	4	5
Coconut	I don't want my child to have foods with this flavor	Not sure	1	2	3	4	5
Marshmallow	I don't want my child to have foods with this flavor	Not sure	1	2	3	4	5
Vanilla	I don't want my child to have foods with this flavor	Not sure	1	2	3	4	5
Milk	I don't want my child to have foods with this flavor	Not sure	1	2	3	4	5
Cauliflower	I don't want my child to have foods with this flavor	Not sure	1	2	3	4	5
Cheese	I don't want my child to have foods with this flavor	Not sure	1	2	3	4	5
Pear	I don't want my child to have foods with this flavor	Not sure	1	2	3	4	5
Strawberry	I don't want my child to have foods with this flavor	Not sure	1	2	3	4	5
Bubble gum	I don't want my child to have foods with this flavor	Not sure	1	2	3	4	5
Guava	I don't want my child to have foods with this flavor	Not sure	1	2	3	4	5
Lemon	I don't want my child to have foods with this flavor	Not sure	1	2	3	4	5
Banana	I don't want my child to have foods with this flavor	Not sure	1	2	3	4	5

Pineapple	I don't want my child to have foods with this flavor	Not sure	1	2	3	4	5
Kiwi	I don't want my child to have foods with this flavor	Not sure	1	2	3	4	5
Lime	I don't want my child to have foods with this flavor	Not sure	1	2	3	4	5
Mint	I don't want my child to have foods with this flavor	Not sure	1	2	3	4	5
Pistachio	I don't want my child to have foods with this flavor	Not sure	1	2	3	4	5
Avocado	I don't want my child to have foods with this flavor	Not sure	1	2	3	4	5
Grape	I don't want my child to have foods with this flavor	Not sure	1	2	3	4	5
Plum	I don't want my child to have foods with this flavor	Not sure	1	2	3	4	5
Lavender	I don't want my child to have foods with this flavor	Not sure	1	2	3	4	5
Fig	I don't want my child to have foods with this flavor	Not sure	1	2	3	4	5
Cranberry	I don't want my child to have foods with this flavor	Not sure	1	2	3	4	5
Raspberry	I don't want my child to have foods with this flavor	Not sure	1	2	3	4	5
Cherry	I don't want my child to have foods with this flavor	Not sure	1	2	3	4	5
Pomegranate	I don't want my child to have foods with this flavor	Not sure	1	2	3	4	5
Watermelon	I don't want my child to have foods with this flavor	Not sure	1	2	3	4	5

Tomato	I don't want my child to have foods with this flavor	Not sure	1	2	3	4	5
Peach	I don't want my child to have foods with this flavor	Not sure	1	2	3	4	5
Pumpkin	I don't want my child to have foods with this flavor	Not sure	1	2	3	4	5
Tangerine	I don't want my child to have foods with this flavor	Not sure	1	2	3	4	5
Mango	I don't want my child to have foods with this flavor	Not sure	1	2	3	4	5
Carrot	I don't want my child to have foods with this flavor	Not sure	1	2	3	4	5
Sweet potato	I don't want my child to have foods with this flavor	Not sure	1	2	3	4	5
Apricot	I don't want my child to have foods with this flavor	Not sure	1	2	3	4	5
Licorice	I don't want my child to have foods with this flavor	Not sure	1	2	3	4	5
Currants/Raisins	I don't want my child to have foods with this flavor	Not sure	1	2	3	4	5
Olives	I don't want my child to have foods with this flavor	Not sure	1	2	3	4	5
Beans	I don't want my child to have foods with this flavor	Not sure	1	2	3	4	5

Appendix C

Treatment Integirty Checklist

Treatment Integrity Checklist

Date: _____ Session #: _____ Condition: _____

Experimenter: _____ Data Collector: _____

General Procedures		
Did the experimenter have the correct materials ready for session? (Binders, datasheets, etc.)	Yes	No
Did the experimenter indicate to the child what food texture would be experiencing before each trial?	Yes	No
Did the experimenter give the correct instructions, as stated on the datasheet?	Yes	No
Did the experimenter blindfold the participant or ask them to close their eyes prior starting each trial?	Yes	No
Did the experimenter record data immediately after each trial?	Yes	No
Did the experimenter offered a choice of water, sparkling water, or a cracker in between trials?	Yes	No
Did the experimenter turn the page after recording data, and then present the next instruction?	Yes	No
Did the experimenter add the secondary target in every trial for each primary target?	Yes	No
Did the experimenter provide a 30 sec break between each trial and a 5-min break between sessions?	Yes	No
TOTAL per Block:		
Baseline Procedures		
Did the experimenter wait 5 – 10 s for response initiation, and 5 – 10 s after initiation for response completion?	Yes	No
Did the experimenter give behavior-specific praise about every 3-4 trials (i.e., 3 total deliveries) for appropriate sitting, blindfold toleration, etc.?	Yes	No
Was praise provided at the end of each block?	Yes	No
Did the experimenter refrain from prompting, error correction, and differential reinforcement?	Yes	No
TOTAL per Block:		
Teaching Procedures		
Did the experimenter prompt and fade prompts as specified by the protocol?	Yes	No
Did the experimenter provide the appropriate consequence as specified by the protocol, for correct/prompted/incorrect/no responses?	Yes	No
If the participant initiated a response within 5-10s of the instruction, did the experimenter wait 5-30s for response completion?	Yes	No
TOTAL per Block:		
Problem Behavior		
Did the experimenter block and redirect any problem behavior?	Yes	No
Did the experimenter continue teaching?	Yes	No
Did the experimenter record frequency of problem behavior throughout session?	Yes	No
TOTAL per Block:		

Appendix D

Fernando's Token Board