

Northeastern University

Applied Behavioral Analysis Master's Theses

Bouvé College of Health Sciences

January 01, 2011

An investigation of non-aversive procedures to increase variety of food consumed

Tiffany Christine Allard Northeastern University

Recommended Citation

Allard, Tiffany Christine, "An investigation of non-aversive procedures to increase variety of food consumed" (2011). *Applied Behavioral Analysis Master's Theses.* Paper 63. http://hdl.handle.net/2047/d20001093

This work is available open access, hosted by Northeastern University.

An Investigation of Non-aversive Procedures to Increase Variety of Food Consumed

A Thesis Presented

by

Tiffany Allard

The Department of Counseling and Applied Educational Psychology

In partial fulfillment of the requirements

for the degree of

Master of Science

in the field of

Applied Behavior Analysis

Northeastern University

Boston, MA

NORTHEASTERN UNIVERSITY

Boston-Bouvé College of Phermacy

And Health Sciences Graduate School

Thesis Title: An Investigation of Non-aversive Procedures to Increase Variety of Food Consumed

Author: Tiffany Atlard

Department: Counseling and Applied Educational Psychology

Approved for Thesis Requirements of Master of Science Degree

Karen E. Gould, Ph.D., BCBA

Pamela M. Olsen, MSEd, BCBA

Date

11 July 2011

An Investigation of Non-aversive Procedures to Increase Variety of Food Consumed

by

Tiffany Allard

B.A., Villanova University

Submitted in partial fulfillment of the requirements for the degree of Master of Science in Applied Behavior Analysis in the Bouvé College of Health Sciences Graduate School of Northeastern University, August 2011

Acknowledgements

I would like to express my gratitude to Dr. Daniel Gould, who served as advisor for my thesis. He was supportive throughout all stages of the study, including initial planning, observations, data collection, editing, and presenting the thesis. I would also like to thank the other members of my thesis committee, Dr. Karen Gould and Pamela Olsen, for their assistance with the project. Finally, I would like to thank Linda Bailey, Rachel Gwin, Courtney Leblanc and Shafaa Al Menhali who observed sessions and collected interobserver agreement data.

Table of Contents

A.	Abstract		
B.	Introduction		
	1. Pui	nishment	5
	2. Ne	gative Reinforcement	6
	3. Pos	sitive Reinforcement	9
	4. Antecedent Interventions		10
C.	General Method		
	1.	Participant	13
	2.	Setting and Materials	14
	3.	Dependent Variable and Response Definition	15
	4.	Measurement and IOA	15
D.	Study 1		
	1.	Procedure	16
	2.	Results and Discussion.	16
E.	Study 2		
	1.	Procedure	17
	2.	Results and Discussion.	17
F.	Study 3		
	1.	Procedure	18
	2.	Results and Discussion.	19
G.	Study 4		
	1.	Procedure	
	2.	Results and Discussion.	22
H.	Contra regard and Discussion		
I.	References		27
J.	Appendix		
K.	Figure Captions		
L.	Figures		

Abstract

Maladaptive feeding behaviors, such as extreme food selectivity, are often exhibited by individuals with autism. The potential consequences of long term selectivity or food refusal range from malnutrition to starvation. The behavior is often operant in nature and can be affected by environmental variables. The current study applied three non-aversive procedures to increase the variety of food consumed by a child with autism. A baseline preference assessment was conducted in Study 1 to identify food the participant would consume independent of programmed consequences. A procedure designed to reverse the effects of an aversive stimulus was applied in Study 2. A treatment package combining positive reinforcement and stimulus fading was applied in Study 3. Finally, an escape contingency combined with a token economy was applied in Study 4. Acceptance of non-preferred foods was not established in Study 2. Positive reinforcement and stimulus fading increased acceptance for two previously nonpreferred foods initially but could not maintain acceptance. The escape contingency and token economy was the only effective intervention, establishing acceptance of 15 previously nonpreferred foods. Results from the current study demonstrate that an escape contingency and token economy can be an effective intervention to increase the variety of food consumed independent of escape extinction procedures.

An Investigation of Non-aversive Procedures to Increase Variety of Food Consumed Maladaptive feeding behavior is a common problem affecting individuals with autism.

Commonly exhibited behavior includes complete food refusal, type or texture selectivity, inadequate food intake, self feeding skill deficits, rumination, and disruption (Ahearn, Kerwin, Eicher, Shantz, & Swearingin, 1996; Mueller, Piazza, Patel, Kelley, & Pruett, 2004; Piazza et al., 2002; Riordan, Iwata, Finney, Wohl, & Stanley, 1984). These behaviors may result in a variety of health concerns, including poor nutrition, inadequate weight gain, gagging, vomiting, and aspiration. The symptoms may be minor and cause inconvenience on the part of the caretaker or they may be life threatening and require hospitalization. Due to the potential severity of mealtime problem behavior further research in the area is warranted.

Mealtime problem behavior may have several causes, the first of which is physical impairments. For some children, the feeding process is initially aversive due to inadequate oral motor skill development or gastrointestinal issues, which cause eating to be painful. As a result, gagging or vomiting may occur. Once food has been paired with aversive physiological consequences, avoidance behaviors may develop (Shore, Babbit, Williams, Coe, & Snyder, 1998; Patel, Piazza, Santana, & Volkert, 2002). Delays in oral motor development also may make eating certain foods more aversive (particularly high texture foods such as meat), or may make independent eating impossible. Consequently, type or texture selectivity may develop (Munk & Repp, 1994).

In addition to these physiological influences, environmental factors can play a significant role in establishing and maintaining maladaptive feeding behavior. Palmer and Horn (1978) concluded that 21% of all feeding problems in children with handicaps referred to their nutrition clinic were maintained by behavioral mismanagement. Borrero, Woods, Borrero, Masler, and

Lesser (2010) conducted a descriptive analysis of mealtime problem behavior, which was one of the few studies examining the issue. Twenty-five children with severe feeding problems participated in the study, the purpose of which was to determine if the commonly used functional analyses assessing food refusal actually measures consequences that occur in the natural environment. The study also compared whether these consequences were more likely to follow refusal or acceptance as well as if they were more likely to follow specific refusal topographies. Results showed that attention in the form of coaxing, and escape most commonly followed refusal. Results for all calculations also indicated that the conditional probability values were higher following refusal than acceptance, suggesting the possibility that refusal was reinforced more frequently than acceptance. In conclusion, this study validated the use of functional analyses that include conditions of attention, tangible items, and escape.

Several studies reported the use of functional analyses to determine the maintaining variables for mealtime problem behavior. Bachmeyer et al. (2009) conducted functional analyses with 4 children who exhibited mealtime problem behavior and found both escape and adult attention maintained the behavior. Function based interventions were then implemented and results demonstrated that both attention extinction as well as escape extinction were necessary to decrease problem behavior and increase consumption. When each intervention was applied in isolation, the behavior did not reach clinically acceptable levels. This study highlights that it is necessary to identify all variables maintaining mealtime behavior in order to develop an effective function based intervention. Due to the role environmental factors play in maintaining mealtime problem behavior, there are a variety of potential treatment options. These include punishment, negative reinforcement, positive reinforcement, and antecedent intervention.

Punishment. An alternative analysis of mealtime problem behavior is that punishment decreases food acceptance. In this analysis, non-preferred food functions as a discriminative stimulus for opening the mouth, and the consequence for this response is contacting the non-preferred food. If the non-preferred food is an aversive stimulus, the future probability of the individual opening the mouth decreases. After contacting a certain quantity or variety of non-preferred food items, the individual may consistently refuse most food items due to the common discriminative stimuli. This analysis suggests a potential treatment approach; specifically, treatment focused on minimizing the response-reducing effects of the contingently-delivered aversive stimulus (i.e., the food).

A number of variables have been identified that make punishment more or less effective. Punishment becomes more effective when the aversive stimulus is delivered at a high intensity on a continuous schedule immediately following the response. Punishment carried out in such a way should have quick dramatic response-reducing effects. Fading out of the procedure should include gradually decreasing the intensity of the punisher, while interspersing high intensity levels throughout the fading process. Interspersing conditioned punishers throughout the fading process can help maintain response suppression (Lerman & Vorndran, 2002).

An effective food refusal treatment based on a punishment model minimizes the effectiveness of the contingent delivery of the aversive stimulus. Therefore, the aversive stimulus, in this case the non-preferred food, is presented intermittently rather than on a continuous schedule. To establish food acceptance an edible is presented that functions as a reinforcer, or at least a preferred stimulus, that the individual accepts independently. Initially the ratio of preferred to non-preferred food is high, then gradually reduced based on percent acceptance of the non-preferred item. Thus, the discriminative properties of the non-preferred food are altered through

consistent pairing with the preferred item. Also, the punisher is presented at the lowest intensity possible. This may be accomplished through various means such as altering the quantity, smell, texture, and color of the food. By examining what foods the individual will initially accept, one can hypothesize which stimulus property of the food is particularly aversive. This variable can then be altered over time based on acceptance percent. Errorless responding optimizes procedural effectiveness; therefore, the schedule and intensity are kept low enough so that refusal never occurs.

Negative Reinforcement. In negatively reinforced mealtime problems, the removal, reduction, postponement, or prevention of aversive stimulation maintains the behavior. Iwata (1987) reviewed the literature on the treatment of negatively reinforced behavior. In escape extinction, continued presentation of the aversive stimulus and elimination of the consequence initially provided occurs. Differential reinforcement of other or alternative behavior may compete with the avoidance or escape responding, but does not suppress it. Treatments combining positive reinforcement with extinction show the most promising results; however, punishment-based procedures may also be effective. Additionally, physical guidance to complete the desired task can decrease the undesirable behavior while at the same time increasing a new avoidance response, in the present case, food acceptance.

Application of these approaches to feeding has been effective in eliminating avoidance or escape behavior. In escape extinction, the mouth is opened through physical guidance, the spoon remains present, and the food is placed in the mouth. Riordan et al. (1984) conducted an experiment with 4 handicapped children who did not feed themselves. For 3 of the children, positive reinforcement increased food acceptance; however, for 1 child physical guidance was also necessary to increase acceptance. The authors mention that the latter technique resembles a

discriminated avoidance contingency; the participant's acceptance increased in order to avoid the physical guidance and forced response. Therefore, the initial avoidance response, food refusal, was replaced with another avoidance response, opening mouth and accepting food. This study demonstrates that at times physical guidance may effectively establish behavior, particularly when the operant level of eating is very low, or if positive reinforcement fails.

Ahearn et al. (1996) used an alternating treatments design to compare the effectiveness of physical guidance to nonremoval of the spoon in three children who chronically refused food. The two treatments were presented quasi-randomly and once acceptance had increased to 80% or greater for at least three consecutive sessions in one of the conditions, the child's caregivers selected a treatment. Positive reinforcement in the form of toys and social interaction was delivered contingent on food acceptance during baseline and all subsequent sessions. In the condition in which the spoon was not removed, the spoon remained on the child's lower lip until acceptance took place. If the child expelled the food, it was immediately represented in the same manner. When physical guidance was given, the experimenter applied gentle pressure to the mandibular junction of the jaw. Results indicated that both treatments were effective in increasing food acceptance. Physical guidance produced less corollary problem behavior than nonremoval of the spoon and it was the parent's preferred treatment.

Cooper et al. (1995) conducted a component analysis to identify the active variables in food acceptance treatment packages. Four young children with a history of food refusal participated in the study. Baseline was first conducted and bites accepted were recorded. Treatment was then implemented that consisted of both positive and negative reinforcement components. The negative reinforcement component, nonremoval of the spoon, was the same for all participants. During the component analysis, one component was removed and then re-implemented within a reversal or multi-element design. Results indicated that nonremoval of the spoon was an essential component to the treatment package. This study supports the hypothesis that food refusal functions as either escape or avoidance and that not removing the spoon is an effective treatment.

Extinction procedures may be necessary for several different topographies of feeding behaviors. Coe et al. (1997) applied extinction to food avoidance and then later applied to both avoidance and expulsion. The study included 2 participants, both with a history of food refusal and gastrostomy tube dependence. In the extinction procedure, the spoon was not removed and a verbal prompt was given every 30 s. While this procedure increased acceptance, it also increased expulsion as well; therefore, the children did not actually ingest the food. Positive reinforcement was added contingent on swallowing, which decreased expulsion for 1 of the 2 participants. When extinction was applied to expulsions, the expelled food was represented, the spoon was not removed, and a verbal prompt was given every 30 s. This final procedure increased swallowing, and consequently decreased expulsion for both participants. This experiment demonstrates that for certain individuals a sequential application of extinction procedures is necessary and there is an inverse relationship between swallowing and expulsion which can be altered.

Escape extinction procedures are effective in decreasing mealtime problem behavior. However, they may not be a viable option if there is a potential for a severe extinction burst. Also, these procedures are intrusive and may not be socially acceptable for children in an inclusive environment. For these individuals positive reinforcement based approaches may be more acceptable.

Positive Reinforcement. Positive reinforcement is often the first intervention used in treating food refusal. For some individuals, the reinforcement is sufficient to increase food acceptance, but for others it must be combined with other function-based approaches. Effective multicomponent treatments have included differential reinforcement of alternative behavior (DRA) plus response cost, positive reinforcement plus physical guidance, and positive reinforcement plus nonremoval of the spoon.

Kahng, Tarbox, and Wilke (2001) used DRA and response cost to increase food acceptance. At the start of each session, the participant was given several preferred toy items. These items were removed contingent on food refusal (response cost) and were represented contingent on food acceptance (DRA). The participant could still escape the bite presented by emitting problem behavior; thus, extinction was not included as a treatment component. Therefore, this reinforcement-based treatment package may be a viable option if an extinction burst is a potential.

Combining an escape contingency with a token economy combines conditioned positive reinforcement with negative reinforcement in the form of escape from the meal. Kahng, Boscoe, and Byrne (2003) used this treatment package to increase the number of bites as well as variety of food consumed after physical guidance failed to do so. In the procedure, a token was delivered initially for each bite consumed; these tokens were then traded for meal termination. Over time, the number of tokens need for meal termination was increased. However, physical guidance for food refusal was continued throughout the experiment. This procedure addresses the function of the behavior, which increases the probability of success, while potentially providing an alternative to escape extinction (Iwata et al., 1994).

Antecendent Interventions. The studies discussed thus far used consequent-based interventions. However, much research has been dedicated to antecedent interventions as well. Mueller et al. (2004) conducted a study based on blending preferred and non-preferred foods, also known as simultaneous presentation. For 2 participants one preferred food and four nonpreferred foods were initially identified based on percent acceptance. The experimenters then blended the non-preferred with the preferred based on percent acceptance. Over time the ratio of preferred to non-preferred food was gradually increased. It is important to note that differential reinforcement and nonremoval of the spoon were in place throughout the entire study for one participant, and noncontingent reinforcement and nonremoval of the spoon were in place for the other participant. Results indicated that after the session with blended food, participants consumed the initially non-preferred food independent of the preferred. One possible explanation for these results is that the preferred food acted like an abolishing operation, decreasing the aversiveness of the non-preferred food. Another explanation is that flavor-flavor conditioning occurred through simultaneous presentation. According to this theory, when a novel flavor is paired with a preferred flavor the novel flavor becomes more preferred in the future.

Piazza et al. (2002) compared simultaneous and sequential presentation of preferred and non-preferred foods. In simultaneous presentation, the preferred and non-preferred foods were presented at the same time and in sequential presentation conditions acceptance of the non-preferred resulted in presentation of the preferred. Three children with feeding problems participated. Simultaneous presentation was more effective for all 3 participants. One explanation that the authors offer for why sequential presentation was not effective in the study is that if initial acceptance rates are near zero the participant may never have an opportunity to

contact the contingency. Another explanation is that the preferred food may not be potent enough to combat the motivation to escape from the non-preferred food. Kern and Marder (1996) conducted a similar study with 1 participant using the term delayed reinforcement rather than sequential. They also found simultaneous presentation to be more effective, claiming that masking may have been in effect. Masking refers to the loss of stimulus control resulting from simultaneous presentation of multiple discriminative stimuli. Thus, the S+ (preferred food) masks the discriminative properties of the S- (non-preferred food).

Munk and Repp (1994) adapted the typical functional analysis procedure reported by Iwata, Dorsey, Slifer, Bauman and Richman (1982/1994) to examine food acceptance across different types and textures. This type of analysis provides more detailed information on why an individual refuses food. Five individuals with severe or profound mental retardation were presented 10 to 12 different types of food with varying textures. All the foods presented in a meal had the same texture. If the participant ate some foods at the given texture while rejecting others, type selectivity was indicated. If the participant accepted a type of food with the initial texture and then in subsequent sessions rejected this food at a coarser texture, texture selectivity was indicated. Results indicated that the variables of type and texture greatly influenced acceptance across individuals.

Patel et al. (2002) used the functional analysis model described by Munk and Repp (1994) to identify type and texture selectivity as a possible cause of feeding difficulties for a 3 year old girl. They then implemented treatment based on their findings. Noncontingent reinforcement, physical guidance, and repeated presentation were all used in conjunction with the antecedent manipulations. Based on their analysis they presented meats only at 100% pure and other foods remained at 50% puree 50% wet ground. Results indicated that by reducing the texture of meats

only, acceptance increased and expulsions decreased. The finer texture may have served as an establishing operation, decreasing the aversive properties of the meat as well as decreasing the response effort involved in consuming the meat.

Shore et al. (1998) applied texture fading in conjunction with positive reinforcement for swallowing and extinction for refusal and expulsions. Gagging was a potential danger for all the children involved and therefore texture was seen as a possible issue in their feeding problems. The pace of texture fading as well as the amount of food consumed was unique to each child. Although this study does not demonstrate which component was necessary in treatment, the texture fading was essential in maintaining low levels of gagging while increasing amount consumed. The function of food refusal was also not examined. The authors offer a few possibilities, the first of which is a conditioned aversion due to physiological disorders. In addition, if the child had never progressed past pureed foods they may not have had the opportunity to develop the skills necessary to consume higher texture foods.

The amount of food presented is another variable which affects mealtime problem behavior. Kerwin, Ahearn, Eicher, and Burd (1995) examined this variable through the perspective of behavior economics. Behavioral economics theory states that refusal occurs when the response effort or cost exceeds the value of reinforcement of accepting the food. There are several variables responsible for increasing the response cost of food consumption, including, gastrointestinal distress, lack of oral motor skills, large amounts of food, and course texture. Kerwin et al. manipulated these variables with children who chronically refused food. The variable examined in the first experiment was the amount of food presented on a spoon which ranged from empty, dipped, quarter, half, and level. The pay-off of toys and social interaction was kept constant despite the amount of food presented.

Each child's responding demonstrated a functional relationship between the number of bites accepted and the amount of food presented, defined as a demand function. That is, as the amount of food presented increased the number of bites accepted decreased. In the second experiment physical guidance or nonremoval of the spoon was applied as treatment to maintain acceptance while increasing cost. Treatment was effective, indicating that the escape extinction procedures altered the elasticity of the demand functions. In this case demand elasticity refers to the extent that acceptance is influenced by spoon volume. The escape extinction procedures altered each child's demand function to relative inelasticity. Therefore, acceptance remained high despite increases in spoon volume. The implications for treatment are to start initially at the cross point where response effort is low enough that acceptance will occur.

The majority of published research addressing feeding problems combines these antecedent manipulations and positive reinforcement with escape extinction procedures. It is therefore unclear whether their success can be attributed to the antecedent manipulations alone or the antecedent manipulation plus physical guidance or nonremoval of the spoon. The purpose of the current study was to increase the variety of food consumed by applying three non-aversive procedures in separate studies.

General Method

Participant

Zack was a 6-year-old boy who attended a day school for children with autism spectrum disorders. He communicated in 3-5 word sentences and demonstrated the ability to request needed or desired items. He was selected for this study because his food choices were highly selective, and his nutritional intake had little value, which posed a variety of potential health risks. As a result, Zack's individualized education plan contained the goal to increase the variety of foods he consumed. Zack could feed himself; however, he packed his food in his mouth and would hold bites of food there for extended periods of time. Although Zack had a history of extended periods of non-compliance; he was expected to transition to a general education setting in the near future. For these reasons, in conjunction with his age appropriate weight at the time of the study, an intrusive escape extinction procedure was not desirable. At the time of the study, Zack's mealtime guidelines included positive reinforcement on a continuous reinforcement (CRF) schedule in the form of preferred edibles or toys contingent on acceptance of rice. At the beginning of the study, he consumed an average of four bites of rice each meal.

Setting and Materials

In Studies 1, 2 and 3, feeding sessions took place in a small partitioned area in Zack's classroom. Maintenance sessions for Study 3 and all sessions for Study 4, were conducted in the school kitchen in which Zack usually ate, with his peers and teachers present. In all sessions, the materials present included two small desks, two chairs, a plastic plate and spoon, Tupperware containers with the appropriate food, and a timer. Descriptions of the food presented are displayed in the Appendix. The plate was on the table throughout the entire session. In Study 2, Tupperware was used instead of typical packaging so that the only difference between the foods was their physical appearance; thus, learning histories associated with certain packaging would not affect the results. During Study 2 Zack's view of the Tupperware containers was blocked with a file folder. All sessions occurred at 10:00 A.M. or 11:30 A.M., before the regularly scheduled snack and lunch times.

Dependent Variable and Response Definition

The dependent variables measured were acceptance, refusal, and negative vocalizations. Acceptance was defined as the participant independently opening his mouth 1.3 cm or wider within 5 s of the food presentation and allowing placement of the food into the mouth. Acceptance was also recorded if the participant initiated food consumption within 5 s and placed food in the mouth within 10 s of food presentation. The participant could use a spoon or his fingers to bring the food to his mouth. Refusal was defined as the participant not opening his mouth within 5 s and/or not allowing placement of the food in the mouth. Negative vocalizations were defined as negative statements that occurred during the presentation of food, such as, "No thanks," "No way," "La," etc. It did not include requests for items other than what was being presented. Negative vocalizations were recorded during Studies 1 and 2.

Measurement Method and IOA

The primary experimenter or another trained therapist recorded data by hand during baseline and treatment sessions. All dependent variables were measured per opportunity. Percent acceptance was the primary measure collected and was calculated by dividing the number of times an item was accepted by the number of times it was presented. Interobserver agreement was calculated by dividing the number of agreements on the occurrence of the behavior by the number of agreements plus disagreements, and multiplying by 100. A second observer independently collected percent acceptance data during 35.7% of Study 1 sessions, 20% of Study 2 sessions, 35% of Study 3 sessions and 29% of Study 4 sessions. Agreement was 100%.

Procedure. Study 1 was a baseline preference assessment in which foods that Zack would consume independent of any programmed consequences were identified. During the assessment, he was exposed to 28 foods including seven fruits, five vegetables, eight protein items, and eight starch items. Each bite of solid food was presented on the spoon, including finger foods, and then placed on the plate so that Zack could feed himself independently. All liquid items were also placed on the spoon; however, the experimenter held the spoon to prevent spilling. Upon presentation of each bite the experimenter stated, "Take a bite." Each bite was presented for 5 s; and after an acceptance or refusal occurred an inter-trial interval of 25 s followed. Four foods were presented in each session. Each food was offered in a randomized order 5 times, as a result, each session included 20 bites of food.

Results and Discussion. Figure 1 displays the results for Study 1. The participant accepted 9 of the 28 foods. The food items with 100% acceptance were identified as preferred and items with 50% or less acceptance were identified as non-preferred. The four highly preferred foods were sour cream and onion Pringles, plain milk, strawberry flavored milk, and orange juice. Percent acceptance was not consistent across type or texture of foods. For example, despite liquids accounting for three of the four highly preferred items, Zack demonstrated no preference for other liquids presented, such as laban and mixed fruit juice. However, none of the food he accepted required chewing either immediately or after being held in the mouth for a period of time. For this reason, low-texture foods were introduced initially. Strawberry flavored milk and plain milk were selected as the preferred foods (P) in Study 2 and plain yogurt was selected as the non-preferred (NP). In Study 3, Pringles were chosen as P and white rice and banana were selected as NP. The first set of NP foods in Study 4 included sliced white processed cheese,

banana, red apple with no skin and plain yogurt. The second set included chicken, pineapple flavored yogurt, cucumber with no skin and orange. White rice was presented during all Study 4 lunch sessions since consumption of white rice was established in Study 3.

Study 2

Procedure. The purpose of Study 2 was to increase food consumption by applying a procedure in which the effects of an aversive stimulus; that is, the NP food, were minimized by modifying the properties of the aversive stimulus. The initial NP food presentations were at a low intensity, frequency, and discriminability. Sessions were similar to baseline except that only three foods were presented, one NP and two P foods. The experimenter presented each bite without giving any verbal direction. The inter-trial interval was reduced to 5 s, which still allowed ample time for Zack to swallow because the foods were not solid and did not require chewing. There were no programmed consequences for either food acceptance or refusal. The ratio of P to NP and food volume increased over 48 steps. There were 20 programmed bites per session until Session 6 when the first refusal terminated the session. Only one property was changed at each step, either ratio of P and NP, or food volume. Criterion to increase a step was 100% acceptance of NP across three consecutive sessions. Criterion to decrease a step was one session with 0% acceptance of NP.

Results and Discussion. Figure 2 displays the results for Study 2. Negative vocalizations occurred during the presentation of yogurt in Sessions 2 and 5. At Step 1, yogurt was presented at dip food volume (the tip of the spoon was coated in yogurt), for 10% of presentations; it was a similar color (white) and texture as the preferred items of milk and strawberry flavored milk. The participant never met criterion to increase steps, so all sessions were conducted at Step 1. In Session 2, the participant accepted half of the yogurt bites presented, and in Sessions 3 and 4 he

accepted 100% of the yogurt bites presented. However, from Session 5-10 he did not accept any yogurt. No variable was manipulated between Session 4 and 5 so it was unclear why refusal began. Sessions were terminated contingent upon the first refusal starting at Session 6 so the preferred edibles were not accessed. This procedural change may also serve as a limitation to this study because refusal terminated the session. If escape or avoidance of food presentation was maintaining behavior session termination could potentially reinforce refusal. After 10 sessions, the procedure was discontinued based on the hypothesis that food refusal was not due to a specific food aversion.

Study 3

Procedure. Study 3 treatment sessions applied a multi-component treatment package to increase the variety of food consumed that included positive reinforcement and stimulus fading. P was delivered contingent on acceptance of NP. P was ¼ of a Pringle chip presented on the plate. NP was white rice presented on the spoon, at the prescribed food volume, which was then placed on the plate. The ratio of reinforcement was gradually thinned based on percent acceptance. The initial schedule of reinforcement was CRF, which was gradually thinned to a VR4. The amount of food on each presentation and the number of bites presented were all gradually increased based on percent acceptance. The food amount increased from ¼ to ½ spoonful. The initial number of bites was determined from the average number of bites Zack consumed in a typical pre-intervention meal prior and increased to the average number of bites classroom peers consumed.

The variables of schedule of reinforcement, amount of food presented, and number of bites presented were manipulated over 12 steps. Only one property was thinned or increased at each step. The terminal criterion for NP food was set at 20 bites at ½ spoonful on a VR4 schedule of

reinforcement. All sessions for the first NP food, white rice, were run at 11:30 A.M. Once the first NP food met the terminal criterion maintenance sessions were run at 11:30 A.M. in the kitchen at the school. At this time a second NP food, banana, was introduced at 10:00 A.M. in the partitioned area in the classroom. Criterion to increase a step was initially two consecutive sessions with at least 90% acceptance, but this was changed to one session with 90% acceptance at Session 19 due to steady levels of responding. Criterion to decrease a step was one session with less than 50% acceptance.

Results and Discussion. The results for Study 3 are displayed in Figure 3. White rice was the first non-preferred food introduced. Probability of reinforcement started at 1.0 (continuous) and was thinned to 0.25 (VR4); similarly, bites increased from 4 to 20. Throughout these initial treatment sessions, food acceptance remained at 100%. The food level increased from 1/4 to 1/2 spoonful at Session 3. The phase change line at Session 17 indicates the move to the natural environment once mastery criterion was met. All subsequent white rice sessions were run at 11:30 a.m. in the natural environment. At this time, banana was introduced as the second nonpreferred food. All banana sessions were run at 10:00a.m. in the partitioned area in the classroom. Percent acceptance decreased for both foods at Session 18. The number of bites presented was decreased and denser reinforcement was provided for white rice acceptance. At session 21, Coke was also provided in addition to Pringles as a preferred edible, to address satiation effects. After these changes were made, food acceptance increased to 100% of presentations for both foods until Session 37. The criterion to decrease steps was followed for banana, and the independent variables were manipulated accordingly. To increase the probability of acceptance, presentations of white rice returned to Step 1 of the program and edibles were eliminated from Zack's reinforcement program during his school day, with the

exception of meal sessions. In addition, the variety of preferred edibles offered as potential reinforcers during sessions was expanded. Despite these changes, acceptance never recovered to previous levels.

Results from Study 3 indicate that the reinforcement provided was not potent enough to compete with the escape contingency. However, there are several limitations to this study. Fading may have occurred too quickly or dramatically. In addition, the variables manipulated may be irrelevant. If a different variable was manipulated, such as the temperature of the food presented, this procedure may have been more successful.

The procedure was initially successful, but percent acceptance could not be maintained. Once one error (refusal) was made, errors became more probable in the future. This indicates that once the escape contingency was contacted, it was more effective than the reinforcement provided for consumption. Therefore, it was hypothesized that escape from the meal environment was a more powerful reinforcer than access to preferred edible items.

Study 4

Procedure. The procedure implemented in Study 4 was an escape contingency combined with a token economy. This package combined negative reinforcement in the form of escape from the meal environment with conditioned reinforcement in the form of tokens. Each session lasted 30 min since that was the time allotted for meals during the school day. One token was delivered for each bite of food consumed. Once the required number of tokens was earned, Zack could leave the meal environment and engage in an activity of his choice for the remainder of the 30 min session. This was done to ensure that the escape environment was more preferred than the feeding environment. A picture board of available activities was visible during all sessions.

For every bite presentation during snack sessions 4 NP foods were presented. Each NP food was presented on a spoon and placed on a separate plate in front of Zack All bites were presented at ½ spoonful. While a bite was being consumed all plates remained present and the consumed bite was replaced. White rice was presented during lunch sessions since its acceptance had already been demonstrated in Study 3. A plate of white rice was presented with a ½ spoonful bite prepared. All requests for previously NP foods were granted during lunch sessions. Once a previously NP food was requested and consumed, it was presented in subsequent lunch sessions at ½ spoonful directly on a plate. A session began when all food choices were presented on spoons placed on plates for snack sessions, or directly on the plate for lunch sessions, in front of Zack and he was seated in his chair.

At the start of the session, the experimenter stated, "If you earn all your tokens for eating your food snack/lunch is all done and you can have Zack's choice." He was given 10 s to choose from the array of NP food or white rice. If he did not choose within 10 s, the experimenter used a light touch shadow prompt to have him choose. If this was unsuccessful, the experimenter recorded a refusal and removed the plates; the food was represented every 30 s. If he refused all presentations during the 30 min session, the session ended and he resumed his normally scheduled activity. If he chose and consumed the bite, a token was delivered and the consumed bite replaced. The experimenter also stated, "Nice job eating your bite, you earned a token." The verbal prompt, "You need to swallow your bite" was given every 30 s until a clean mouth was demonstrated. Clean mouth was defined as food less than the size of a pea in the participant's mouth. The criterion to increase the number of bites required to escape a meal was two consecutive sessions with 100% acceptance, and criterion to decrease was one session with less than 50% acceptance. The terminal criterion was set at 10 bites for snack and 15 bites for

lunch. For snack sessions, the initial number of bites was 1 and increased to 2, 4, 6, and 10 once criterion was met. For lunch sessions, the initial number of bites was 4 and increased to 6, 10, and 15 once criterion was met. Once a set of NP food reached the terminal criterion, a new set of four NP foods were introduced at Step 1 during snack sessions.

Results and Discussion. The first set of NP foods introduced during snack sessions included banana, plain yogurt, red apple with no skin and white sliced cheese. Zack chose cheese upon every presentation and had 100% acceptance across increasing response requirements. Once the terminal criterion of 10 bites was reached a second set of NP foods was introduced. The second set of NP foods introduced included pineapple flavored yogurt, chicken nugget, cucumber and orange. During the first session of the second set Zack did not accept any of the bite presentations. This was the first and only time during the program that he did not earn all the tokens to escape the meal environment. After this initial session he had 100% acceptance across increasing response requirements, from 1 to 10 bites consumed to escape the meal environment. He also consumed each of the foods presented more than once.

Acceptance was 100% during all lunch sessions while the response requirement increased from 4 to 15 bites. Zack was initially presented with white rice since consumption had been established in Study 3. Throughout the remainder of the sessions, Zack also consumed cheese, bread, pineapple yogurt, chicken, cucumber, orange, tomato, apple, banana, plain yogurt, cracker, pretzel, popcorn and celery. These items were either visible in the natural environment in the catered or staff meal, Zack independently retrieved them from the refrigerator, or he brought them in from home. Once requested and consumed these items were presented in subsequent sessions.

Results from Study 4 demonstrate that an escape contingency and token economy effectively established consumption of 15 previously NP foods. Results from the previous studies suggest that the negative and positive reinforcement components may have been necessary to establish acceptance. It also appears that after an initial acceptance exposure effects influenced motivating operations, making the previously non-preferred food either less aversive or more reinforcing. This is evident in the independent requests of previously non-preferred foods during lunch sessions. Also, during 3 sessions Zack continued to consume the previously non-preferred food after all the required tokens had been earned. This shows a shift in preference from escape to the edible item.

The opportunity for choice may also have affected motivating operations. Choice was not possible in the previous studies due to the stimulus fading components and is therefore another advantage to the escape contingency and token economy procedure. Previous studies have demonstrated that choice among non-preferred activities is more preferred than no choice (Schmidt, Hanley & Layer, 2009). Results from this study support this hypothesis with edible items as well.

There are several potential limitations to this study. It is unclear if the conditioned reinforcement in the form of tokens was necessary. A component analysis would further clarify the role of tokens in the escape contingency. It is also unclear whether the contingency was effective because it resulted in escape from the meal environment or avoidance of additional food items. However, results suggest that a negative reinforcement based intervention was effective.

General Discussion

For this participant, a procedure to reverse the effects of an aversive stimulus and positive reinforcement combined with stimulus fading were not effective in increasing the variety of food consumed. However, an escape contingency combined with a token economy was effective. Fifteen previously NP foods that were not accepted during a baseline assessment were consumed during the escape contingency procedure. These results suggest that the participant's mealtime problem behavior was sensitive to negative reinforcement contingencies and that an escape contingency and token economy can be an effective intervention to increase the variety of food consumed independent of escape extinction procedures. Results from the current study support previous findings that a function based intervention may be more successful than reinforcement alone (Iwata et al., 1994).

This study extends previous research on mealtime problem behavior by demonstrating the effectiveness of an escape contingency and token economy in the absence of escape extinction. The study by Kahng et al. (2003) combined the escape contingency with physical guidance for food refusal. Results from the current study indicate that positive reinforcement and stimulus fading were not effective in the absence of escape extinction. Previous research has demonstrated success with these procedures combined with escape extinction for refusal (Freeman & Piazza, 1998; Coe et al.1997). Therefore, applying an escape contingency may be a more suitable treatment option for individuals with the potential for a severe extinction burst or in settings where an intrusive treatment may not be desirable.

The escape contingency procedure had some other benefits as well. It was less time consuming to implement than the stimulus fading procedure. The variety of foods consumed was increased at a more rapid pace because the food delivered was not preselected by the experimenter; the participant was able to choose what food to consume. This would be impossible in the stimulus fading procedure where one aspect of the food delivery had to be gradually changed over a period of time. This may have also worked as an abolishing operation, decreasing the aversiveness of the non-preferred food, or as an establishing operation increasing the reinforcing properties of the previously non-preferred food. In addition, the opportunity for choice may have helped to accommodate changing preferences. The decline in acceptance during Study 3 may be due to satiation since the same two NP foods were presented over 75 sessions.

There are several limitations to the current study. Firstly, the procedures were implemented with only one participant. This limits the generality of the findings. Secondly, the variable maintaining the behavior was not empirically demonstrated prior to the implementation of treatment. Also, it is unclear how the token economy affected responding since a component analysis was not implemented. The token economy was likely effective because conditioned reinforcement serves to bridge the gap between response and primary reinforcement (escape). It is also easy to implement in the natural environment and does not disrupt the behavior chain in the same way as edibles or toy items (Kazdin & Bootzin, 1972). It is not clear however if the token economy was essential to the treatment package. During three sessions Zack chose to consume more bites after earning the required number of tokens. This implies that the previously NP food had acquired reinforcing properties possibly through exposure or pairing with the tokens.

Other possible limitations include flaws in the programming. The stimulus fading components may have been altered too quickly or dramatically in Study 3. In addition, the properties manipulated may have been irrelevant. There were several food properties not addressed in the study, such as, temperature, color, and texture. Therefore, positive reinforcement and stimulus fading cannot be ruled out as a potential intervention.

Future studies should examine the role of tokens when combined with an escape contingency through a component analysis. The role of choice among NP food items with participants who exhibit mealtime problem behavior should also be examined further. In addition, the current study should be replicated with more participants in order to increase the generality of the findings.

Results indicate that an escape contingency and token economy applied in isolation was an effective treatment for mealtime problem behavior. This is an extension from the work conducted by Kahng et al. (2003). The treatment package provided a less intrusive function based intervention than escape extinction procedures commonly applied in treatment settings. Future research should work towards identifying what specific variables account for its effectiveness.

References

- Ahearn, W.H., Kerwin, M.E., Eicher, P.S., Shantz, J., & Swearingin, W. (1996). An alternating treatments comparison of two intensive interventions for food refusal. Journal of Applied Behavior Analysis, 29, 321-332.
- Bachmeyer, M.H., Piazza, C.C., Fredrick, L.D., Reed, G.K., Rivas, K.D., & Kadey, H.J. (2009) Functional analysis and treatment of multiply controlled inappropriate mealtime behavior. Journal of Applied Behavior Analysis, 42, 641-658.
- Borrero, C.S.W., Woods, J.N., Borrero, J.C., Masler, E.A., & Lesser, A.D. (2010). Descriptive analyses of pediatric food refusal and acceptance. Journal of Applied Behavior Analysis, *43*, 71-88.
- Coe, D.A., Babbit, R.L., Williams, K.E., Hajimihalis, C., Snyder, A.M., Ballard, C., & Efron, L.A. (1997). Use of extinction and reinforcement to increase food consumption and reduce expulsion. Journal of Applied Behavior Analysis, 30, 581-583.
- Cooper, L.J., Wacker, D.P., McComas, J.J., Brown, K., Peck, S.M., Richman, D., Drew, J., Frishmeyer, P., & Millard, T. (1995). Use of component analyses to identify active variables in treatment packages for children with feeding disorders. Journal of Applied Behavior Analyses, 28,139-153.
- Freeman, K.A., & Piazza, C.C. (1998). Combining stimulus fading, reinforcement, and extinction to treat food refusal. Journal of Applied Behavior Analysis, 31,691-694.
- Iwata, B.A. (1987). Negative reinforcement in applied behavior analysis: an emerging technology. Journal of Applied Behavior Analysis, 20, 361-378.
- Iwata, B. A., Dorsey, M. F., Slifer, K. J., Bauman, K. E., & Richman, G. S. (1994). Toward a functional analysis of self-injury. Journal of Applied Behavior Analysis, 27, 197-209. (Reprinted from Analysis and Intervention in Developmental Disabilities, 2, 3-20, 1982)

- Iwata, B.A., Pace, G.M., Dorsey, M.F., Zarcone, J.R., Vollmer, T.R., & Smith, R.G., (1994). The functions of self-injurious behavior: An experimental-epidemiological analysis. Journal of Applied Behavior Analysis, 27, 215-240.
- Kahng, S.W., Boscoe, J.H., & Byrne, S. (2003) The use of an escape contingency and a token economy to increase food acceptance. Journal of Applied Behavior Analysis, 36, 349-353.
- Kahng, S.W., Tarbox, J., & Wilke, A.E. (2001). Use of a multicomponent treatment for food refusal. Journal of Applied Behavior Analysis, 34, 93-96.
- Kazdin, A. E., & Bootzin, R. B. (1972). The token economy: An evaluative review. *Journal of Applied Behavior Analysis*, 5, 343-372.
- Kern, L. & Marder, T.J. (1996). A comparison of simultaneous and delayed reinforcement as treatments for food selectivity. Journal of Applied Behavior Analysis, 29, 243-246.
- Kerwin, M.E., Ahearn, W.H., Eicher, P.S., & Burd, D.M. (1995). The costs of eating: a behavioral economic analysis of food refusal. Journal of Applied Behavior Analysis, 28, 245-260.
- Lerman, D.C., & Vorndran, C.M. (2002). On the status of knowledge for using punishment: implications for treating behavior disorders. Journal of Applied Behavior Analysis, 35, 431-464.
- Mueller, M.M., Piazza, C.C., Patel, M.R., Kelley, M.E., & Pruett, A. (2004) Increasing variety of foods consumed by blending nonpreferred foods into preferred foods. Journal of Applied Behavior Analysis, 37,159-170.
- Munk, D.D., & Repp, A.C. (1994). Behavioral assessment of feeding problems of individuals with severe disabilities. Journal of Applied Behavior Analysis, 27, 241-250.

- Palmer, S., & Horn, S. (1978). Feeding problems in children. In S.Palmer, & S. Ekvall (Eds.), Pediatric nutrition in developmental disorders (pp.107-128). Springfield, IL; Charles C Thomas.
- Patel, M.R., Piazza, C.C., Santana, C.M., & Volkert, V.M. (2002). An evaluation of food type and texture in the treatment of a feeding problem. Journal of Applied Behavior Analysis, *35*, 183-186.
- Piazza, C.C., Patel, M.R., Santana, C.M., Goh, H., Delia, M.D., & Lancaster, B.M. (2002). An evaluation of simultaneous and sequential presentation of preferred and nonpreferred food to treat food selectivity. Journal of Applied Behavior Analysis, 35,259-270.
- Riordan, M.M., Iwata, B.A., Finney, J.W., Wohl, M.K., & Stanley, A.E. (1984). Behavioral assessment and treatment of chronic food refusal in handicapped children. Journal of Applied Behavior Analysis, 17, 327-341.
- Schmidt, A.C., Hanley, G.P., Layer, S.A. (2009). A further analysis of the value of choice: controlling for illusory discriminative stimuli and evaluating the effects of less preferred items. Journal of Applied Behavior Analysis, 42. 711-716.
- Shore, B.A., Babbit, R.L., Williams, K.E., Coe, D.A., & Snyder, A. (1998) Use of texture fading in the treatment of food selectivity. Journal of Applied Behavior Analysis, 31, 621-633.

Appendix

FOOD

FOOD	PROPERTIES
Pringles	Yellow, room temperature, crunchy, sour cream and onion flavored
Strawberry flavored milk	White, removed from refrigerator and used within 5 minutes, liquid
Milk	White, removed from refrigerator and used within 5 minutes, liquid
Orange juice	Orange, removed from refrigerator and used within 5 minutes, liquid
Bread – white roll	White, room temperature, ½ spoonful torn from loaf
Mixed fruit juice	Orange, removed from refrigerator and used within 5 minutes, liquid
Laban	White, removed from refrigerator and used within 5 minutes, thick
	liquid
Plain yogurt	White, removed from refrigerator and used within 5 minutes, creamy
Cheese	White, removed from refrigerator and used within 5 minutes,
	presliced in package
Cauliflower	White, room temperature, cooked
Fried fish	White, room temperature, all breading removed
Apple	White, removed from refrigerator and used within 5 minutes, all red
	skin removed, crunchy
Pineapple flavored yogurt	White with yellow pineapple pieces, removed from refrigerator and
	used within 5 minutes, creamy
Banana	Yellow, removed from refrigerator and used within 5 minutes, sliced
	along the width
Bread – Arabic	Tan, room temperature, ½ spoonful torn from flat circular piece
Orange	Orange, removed from refrigerator and used within 5 minutes, one
	slice removed and cut along the width
Cucumber	Light green, removed from refrigerator and used within 5 minutes,
	sliced along the width and skin cut off
Tomato	Red, removed from refrigerator and used within 5 minutes, ½
	spoonful cut from whole tomato
Cupcake	Yellow, room temperature, no frosting
Pretzel	Brown, room temperature, rod shaped
Cracker	Tan, room temperature, ½ spoonful broken from whole circular
	cracker
Pear baby food	Tan, removed from refrigerator and used within 5 minutes
Mixed vegetable baby food	Brown, removed from refrigerator and used within 5 minutes
Dragonfruit	White with small black spots, removed from refrigerator and used
	within 5 minutes, soft
Celery	Light green, removed from refrigerator and used within 5 minutes,
21.1	crunchy
Chicken	Tan, nugget microwaved from package and cooled to room
	temperature, piece cut into ½ spoonfuls
Popcorn	White, room temperature, microwaved, light butter
White rice	White, room temperature

Figure Captions

Figure 1. Percent acceptance and negative vocalizations for the baseline preference assessment conducted in Study 1.

Figure 2. Percent acceptance of preferred (milk and strawberry milk) and non-preferred (yogurt) food during Study 2.

Figure 3. Percent acceptance, number of programmed bites and probability of reinforcement during Study 3. The probability of reinforcement is multiplied by 10 for display purposes. The phase change line denotes the change to maintenance sessions in the kitchen for white rice. The arrow denotes the change from ¼ spoonful to ½ spoonful.

Figure 4. Percent acceptance, number of programmed bites, meal duration and cumulative number of foods consumed across snack and lunch sessions for Study 4

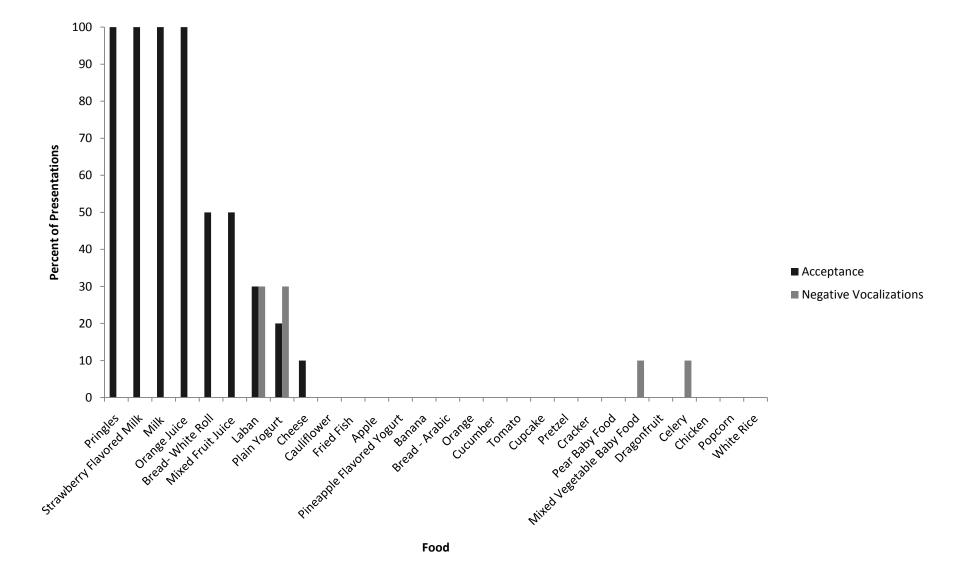
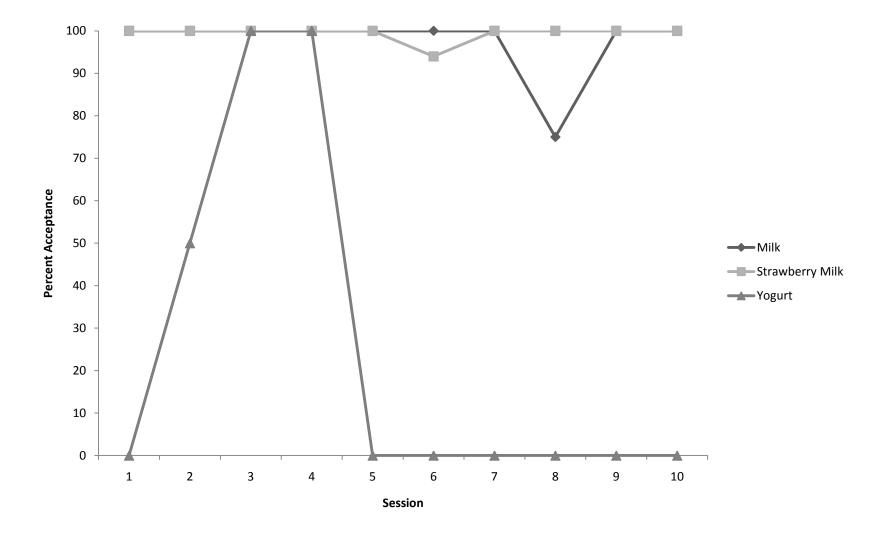
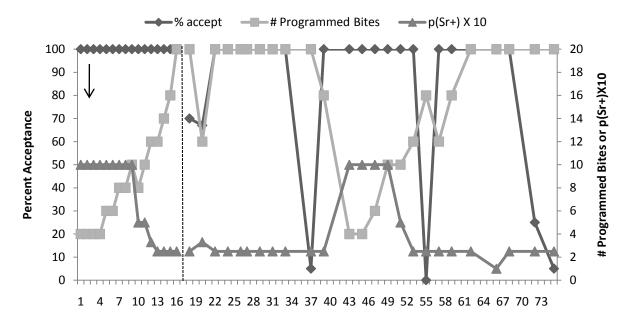


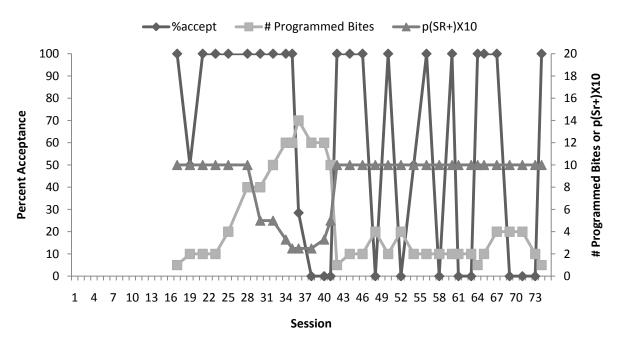
Figure 1



White Rice



Banana



Snack

