

THE EFFECT OF SIMULTANEOUS PRESENTATION OF PREFERRED
AND NON-PREFERRED FOODS, AND FADING OF PREFERRED FOODS
ON ACCEPTANCE OF NON-PREFERRED FOODS BY CHILDREN WITH
FOOD SELECTIVITY

by

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Abstract

THE EFFECT OF SIMULTANEOUS PRESENTATION OF PREFERRED AND NON-PREFERRED FOODS, AND FADING OF PREFERRED FOODS ON ACCEPTANCE OF NON-PREFERRED FOODS BY CHILDREN WITH FOOD SELECTIVITY

by

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The effects of simultaneous presentation and fading on acceptance of food placed at the participant's mouth, independently eating foods placed on the table, and selection and eating the target foods in a choice situation were examined using a within-subject multiple-baseline design across edible items. Target foods were identified by conducting a preference assessment (Fisher, Piazza, Bowman, Hagopian, Owens, & Slevin, 1992) with each participant, using foods that the parents and/or teacher reported each child did not eat. During the baseline phase, target foods were presented by themselves. During each treatment session, a preferred food item (identified via observation and teacher report) was presented simultaneously in a single bite, with the target food, and systematically faded. During fading, the amount of the preferred food in each bite was systematically decreased while the amount of the target food remained the same. Under this procedure, the ratio of the preferred-to-target food was systematically changed by volume, until a participant accepted two consecutive bites of the target food

alone. During baseline and treatment phases, all instances of eating target or other non-preferred foods, either presented alone or in combination with a preferred food, were reinforced. Results indicated that the simultaneous presentation and fading procedure resulted in an increase in each participant's acceptance of non-preferred foods. It also resulted in an increase of independent eating of the non-preferred target foods, and selection of some of the targeted foods on the food-selection trials for all three participants.

Dedication

This project is dedicated to my husband, Alan Shamoun, and my children, Jordan and Jackson. Without their love and support, this work would not have been possible.

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First, I would like to thank my research mentor, Dr. Nancy Hemmes, who provided me with valuable guidance, encouragement, and enthusiasm along the way. Dr. Hemmes once made a statement to me that I will always remember, remarking that “research is a privilege, not a right,” which leads me to my next acknowledgment. I would like to thank the children who participated in this study, along with their families and the classroom staff. I truly enjoyed working on this project and believe that I was very fortunate to have such dedicated family members and school-based staff working with me. I am very thankful for the useful feedback and support of my committee members, Dr. Bruce Brown and Dr. Robert Lanson, as well as that of my outside readers, Dr. Bridget Taylor, and Dr. William Ahearn. Dr. Mari Watanabe-Rose, my best friend and role model, thank you for being one of my biggest cheerleaders and reviewing various portions of this work, providing me with valuable feedback along the way. Michelle Garruto and Tricia Moss, your consistent offers of assistance and words of praise were greatly appreciated and were always a source of encouragement. Rina Shamoun, my mother-in-law, thank you for always making yourself available, so I was able to dedicate my time and effort to this project. Last but certainly not least, my parents, Shayne and Doug Blair; I am extremely fortunate to have such supportive and caring parents who have always had only words of encouragement in all of my endeavors. Thank you.

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Introduction

Schreck, Williams, and Smith (2004) reported that approximately 72% of children with autism spectrum disorders (ASD) are characterized as consuming a low quantity and variety of food. If sustained, this low consumption may result in health-related risks if the child fails to eat a sufficient variety of foods (Piazza, Patel, Santana, Goh, Delia, & Lancaster, 2002). Replicating an earlier study by Munk and Repp (1994), Ahearn, Castine, Nault, and Green (2001) used direct-observation procedures to assess feeding patterns based on responses to repeated presentations of food from four food categories (fruit, vegetables, protein, and starch). According to Ahearn et al. (2001), acceptance of food across all of the categories was quite low, with 17 out of 30 participants exhibiting selectivity for food type. The overall level of acceptance was based on a range of 0 to 90 bites of solid foods. In order to analyze the variety of foods accepted by each participant, Ahearn et al. examined the level of acceptance within the food groups as well. *Low* acceptance was defined as 10 or fewer bites accepted within a food group. A *moderate* level of acceptance was defined as 11 to 20 bites accepted in a given food group, and *high* acceptance was 21 to 30 bites accepted. Following these criteria, a participant was categorized as being *highly selective* if s/he exhibited a low, moderate, or high level of acceptance for only one food group. If the participant exhibited acceptance at a high level for one food group, but low for one of two other food groups, the participant was considered *moderately selective*. Participants who accepted foods at a moderate to high level for one food group and at a low level for all other food groups, were categorized as being *mildly selective*.

Schreck et al. (2004) compared eating behaviors of children with autism to those of children without autism, using a standardized questionnaire. A group of 298 children who were not previously diagnosed with autism or PDD and obtained scores of less than 80 on the Gilliam Autism Rating Scale (GARS) (Gilliam, 1995) were compared to a group 138 children who had been diagnosed with autism or pervasive developmental disorder (PDD) and had a GARS score of ≥ 80 . The authors found that the parents of children with autism reported more restricted food repertoires and more general feeding problems (e.g., refusing foods, requiring a specific utensil, eating only low-texture foods, and requiring the food to be presented in a certain manner) for their children than parents of typically developing children. Furthermore, it was noted that the eating behaviors of the families of children with autism did not significantly differ from the families who did not have a child with autism, indicating that the opportunity for eating a wider variety of foods appeared to be about the same for children from both groups.

There is a growing body of literature examining the efficacy of different procedures used to increase acceptance of non-preferred foods: reinforcement for acceptance (Riordan, Iwata, Wohl, & Finney, 1980; Piazza, et al., 2003); reinforcement plus escape prevention (e.g. Piazza et al., 2003); escape prevention (e.g. Piazza et al., 2003); antecedent manipulations such as changing the presentation of the foods (Ahearn, 2003; Tiger & Hanley, 2006; and antecedent manipulations in conjunction with consequence-based manipulations (e.g. Ahearn, Kerwin, Eicher, Shantz, & Swearingin, 1996; Kern & Marder, 1996; Piazza, et al., 2002; Riordan et al., 1980).

One antecedent manipulation that has been used to treat food selectivity is the simultaneous procedure (Kern & Marder, 1996). This procedure involves presenting a

combination of preferred and non-preferred food items in a single bite (Kern & Marder, 1996). A consequence-based method that has been used is the sequential presentation procedure (Riordan et al., 1980), involving presenting a preferred food item contingent on acceptance of a non-preferred (target) food.

Simultaneous and Sequential Presentation

In Kern and Marder (1996), simultaneous and sequential presentation methods were compared in the treatment of food selectivity of a 7-year-old boy diagnosed with Pervasive Developmental Disorder. In both conditions, escape prevention was used in addition to the antecedent manipulations. Escape prevention consisted of the spoon being held at the child's mouth until he accepted the food. The findings indicated that simultaneous presentation plus escape prevention was more efficient at increasing acceptance of non-preferred foods; but after nine sessions, the level of acceptance was similar for the two conditions. A plausible reason for success of both presentation procedures, although slower for the sequential presentation, is that escape prevention was used with both presentation methods and was primarily responsible for the change in acceptance. The use of an escape-prevention procedure results in forced exposure to the non-preferred food item and could have been a determinant of food acceptance.

Piazza et al. (2002) used a multi-element design to examine the effects of the simultaneous and the sequential presentation of food items on food selectivity behavior exhibited by three participants diagnosed with autism or PDD. In the simultaneous condition, the non-preferred food item was either embedded (hidden) within the preferred food item or presented on a spoon at the same time as the preferred food item. In the sequential condition, one piece of a preferred food item was presented

following consumption of one bite of a non-preferred food item. In both conditions, verbal praise was provided for acceptance. The results of this study demonstrated that eating increased for one participant in the sequential condition, but only after acceptance occurred under the simultaneous presentation procedure. Furthermore, the simultaneous presentation method was effective in increasing acceptance in the absence of escape prevention for two participants. One of the three participants did not demonstrate an increase in consumption following sequential or simultaneous presentation methods, so physical guidance was added to treatment. Physical guidance was described as the therapist placing gentle pressure to the mandibular joint and then placing the bite of food into the participant's mouth. Consumption did not increase following physical guidance, so re-presentation was added and acceptance increased. Results of the Piazza et al. (2002) study indicated that the percentage of non-preferred bites consumed during sequential presentation remained at zero for two of the three participants. For these two participants, the percentage of non-preferred bites consumed increased only during simultaneous presentation. For the participant who required additional treatment, consumption of the non-preferred food item increased more quickly using the simultaneous presentation, but after several sessions with 100% consumption using the simultaneous presentation, consumption increased using the sequential presentation.

Ahearn (2003) extended the research conducted by Kern and Marder (1996) as well as Piazza et al. (2002) by examining the effects of simultaneous presentation of preferred and non-preferred food items alone. In this study, a multiple-baseline design across food items was used to examine the effectiveness of the simultaneous

presentation of a condiment with a non-preferred vegetable to increase consumption of vegetables by 14-year-old boy with autism and mild food selectivity. This study demonstrated that the simultaneous presentation of preferred foods (ketchup, barbeque sauce, or salad dressing) and non-preferred foods (carrot, broccoli, or corn) was a successful method of increasing acceptance of the targeted non-preferred foods. This study also employed a return to baseline, in which the non-preferred food items were presented without a condiment, to probe whether acceptance persisted in the absence of the condiment and it did not for this participant. During the return to baseline, the percentage of bites accepted immediately decreased, usually to zero, for all three vegetables.

In a study by Buckley and Newchok (2005), the effects of simultaneous food presentation as well as other treatment options on packing behavior were examined. Packing is defined as the retention of food in the mouth for extended periods of time. A reversal design (ABACBCDAD) was implemented, where A was baseline, B was differential reinforcement plus response cost, C was differential reinforcement plus response cost, plus simultaneous presentation, and D was simultaneous presentation alone. This study was conducted with one 9-year-old girl with autism. The dependent measure was frequency of packed intervals per session and it was measured by conducting mouth checks every 30 minutes. The results of this study indicated that simultaneous presentation alone was a more effective procedure for reducing packing than differential reinforcement plus response cost.

Stimulus Fading Procedures

Stimulus fading procedures, without pairing, have also been used to treat food refusal and food selectivity in children with developmental disabilities. For example, Shore, Babbitt, Williams, Coe, and Snyder (1998) demonstrated the efficacy of texture fading and escape extinction in treating food selectivity in four children diagnosed with feeding disorders. In this study, the texture of the non-preferred foods was the manipulated variable. Texture fading involved systematically increasing the texture of the food in the following sequence: 100% pureed, 100% junior, 100% ground, and 100% chopped fine. The texture was altered only after three consecutive successful sessions (80% or more acceptances) at the current texture. A multiple-baseline across-subjects design was used to evaluate treatment efficacy. Results indicated that the treatment was effective in establishing consumption of higher texture (chopped) food for the four children.

Simultaneous Presentation and Stimulus Fading

Patel, Piazza, Kelly, Ochsner, and Santana (2001) used a simultaneous presentation and fading procedure along with differential reinforcement and escape extinction to increase liquid intake using a preferred liquid (water) with non-preferred liquids (Carnation Instant Breakfast[®] and milk) with one child diagnosed with a severe feeding disorder. The amount of the Carnation Instant Breakfast[®] packet (CIB packet) presented was systematically increased by 5% (of the total packet) initially until there were three consecutive sessions with a clean mouth on 80% of the trials; then the amount of the CIB packet presented was increased to 10%. Differential reinforcement (DRA) of clean mouth and escape prevention (with prompts provided according to a

least-to-most prompt hierarchy) was used throughout the study. Contingent on eating, the participant was given access to a preferred toy for 20 s and praise was provided. If the participant rejected the food, prompts were provided until he accepted the food (escape prevention). The combination of these procedures (stimulus fading, differential reinforcement and escape prevention) resulted in an increase in the percentage of trials with clean mouth and increased acceptance of Carnation Instant Breakfast® in water and then Carnation Instant Breakfast® in milk. In the final phase, the participant accepted milk with Carnation Instant Breakfast® and water with Carnation Instant Breakfast®. The authors remarked that it could not be ascertained from the results whether fading without the differential reinforcement and escape-extinction procedure would have been as effective.

In another study, conducted by Mueller, Piazza, Patel, Kelley, and Pruett (2004), simultaneous presentation and fading along with escape extinction was used to treat food selectivity of two children by blending a preferred food and non-preferred food together. The amount of the preferred food was systematically reduced and the amount of the non-preferred food was systematically increased. The step size was 10% and the criterion for changing the ratio was 75% acceptance and clean mouth for three consecutive sessions. Probes of 100% non-preferred food were also conducted after the three consecutive successful sessions, to determine if further fading was required. After treatment, the participants accepted several foods that were initially rejected.

Tiger and Hanley (2006) used the simultaneous presentation and fading procedure to increase milk consumption. In this study, milk was paired with a preferred item (chocolate syrup) and the amount of the chocolate syrup in the milk was

systematically reduced until the participant accepted the milk in the absence of the chocolate syrup. The pairing procedure consisted of a teacher mixing 5 ml of chocolate syrup (preferred) into 4 oz of milk. The amount of the chocolate syrup was decreased by .2 ml every two meals. This study was conducted with one pre-school child, who was typically developing and not characterized as being highly selective in his food consumption. He was selected for participation because he refused to drink milk. The study took place in the child's classroom, during regularly scheduled mealtimes. This study supported previous findings on the use of a pairing and fading procedure to increase acceptance of a non-preferred liquid. In addition, the child's consumption of milk, without chocolate syrup, increased at home following the treatment.

Overview and Current Study

In many of the studies described above, stimulus pairing procedures (antecedent manipulations) have been used, in addition to escape prevention, response cost, or physical guidance (consequence-based manipulations) to increase acceptance of target foods. The current study was one of the first to use an antecedent manipulation and positive reinforcement without escape prevention. In the current study, a motivation system was used in baseline and treatment for any occurrences of eating. The only manipulated variable in this study was the simultaneous presentation and fading procedure.

The present study was the first to examine the effects of simultaneous presentation and fading on three foods for each participant and on three dependent measures. One dependent variable was food acceptance, which was defined as the participant allowing the experimenter to place a bite at his/her mouth, opening his/her

mouth, allowing the food in his/her mouth beyond the lip line, and not expelling the food prior to the next bite presentation. A second dependent variable was independent eating, which was defined as the participant picking up a bite (either placed directly on the table or on a fork) from the table in front of him/her and placing the food in his/her mouth, and not expelling the food prior to the next bite presentation. The third dependent measure was selection and eating of the target foods when it was presented with another non-preferred food.

The current study also extended the procedure of Ahearn (2003) by combining fading with the pairing procedure to increase vegetable consumption in the absence of the preferred condiment for one child diagnosed with autism and presenting with mild food selectivity. In the current study, the amount of the condiment was systematically decreased until the vegetables and fruit were accepted alone.

Most prior studies on treating food selectivity and food refusal have been conducted in in-patient facilities or out-patient facilities, though a few have been conducted with children with autism in natural settings, such as his/her school or home (Casey, Perrin, Mercial, Lecomte, Milligan, & Walsh-Czekalski, 2008). The current study was conducted in a classroom for two of the participants and in the home of the third participant.

Method

Participants and Inclusion Criteria

Three children diagnosed with autism participated in the study. All of the children presented with food selectivity, ranging from mild (rejecting only vegetables) to severe (rejecting the majority of foods from meat and vegetable food groups or dairy and vegetable food groups). The children ranged in age from 6 years to 7 years of age. The inclusion criterion was rejection of a majority of foods from at least one of the five food groups (meat, dairy, fruit, vegetable, or grain) and parental and teacher-reported difficulties during mealtimes (e.g. pushing foods away, refusal to eat, throwing foods, falling to the floor, crying or whining, spitting food out).

Joey was a 7-year-old boy, diagnosed with autism who presented with a history of rejecting foods and was considered to be severely selective (not accepting any foods from the fruit, vegetable, and dairy food groups). His teacher reported that he ate chicken with rice or rice with bacon every day for lunch and/or dinner and he always rejected novel foods or drinks. His diet consisted of crunchy foods (i.e. chips and popcorn), soda, water, and rice with meat. He did not consume any dairy products or eat any fruits or vegetables in school or at home. He would typically push non-preferred foods away and cry.

Mary was a 6-year-old girl, diagnosed with autism, also presenting with a history of rejecting foods and was considered to be severely selective (not accepting any foods from the vegetable and meat food groups, and only accepting banana from the fruit food group). She presented with some oral-motor difficulties, such as difficulty drinking from a cup without spilling and difficulty using a straw. When presented with new foods, she

would often reject them or occasionally swallow them without chewing. Her mother reported that Mary appeared to have a severe aversion to texture, demonstrated by her refusal to eat meat or vegetables; the only fruit she ate was banana. She would not accept yogurt with any fruit in it. Her diet consisted of pancakes, pizza, yogurt (without fruit), banana, chocolate chip cookies, brownies, chocolate ice cream, popcorn, cheese popcorn, plain crackers, milk, and water. Her mother also reported that Mary “mouthed” a variety of non-edible objects, not necessarily swallowing them. Her teachers stated that she would only eat frozen pizza and refused non-frozen pizza slices. In the presence of novel foods, she would often flop to the floor, throw the foods, or push them away.

The third participant, Jack, was a 7-year-old boy diagnosed with autism, who had a fairly large variety of foods in his repertoire (mildly selective), but he was selected as a candidate for participation in this study owing to rejection of vegetables. His mother reported that she needed to “force feed” him to get him to eat any vegetables. He also often engaged in problem behavior (crying, yelling, and falling to the floor) in the presence of non-preferred foods. A behavior therapist who shadowed him at school stated that when presented with new foods, he would typically spit them or occasionally he would quickly swallow them without chewing.

Setting and Materials

For Joey and Mary, the study took place in their classroom, which was a self-contained class with a small teacher/student ratio in a public elementary school. The sessions were conducted by the author and the generalization sessions were conducted by either a teacher’s assistant with a bachelor’s degree in education or a family member

with no graduate-level education, all of whom were familiar to the participants. A rectangular-shaped desk and chairs for the child and the experimenter were used in every phase of the study. Each session for Joey and Mary was conducted at his/her desk either in a cubicle or in another location in the classroom at their desk, depending on the set up of the classroom. For Jack, the study took place in his home and the sessions were conducted in the kitchen at a rectangular-shaped eating counter with three tall stools.

Data sheets were designed for this study to record each child's food selections on the food-selection trials, acceptance of food placed to the child's mouth, and independent eating of the foods presented (see Appendices A-C). A ruler calibrated in mm was used to prepare the bites and a watch with a second hand was used to count the elapsed seconds during each trial.

Preferred, Target, and Non-Preferred Foods

Prior to pre-training (for Joey and Mary) and baseline (for all participants), three categories of food items were identified for use in the study: *preferred foods*, *target foods*, and *low or non-preferred foods*. *Preferred foods* were identified by means of teacher report and observation. A preferred food was defined as a food item that was frequently consumed by the participant (at school, for Joey and Mary, and at home for Jack). During the treatment procedure, a preferred food was combined with a target food during stimulus pairing and fading trials.

In order to identify target foods and low or non-preferred foods, 8-9 foods were identified based on verbal reports by the teacher and/or parent. Selected foods were from food groups from which the child did not accept foods or food groups the child was

very selective with. These foods were also specifically identified as potential target foods that the child would have regular opportunity to eat at school or at home. Parents' opinions about appropriate target foods were also taken into account. The selected foods (tested foods) were studied under a preference-assessment procedure, using the Fisher et al. (1992) paired-stimulus procedure. During the preference assessments, 8-9 foods were presented, per assessment, for each participant and the assessment was replicated once for each participant.

Data from the preference-assessment procedure were used to identify *target foods* (foods that were rejected on all trials) and *low or non-preferred foods*. A low or non-preferred food was defined as a food that was selected on fewer than 25% of the assessment trials. Foods so identified were used during baseline and treatment sessions on food-selection trials when they were presented on the table next to a target food.

Table 1 shows the foods that were tested on the initial preference assessments (tested foods), and the target foods and the non-preferred foods identified for Joey. On the preference assessments, he selected rice cake each time it was presented, so this food was eliminated as a potential target food. His preferred food was Smartfood® popcorn, which was paired with each of the three target foods during treatment.

Table 1. Tested, target, and non-preferred foods used for Joey.

Participant:	Joey	
=====		
<u>Tested</u>	<u>Target</u>	<u>Non-Preferred</u>
Apple	Polly-O® string cheese	Blueberry
Grape	Banana Chip	Whole-wheat cracker
Polly-O® string cheese	Health Valley® fruit bar	Apple
Blueberry		Grape
Banana Chip		
Carrot		
Whole-wheat rice cake		
Health Valley® fruit bar		
Whole-wheat cracker		

Table 2 shows the foods tested on the initial preference assessments, and the target foods and non-preferred foods identified for Mary. The only food selected on the initial preference assessments was rice cake, which was selected on 50% of the trials. This food was eliminated as a potential target food as well as an alternative food for the food-selection trials, as it was selected on more than 25% of the trials. Two different preferred foods were used for Mary in an effort to match the foods according to flavor, texture, and appearance as much as possible, owing to her mother's reporting that Mary demonstrated an aversion to texture as well as observations of Mary "picking her food apart." Mary's preferred foods were Smartfood® popcorn (paired with cheese because of similarity in color and flavor) and Entenmann's little bites® fudge brownies (paired with fruit bar and crackers). The brownie was paired with fruit bar because of their similarity in texture and flavor (sweet) and it was paired with cracker because a preferred food of similar color and texture to cracker could not be identified and brownie was the snack food Mary most often selected and ate during snack time at school. The foods targeted were selected because her mother had reported that she would be pleased if her daughter would eat foods like jam that could be spread on bread and she would like her to eat fruits other than banana, as well as snack foods that Mary's brother ate. She reported that she would typically not eat anything when brought to birthday parties, including cake. An effort was made to start with foods that other children typically eat, such as string cheese and other snack foods. The fruit bar was selected since it had real fruit in it and the outside was a cookie-like texture (which she currently accepted). The whole-wheat crackers were selected because she did not consume any whole-grain foods.

Table 2. Tested, target, and non-preferred foods used for Mary.

Participant:	Mary	
=====		
<u>Tested</u>	<u>Target</u>	<u>Non-Preferred</u>
Beets	Health Valley® fruit bar	Blueberry
Whole-wheat cracker	Polly-O® string cheese	Carrot
Whole-wheat rice cake	Breton® wheat crackers	Apple
Carrot		Grape
Polly-O® string cheese		
Health Valley® fruit bar		
Apple		
Grape		
Blueberry		

Table 3 depicts the tested foods and the target and non-preferred foods identified for Jack. Carrot and pea were selected on more than 25% of the trials, so these foods were eliminated as target foods or alternative foods for the food-selection trials. All steamed vegetables were steamed using a Sunbeam food steamer. The target foods were selected because his mother reported he did not eat vegetables without her “force feeding him.” His mother also selected the target vegetables based on the vegetables that the family consumes most often. The preferred food was Heinz® ketchup.

Table 3. Tested, target, and non-preferred foods used for Jack.

Participant: Jack		
<u>Tested</u>	<u>Target</u>	<u>Non-Preferred</u>
Steamed broccoli	Steamed broccoli	Green pepper
Steamed cauliflower	Steamed cauliflower	Red pepper
Cherry Tomato	Cherry tomato	Steamed zucchini
Carrot		Steamed yellow squash
Pea		
Steamed squash		
Steamed zucchini		
Green pepper		
Red pepper		

Motivation system

A motivation system was used for each participant during all phases of the study to reinforce eating of the target or non-preferred foods. One justification for the use of this system was that children who present with food selectivity are likely to have eating responses reinforced by family members and teachers. All of the participants had a history with this system during discrete trial teaching. The reinforcement schedule for each child was consistent with the schedule of reinforcement used during his/her discrete trial teaching sessions.

For Joey and Mary, the same check system that was used in the classroom during instructional time was used during this procedure. Mary and Joey's check boards were 3" x 5" white laminated cards (Mary's had a picture of Dora® on it and Joey's had a picture of a car on it) with 10 boxes that were 10 mm x 10 mm for the checks to be handwritten in. There was a larger box at the top of the board to place a picture of the preferred item s/he was working for prior to earning any checks. There was a small piece of Velcro in this box for the picture to be placed on. On the back of Mary and Joey's token boards were five pictures of preferred items velcroed for him/her to select prior to earning any checks. Jack's token board was a 8.5" x 3" yellow strip of construction paper that was laminated. There were 10 small (5 mm x 5 mm) pieces of Velcro on the front of his token board where the tokens were placed as he earned them. On the back, there were ten 10 x 10 mm apple tokens to be earned. On the front, "I am working for _____." was written and he would write the preferred item of his choice prior to earning any tokens.

For all three participants, checks or tokens were earned for accepting, independently eating, or selection and eating of any of the foods presented according to the reinforcement schedule that was used during his/her discrete trial teaching objectives. After earning a specified number of checks/tokens (10 for Joey, two for Mary, and five for Jack), s/he was given access to an item selected prior to the eating trials. This contingency was in place during baseline (no pairing of preferred food) and treatment (with pairing and fading of preferred food).

Research Design and Independent Variable

The independent variable (absence versus presence of the simultaneous presentation and fading procedures) was manipulated in a within-subject multiple-baseline design across edible items (target foods) for the three participants. For Joey, the multiple baseline was implemented across cheese, banana chip, and fruit bar. The multiple baseline, for Mary, was implemented across fruit bar, cheese, and cracker. With Jack, treatment was implemented using a multiple-baseline design across broccoli, cauliflower, and tomato. The motivation system was implemented in both baseline and treatment sessions. The criterion for implementation of the treatment phase was data from three consecutive sessions showing neither an increasing nor decreasing trend for the food-acceptance and independent-eating responses across each food.

Dependent Measures

There were three dependent measures (*food acceptance, independent eating, and selection and eating*) in baseline and treatment. Two of these dependent measures (food acceptance and independent eating) were studied under the pairing and fading

procedure and the third dependent measure (selection and eating) was taken only on trials without the pairing and fading procedure.

Food acceptance was defined as the participant allowing the experimenter to place the food in his/her mouth (past his/her lips) within 5 s of presentation and not expelling the food prior to the next trial (20 s later).

Independent eating was defined as the participant picking up the food presented on the table in front of him/her and placing the food in his/her mouth (past his/her lips) within 10 s of presentation, and not expelling the food prior to the next trial.

Selection and eating was defined as the participant picking up and eating one of two concurrently-available foods that were placed on the table, approximately 5 cm apart, after being told “pick one.”

The occurrence or nonoccurrence of each of three dependent variables was recorded on a trial-by-trial basis. A trial started when the food was presented at the participant’s mouth or on the table in front of him or her, and the trial ended after a food was eaten or 5 s elapsed. The data were reported as the percentage of trials in which the target response occurred, divided by the total number of trials.

Definitions and Ordering of Trials

Definitions

Food-acceptance trials consisted of placing each bite of food approximately 12 mm from the participant’s mouth and leaving it there until the participant opened his/her mouth and accepted placement of bite or until 5 s elapsed.

Independent-eating trials involved placing the bite of food on the table in front of the participant, approximately 750 mm from the edge of the table or counter in front of

the participant, and leaving it there until the participant picked it up, pushed it away, threw it, spit it out, or 5 s elapsed.

On *food-selection trials*, a low or non-preferred food (5 mm x 5 mm) was placed on the table next to a target food (5 mm x 5 mm) at a distance of approximately 5 cm, and the participant was told “pick one.” The two foods were placed approximately 750 mm from the edge of the table or counter in front of the participant, and they were left there until the participant either: picked one up, pushed one or both away, threw them, handed them back to the experimenter, spit it out, or 5 seconds elapsed. On these trials, the target food was not paired with a preferred food. The alternative foods presented next to the target foods on the food-selection trials were foods of little or no preference because of the risk that including preferred or highly-preferred foods might displace foods of little or no relative preference (target foods) on the food-selection trials.

Ordering of trials

Each session included six food-acceptance and two independent-eating trials for each target food, presented in two randomized blocks of four trials for a given target food. All trials for a given target food were presented consecutively. On every other session, four food-selection trials were also presented for each target food. These occurred after the six food-acceptance and two independent-eating trials with a particular target food. Each of the four non-preferred foods was presented one time across four food-selection trials per target food. The order in which these four foods were presented with a given target food varied randomly within a session and across sessions.

Procedure

General Procedure

The sessions, lasting approximately 30 minutes, were conducted one time daily about three to five times per week. Several components were in place throughout all phases of the study. For all experimental phases and trial types, food trials were presented approximately every 20 s and the size of the target food was always the same (5 mm x 5 mm). The experimenter sat next to (within .31 m) the participant during all pre-training, baseline, and treatment sessions. Sessions were conducted 30 minutes prior to lunch or dinner and with access to preferred food items prohibited for at least two hours prior to treatment, to eliminate the possible effects of satiation on acceptance of the target foods.

Similar to Patel, Piazza, Layer, Coleman, and Swartzwelder (2005), *table-top activities*, such as puzzles, or paper and crayons were continuously available to the participant during each session. These activities were presented to prevent the need for prompting to keep the child in his/her seat during the session. The participants each had a history of engaging with these activities.

A motivation system was used to reinforce any of the target responses during baseline or treatment. This system consisted of behavior-specific praise (e.g. “great job taking a bite.”) and a token (for Jack) or a *check* (for Joey and Mary) being provided for each occurrence of food acceptance, independent eating, or selection and eating of any food (target or non-target). The motivation system was used during both baseline and treatment sessions to demonstrate that the simultaneous presentation and fading procedure was responsible for the behavior change. Prior to earning any tokens, Jack

would write the name of a preferred food or activity at the top of his token board when given the verbal cue, "what do you want to work for?" For every five tokens earned, he was given access to the preferred item that he wrote on the top of the token board. If Jack accepted a bite, behavior-specific praise was provided and he earned an apple token within 3 seconds of acceptance. Prior to earning any checks, Joey and Mary were asked, "what do you want to work for?" S/he would select an item from the back of his/her check board (2 cm x 2 cm pictures of preferred foods and activities were on the back of the check board) and place the picture of the selected item on the front of the check board. Joey and Mary were each given a check within 3 seconds of accepting a bite. After earning ten checks, Joey was given access to a preferred item that he selected from the back of his check board. If he rejected a bite, the food was removed after 5 s and no feedback was provided. For Mary, after every two checks earned, she was given access to a preferred item that she selected from the back of her check board. The reinforcement schedules for both children were determined based on the reinforcement schedule typically employed during discrete trial teaching in the classroom. If a participant rejected the presented bite, the bite was removed and no feedback was provided.

Generalization Sessions. Generalization sessions were conducted across people. These sessions were conducted with a teacher's assistant for Joey and Mary, and by a family member for Jack. Generalization sessions were conducted in baseline and treatment phases for all participants. The procedures followed during generalization sessions did not differ from those used in the other comparable sessions (baseline and treatment).

Pre-training

Prior to the first experimental phase, two participants (Joey and Mary) received pre-training to ensure that they would accept the preferred foods presented to their mouths. Pre-training was not conducted for the third participant since the preferred food was a condiment that he regularly consumed, and because he had been observed accepting other preferred foods (not used in the study) presented to his mouth prior to the study. Pre-training sessions were conducted at the child's desk where s/he typically completed instructional tasks. During pre-training, the experimenter placed the preferred food at the participant's mouth (within 10 mm of lips), either following a request by the participant or while s/he was engaged in a table-top activity (e.g. stringing beads, matching, completing a puzzle, etc.). Contingent praise and a check or token was provided for acceptance of the preferred food placed at his/her mouth. If the participant rejected the preferred food (defined as the participant pushing the experimenter's hand away from his/her mouth, pushing the food off or away on the table, or spitting the bite out), the food was removed, and no feedback was provided. After two consecutive 5-trial sessions with 100% acceptance (defined as food-acceptance, above) of food placed in the participant's mouth on five consecutive trials per session, baseline began.

Baseline

For each participant, baseline sessions consisted of the presentation of the target foods alone (in 5 mm x 5 mm pieces) under the three different trial types described above. With Joey and Mary, the experimenter presented the bites to the participant's mouth (food-acceptance trials) using her hand and the food was placed on the table on

the independent-eating and food-selection trials. For Jack, the experimenter presented the bites on a fork either to his mouth (food-acceptance trials) or on the table in front of him (independent-eating and food-selection trials).

Generalization. During baseline, generalization sessions were conducted in the same manner described above, except these sessions were conducted by either a research assistant or a family member.

Treatment

The order of the trial types, timing of the trials, and the contingencies of reinforcement (described in the general procedure) were the same as in baseline, except in this phase, each target food was presented simultaneously with a preferred food, in *mixed-food trials* on all food-acceptance and independent-eating trials. Throughout treatment, each session started with mixed-food trials. As described below, the preferred food was systematically faded. On some sessions the preferred food was completely faded; however, this was not always the case.

Six food-acceptance trials and two independent-eating trials were presented per target food, with food-selection trials conducted every other session, as in baseline. Fading occurred on both the food-acceptance (preferred and target were held together and placed in the participant's mouth) and the independent-eating (preferred and target foods were pressed together and placed on table) trials. Under the fading procedure, the amount of the preferred food was systematically reduced until the target food was presented alone (in 5 mm by 5 mm bites). Criterion for fading was two consecutive bites accepted at the current ratio of target to preferred food. Criterion for moving back to the previous ratio was two consecutive bites rejected at the current ratio.

On mixed-food trials, for *Joey* and *Mary*, the target food was presented together in a *bite* consisting of a 5 mm x 5 mm piece of target food combined with a piece of preferred food. All of the bites were prepared prior to the session with several bites of each ratio prepared in advance without participant observation. Initially the piece of preferred food was either approximately 10 mm x 10 mm (when the step size was 20%) or approximately 13 mm x 13 mm (when the step size was 10%). For example, with *Joey*, his preferred food (Smartfood® popcorn) was pressed together (by hand) with a target food, such as banana chip. The piece of banana chip always remained at 5 mm x 5 mm pieces and the popcorn started out at about 10 mm x 10 mm in size. After two consecutive bites accepted (with the bite ratio being about 20% banana chip and 80% popcorn), the amount of the popcorn was faded by about 20% of the total bite (with the bite ratio then being 40% banana chip and 60% popcorn). The magnitude of the preferred food was faded until no preferred food was present in a bite. Accordingly, the bite size for combined bites ranged from 15 x 15 mm to 5 x 5 mm (no preferred food present). The size of the target food always remained the same (5 mm x 5 mm).

For *Joey*, the fading increment of the preferred food for the first target food (Polly-O® string cheese) was initially 20%, but was reduced to 10%, owing to less than 50% acceptance on the mixed-food trials in the first treatment session. In the subsequent sessions for this food *only*, the fading increment remained at 10%. The fading increment for banana chip and fruit bar was 20%. With all targeted foods for *Mary*, the fading increment was 10%.

On mixed-food trials for *Jack*, the fading increment was 25% for all target foods, since the preferred food was a condiment versus a solid food. The size of the target

foods were the same (5 mm x 5 mm) as with Joey and Mary. The bites were prepared by placing catsup on the vegetables and the pieces of tomato prior to the session. On the first trial of each session, a thin layer of catsup was placed on about 75% of the surface area of the target food. If he accepted two consecutive bites with 75% of the vegetable covered in catsup, the next bite was comprised of catsup on about 50% of the surface area of the target food. The amount of the catsup was faded within the session (as with Joey and Mary). Since the preferred food was a condiment, the size of the bites were smaller (always 5 mm x 5 mm target food).

Generalization. As in baseline, generalization sessions, across people, were conducted for each participant in the treatment phase of the study. These sessions were conducted in the same manner as the regular training sessions, except a teacher's assistant or family member conducted these sessions.

Follow-up (Mary and Jack)

Two follow-up sessions were conducted with Mary and Jack to examine maintenance of independent eating of the target foods alone during more "natural" situations. Follow-up sessions were not possible for Joey, owing to his absence from school. Follow-up sessions consisted of independent-eating trials but not food-selection trials, because the main goal of the current study was to achieve acceptance and independent eating of the target foods in the absence of the preferred food. For *Mary*, the two follow-up sessions were conducted within five days of each other, one month after treatment ended. The follow-up sessions for *Jack* were conducted within two days of each other, two weeks after treatment ended. During these sessions, the children did not have access to table-top activities and for *Mary* these sessions were conducted at a

different table in her classroom during snack time with her classmates, as opposed to conducting them at a desk in a cubby in her classroom. For both children, the only trial type presented was independent eating. Each target food was presented twice, as during the treatment phase. The target foods were presented alone, one at a time, as they were during baseline and treatment on the target-alone trials. For Jack, the food was placed on a fork on his plate, rather than on a fork on the counter. His token board was implemented in the same manner as it was during baseline and treatment. For Mary, the foods were presented on the table in front of her and the check board was implemented in the same manner as it was during baseline and treatment.

Data Collection, Interobserver Agreement and Procedural Integrity

Data Collection

Data were collected using a paper and pencil system by an experimenter and a classroom teacher or a teacher's aide, using data sheets that were customized for this procedure (see Appendices A-C). Inter-observer agreement was measured using the point-by-point method. For food-acceptance trials, an agreement was scored if both observers recorded the same response (either allowing the food to be placed beyond his or her lips and not expelling the food prior to the next trial or rejection of the food presented to his/her mouth). For independent-eating trials, an agreement was scored if both observers record the same response (either the participant picked the food up and independently ate it or did not eat the food(s) placed on the table in front of him/her). For food-selection trials, an agreement was scored if both observers recorded the selection and eating of a food, or recorded that no selection occurred on a given trial.

Inter-observer Agreement

Inter-observer agreement was calculated by dividing agreements by agreements plus disagreements multiplied by 100%. Inter-observer agreement was recorded on 32% of baseline sessions and 19% of treatment sessions for Joey, 24% of baseline and 23% of treatment sessions for Mary, and 36% of baseline sessions and 33% of the treatment sessions for Jack. Table 4 shows the percentage of inter-observer agreement for each participant during baseline and treatment conditions.

Table 4. Inter-observer agreement on food-acceptance, independent-eating, and food-selection responses during baseline and treatment sessions for all participants. Data for inter-observer agreement on the food-selection trials were not evaluated according to experimental phase, as this response was not treated (no pairing and fading).

	<u>% Agreement Per Experimental Phase</u>				
	Baseline		Treatment		
	<u>FA</u>	<u>IE</u>	<u>FA</u>	<u>IE</u>	<u>FS</u>
<u>Participant</u>					
Joey	100	100	100	100	100
Mary	100	100	100	89	100
Jack	100	100	99	96	83

Note. FA = food-acceptance responses, IE = independent eating responses, FS = food-selection responses.

Procedural Integrity

Procedural integrity was measured by an assistant who recorded the experimenter's accuracy in administering the experimental procedures during baseline and treatment sessions. Accuracy was defined as follows: a) on food-acceptance trials, the experimenter placed a bite at the child's lips and held it there for 5s or until the child opened his or her mouth; b) on independent-eating trials, the experimenter placed food on the table in front of the child and if the child did not pick the food up, eat, move, or look at the food (an observing response) within 5 s, the food was removed; c) on food-selection trials, a target food was placed on the table approximately 5 cm away from a low or non-preferred food (5 mm x 5 mm piece) and the participant was told "pick one." The foods remained on the table for a maximum of 5 s. If the participant picked a food up and independently ate it on a choice trial, behavior-specific praise (e.g. "nice job picking one.") was provided, along with a check or token as described above. If the participant did not select an item, no feedback was provided and the foods were removed after 5 s; d) food was presented approximately every 20 s; e) the correct ratio of foods was presented on mixed-food trials; f) if the child accepted the bite, behavior-specific praise, such as "great eating," was provided along with a check or a token; g) if the child rejected the food, the experimenter removed the bite after 5-10s, with no verbal feedback provided.

The percentage of correct responses was calculated by dividing the number of correct responses by the total number of responses and multiplying by 100. Procedural integrity was measured during 16% of baseline and 19% of treatment sessions for Joey, 11% of baseline and 13% of treatment sessions for Mary, and 27% of baseline and 27%

of treatment for Jack. Table 5 shows the procedural integrity data for each participant, according to trial type in baseline and treatment conditions.

Table 5. Mean percentage of trials presented accurately for each participant and trial type in baseline and treatment conditions.

Participant	Phase	Trial Type	Mean % of Accurate Trials
Joey	Baseline	Food acceptance	96
Joey	Baseline	Independent eating	100
Joey	Treatment	Food acceptance	97
Joey	Treatment	Independent eating	94
Joey	N/A	Choice	95
Mary	Baseline	Food acceptance	100
Mary	Baseline	Independent eating	100
Mary	Treatment	Food acceptance	95
Mary	Treatment	Independent eating	95
Mary	N/A	Choice	97
Jack	Baseline	Food acceptance	96
Jack	Baseline	Independent eating	100
Jack	Treatment	Food acceptance	86
Jack	Treatment	Independent eating	88
Jack	N/A	Choice	90

Results

Figure 1 shows the effects of the independent variable on food acceptance and independent eating of target foods for Joey. In each column, the top three graphs indicate the percentage of trials with food acceptance for all three targeted foods. The bottom three graphs in each column show the percentage of trials with independent eating of all of the target foods. The graphs in the left column show performance on mixed-food trials and the right column shows performance on target-alone trials only. There are several sessions without data points in the right column. This is because for those sessions, the preferred food was not able to be completely faded, based on the fading criterion.

The solid circles in all graphs represent data during experimenter-conducted sessions; the open squares represent performance during generalization sessions, conducted by a teacher's assistant. The percentage of each mixed-food bite that was composed of the preferred food was as follows: *A* = 90-80%, *B* = 90-60%, *C* = 60-30%, *D* = 30-0%, *E* = 80-20%, and *F* = 60-0%.

The results illustrated in Figure 1 show that the percentage of trials with acceptance of the three targeted foods was at or close to 0% in baseline. After implementation of the simultaneous presentation and fading procedure, there was an increasing trend in acceptance of cheese on mixed-food trials. With banana chip and fruit bar, acceptance immediately increased to 100% after implementation of the simultaneous presentation and fading procedure. The three bottom graphs of Figure 1 show that Joey did not independently eat any of the target foods during baseline sessions. With the exception of the first treatment session for cheese, independent

eating of the target food immediately increased and remained at 100% for all treatment sessions. The three bottom graphs in the right column show that after a number of sessions with fading of the preferred food, Joey independently ate all of the target foods on 100% of target-alone trials. Performance during the generalization sessions was consistent with performance during the sessions conducted by an experimenter.

Figure 1. Results of the simultaneous presentation and fading procedure on the percentage of trials with food acceptance and independent eating on the mixed-food and target-alone trials, for Joey. The left column represents the percentage of trials with acceptance and independent eating of target foods when the target foods were paired with the preferred food and the right column shows the percentage of trials with acceptance and independent eating of target foods when they were presented alone (without the preferred food). The letters with attached arrows represent fading levels (A = 90-80%, B = 90-60%, C = 60-30%, D = 30-0%, E = 80-20%, and F = 60-0%).

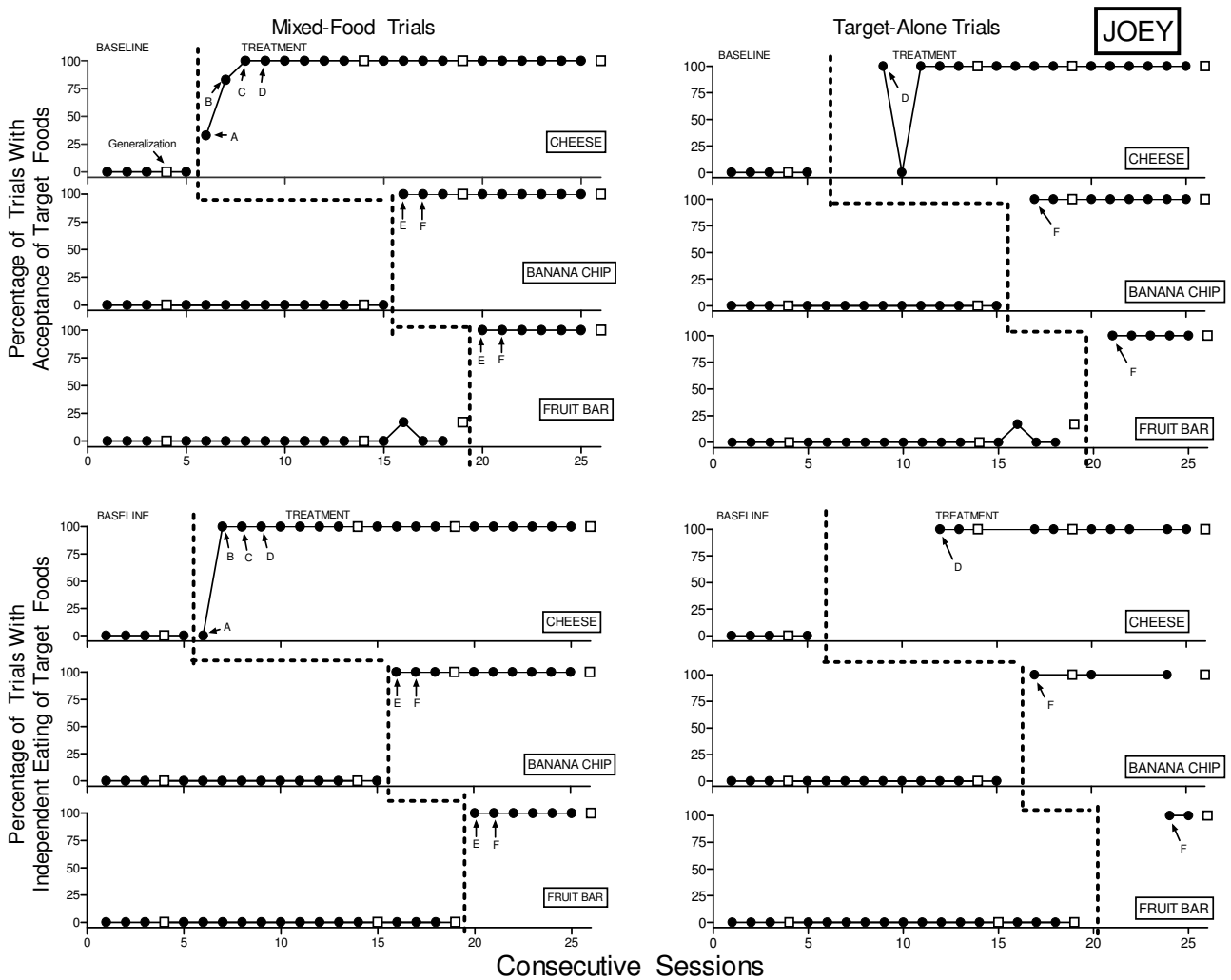


Figure 2 shows the percentage of food-selection trials in which the target foods were selected and eaten by Joey. Data are shown for baseline and treatment phases, with solid circles representing the percent of trials with selection of the target foods during training sessions conducted by an experimenter and the open squares depicting performance during generalization sessions conducted by a teacher's assistant.

Data are shown across the three target foods for baseline and treatment phases of the study. On these trials, the target foods were not mixed with a preferred food. Eventually, all target foods were selected and eaten on these trials. Joey's selection and eating of the third target food (fruit bar) emerged very quickly (within two treatment sessions) after implementation of the simultaneous presentation and fading procedure. Selection and eating of cheese and banana chip was slower to emerge than fruit bar, but eventually Joey selected and ate these foods when they were each presented with another food of little or no preference. Not indicated on the figures are Joey's responses to the alternative foods on the food-selection trials. Joey did not select any of the non-target foods on the selection trials. Joey either selected the target food or handed both foods back to the experimenter.

Figure 2. Percentage of trials with selection and eating of the targeted foods for

Joey.

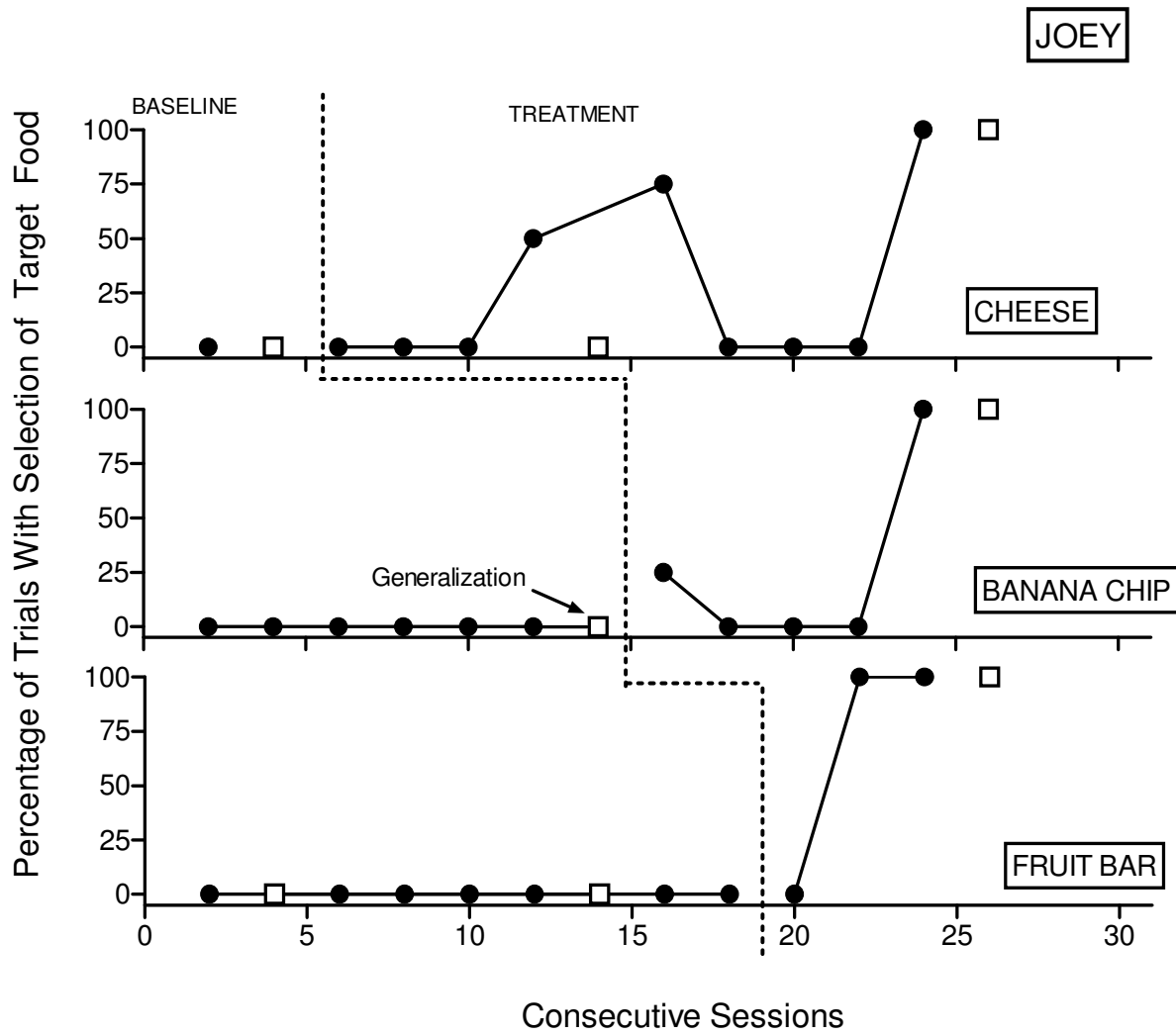


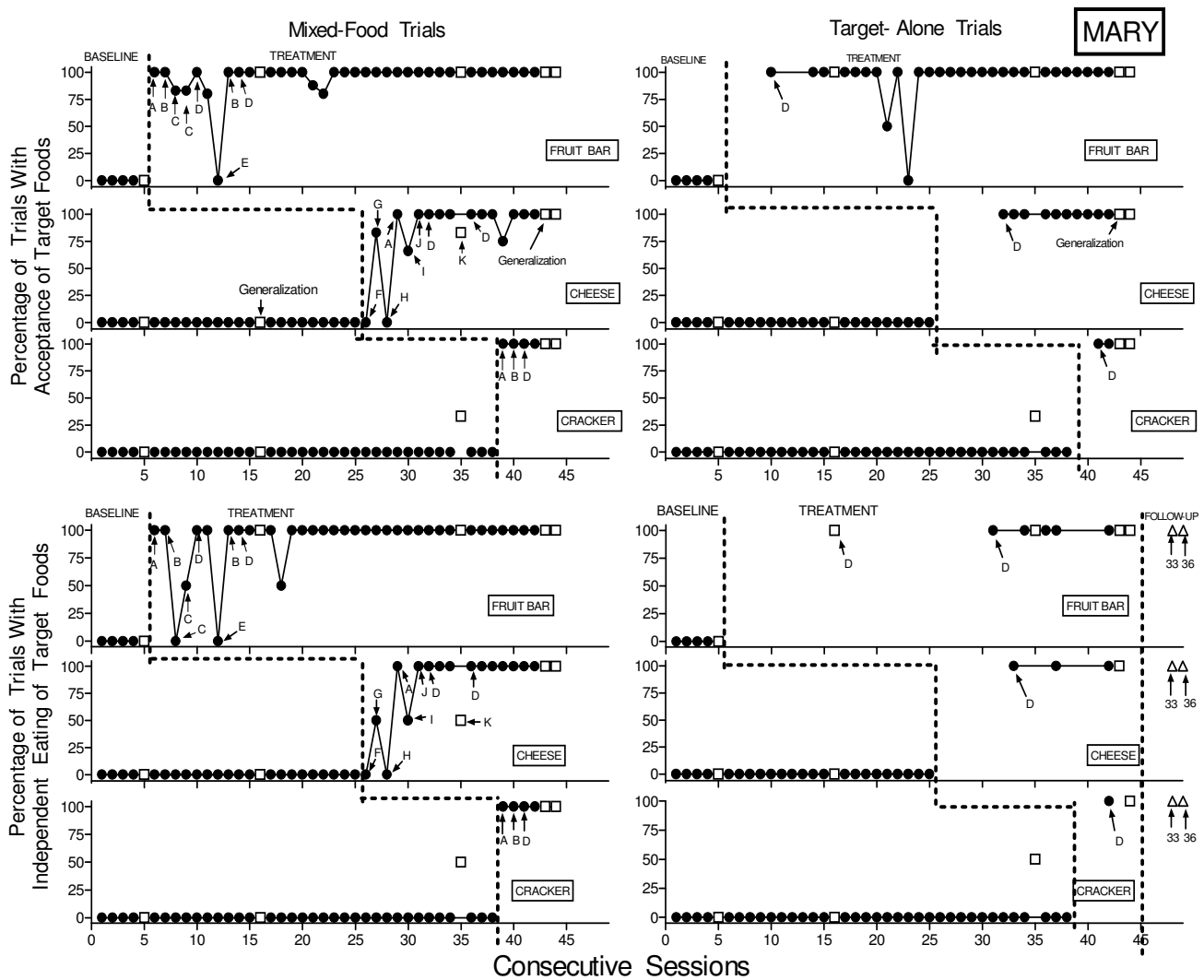
Figure 3 shows the results for Mary for food acceptance and independent eating. The percentage of trials with food acceptance and independent eating of the target foods on mixed-food trials and target-alone trials is depicted. As with figure 1, there are several sessions without data points in the right column. This is because for those sessions, the preferred food was not able to be completely faded, based on the fading criterion. The format of this figure is the same as Figure 1, with the addition of open triangles representing independent-eating on target-alone trials from the follow-up sessions conducted 33 and 36 days after treatment ended. The percentage of each mixed-food bite that was composed of the preferred food was as follows: *A* = 90-60%, *B* = 60-30%, *C* = 30-20%, *D* = 30-0%, *E* = 30-60%, *F* = 90-70%, *G* = 70-60%, *H* = 60-90%, *I* = 60-40%, *J* = 40-10%, and *K* = 30-10%.

As indicated in the three top graphs of the left column, Mary's percentage of acceptance of the target foods during baseline was at 0% for all foods, except one session with cracker. Acceptance of the target foods increased after the implementation of treatment, though the percentage of acceptance of fruit bar and cheese remained variable for the first few sessions in which mixed-food trials were presented. Mary immediately accepted cracker on the mixed-food trials, as indicated in the third graph in the left column. As seen in the top three graphs in the right column, acceptance of fruit bar on the target-alone trials eventually occurred after a few treatment sessions. There was some variability, but from session 24 her acceptance of fruit bar on the target-alone trials remained at 100%.

The bottom three graphs of the left column show that Mary did not independently eat fruit bar or cheese during baseline. There was only one session in which Mary independently ate cracker in baseline, but her independent eating of cracker immediately went back down to 0% and remained at 0% until it was introduced into

treatment. Mary's independent eating of fruit bar and cheese on the mixed-food trials was variable for the first several treatment sessions. Eventually, Mary independently ate all of the targeted foods on mixed-food and target-alone trials. The bottom three graphs in the right column show that after several treatment sessions, Mary independently ate all of the targeted foods on target-alone trials. These effects generalized to a more natural setting (the snack table with classmates) during two follow-up sessions conducted 33 and 36 days after treatment ended.

Figure 3. Percentage of trials with food acceptance and independent eating of the target foods on mixed-food and target-alone trials for Mary. The percentage of acceptance and independent eating on mixed-food trials is indicated in the left column and the percentage of acceptance and independent eating on the target-alone trials (after fading was completed) is shown in the right column. The letters with attached arrows represent fading levels (*A* = 90-60%, *B* = 60-30%, *C* = 30-20%, *D* = 30-0%, *E* = 30-60%, *F* = 90-70%, *G* = 70-60%, *H* = 60-90%, *I* = 60-40%, *J* = 40-10%, and *K* = 30-10%). Follow-up data are illustrated in the three bottom graphs in the right column.



Indicated in Figure 4 are the results from the food-selection trials for Mary. The format of this figure is the same as that of Figure 2. Selection and eating of the target foods was at 0% in baseline for all foods. Acquisition of selection and eating occurred for fruit bar and cracker, but not for cheese. The acquisition of this response was much slower for fruit bar than cracker, but eventually Mary independently selected and ate fruit bar on all food-selection trials during the last session, which was a generalization session. Mary did not select the alternative food on any food-selection trials. She either selected and ate the target food, left both on the table, or handed both the target and non-target food back to the experimenter.

Figure 4. Percentage of food-selection trials with independent selection and eating of the target foods for Mary.

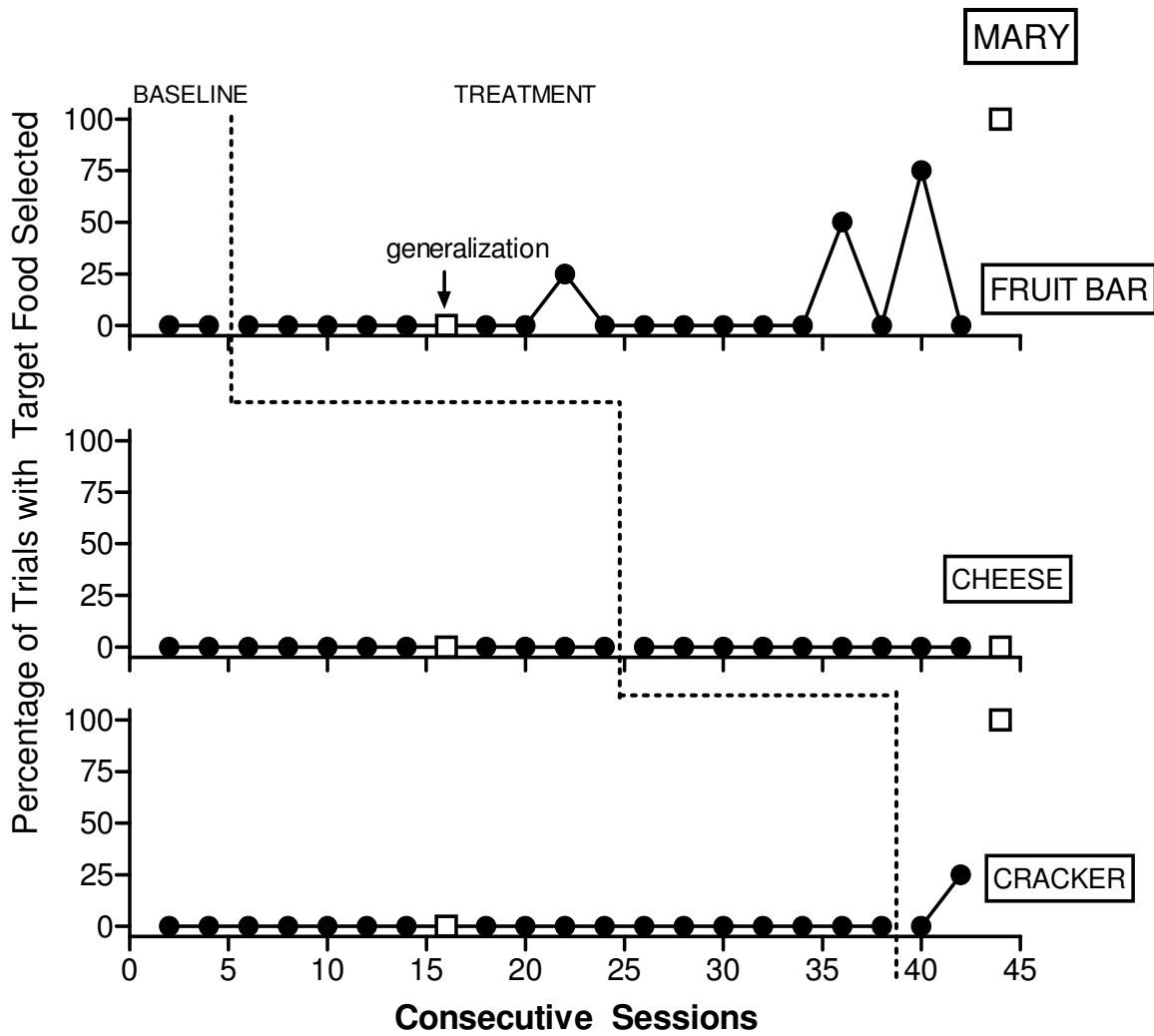


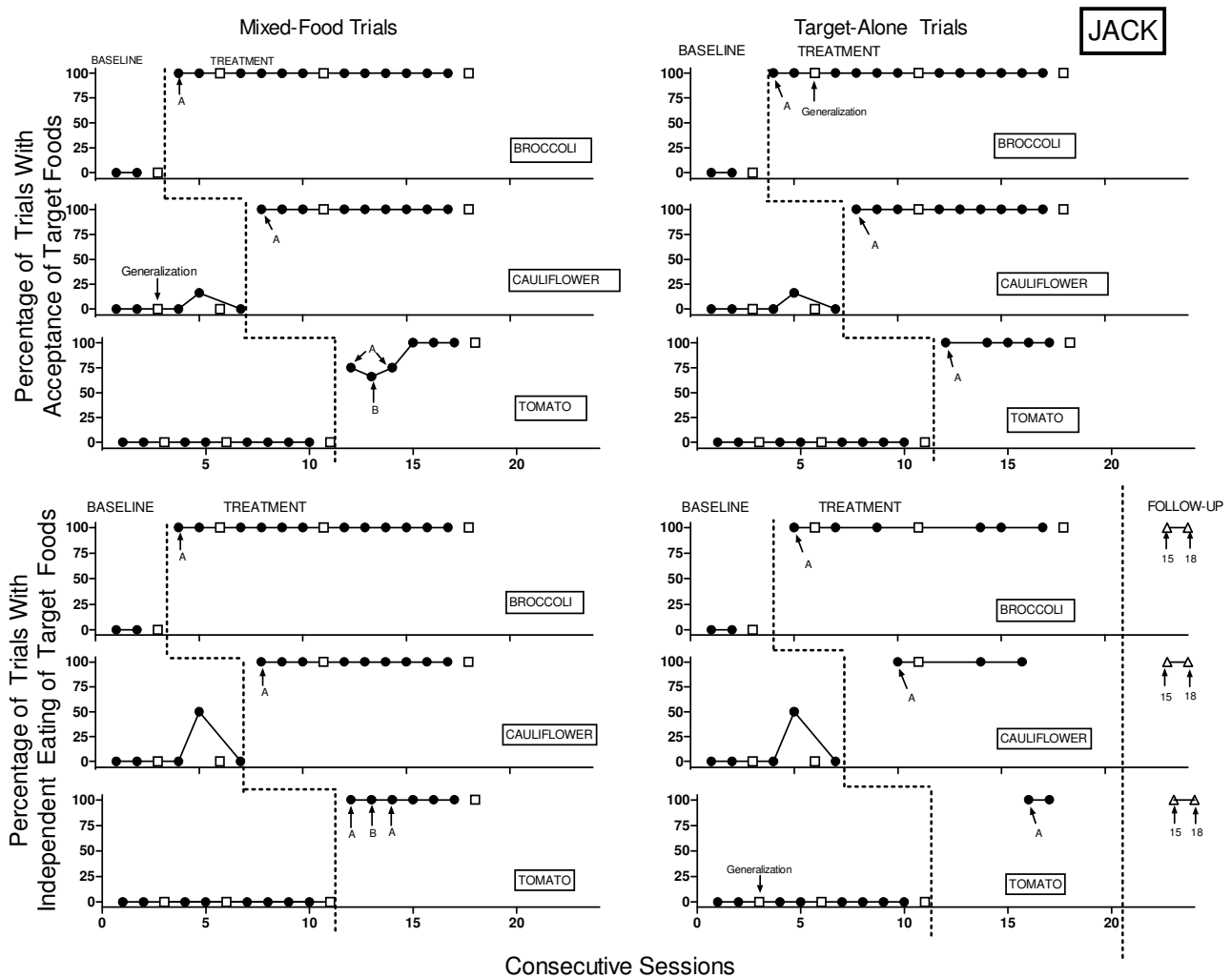
Figure 5 shows the percentage of trials with food acceptance and independent eating on mixed-food and target-alone trials for Jack. This figure is formatted in the same manner as figures 1 and 3. The percentage of each mixed-food bite that was composed of the preferred food was as follows: $A = 75-0\%$, and $B = 75-25\%$. The three bottom graphs in the right-hand column show the follow-up data collected 15 and 18 days after treatment ended.

As seen in the top three graphs in the left column, Jack's percentage of trials with acceptance was at or close to 0% for all target foods during baseline. In one baseline session only, he accepted cauliflower. After implementation of treatment, acceptance of all three foods increased immediately. There was a bit of variability in his acceptance of tomato on the food-acceptance trials (between 75% and 83% acceptance), but after a few treatment sessions, he consistently accepted tomato on both mixed-food and target-alone trials. As seen in the top three graphs of the right column, acceptance of the target foods on target-alone trials occurred immediately for all targeted foods. Jack's performance during generalization sessions (conducted with a family member) was consistent (0% during baseline and 100% acceptance during treatment) with his performance during the training sessions.

The bottom three graphs of the left column show Jack's performance on independent-eating trials, during baseline, in which the target foods were presented alone and during treatment with mixed-food trials. During baseline, Jack independently ate one of two bites of cauliflower in one session, but this percentage dropped back down in subsequent baseline sessions. As indicated in the bottom three graphs of the left column, Jack independently ate all of the target foods on all trials immediately after

implementation of treatment. His performance during the generalization sessions was consistent (0% during baseline and 100% during treatment) with his performance during the training sessions. As indicated in the three graphs in the bottom of the right column, independent eating was maintained and generalized to dinner time at home 15 and 18 days after treatment ended.

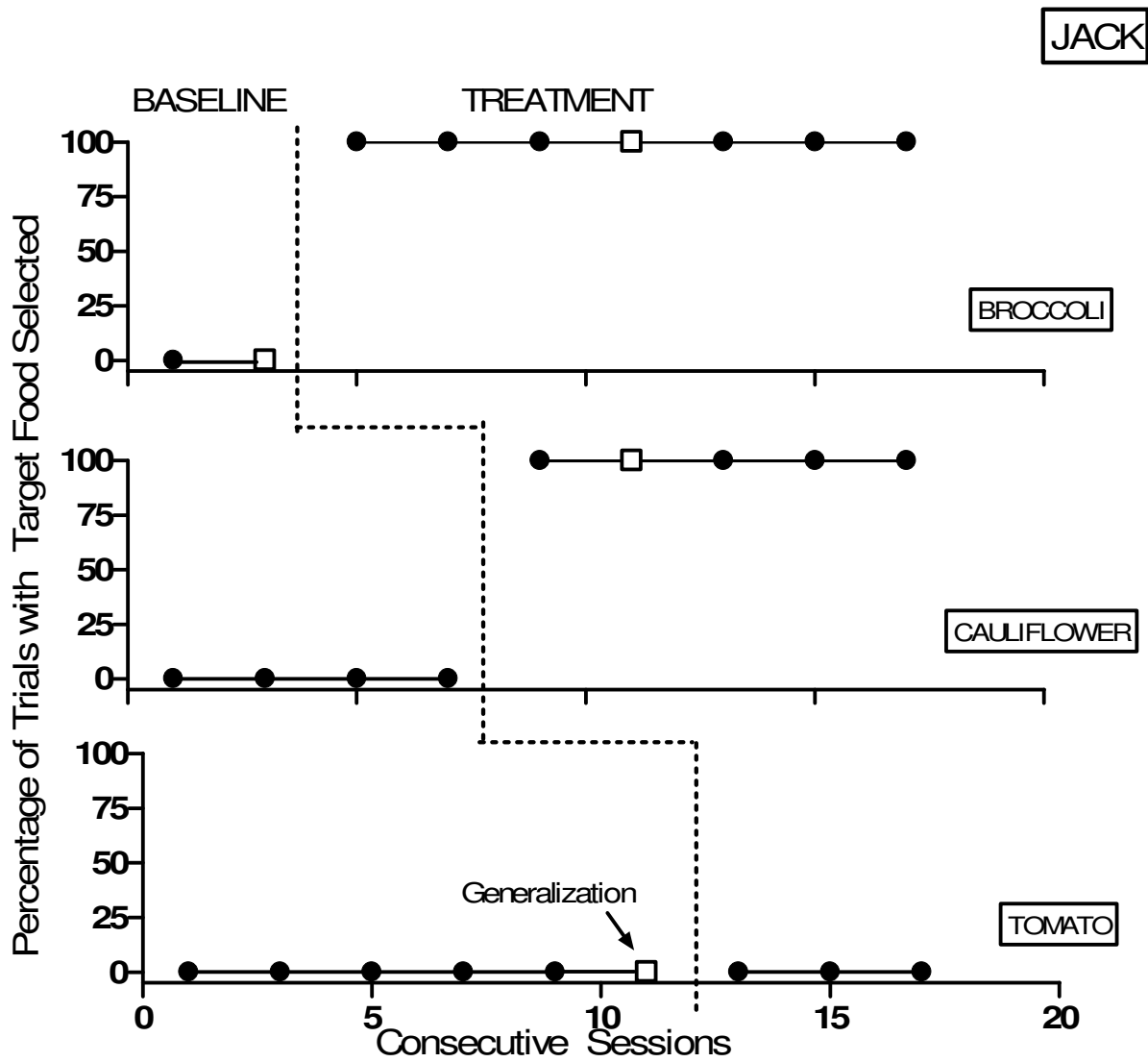
Figure 5. Percentage of food acceptance and independent eating on mixed-food and target-alone trials for Jack. This figure is formatted in the same manner as figure 3, with fading ratios indicated on the mixed-food graphs and follow-up data shown in the bottom graphs in the right column. Data are shown for acceptance and independent eating on the mixed-food trials (preferred with target) in the left column and the target-alone trials (without preferred) in the right column. The letters with attached arrows represent fading levels (A = 75-0% and B = 75-25%). Follow-up data are illustrated in the three bottom graphs in the right column.



In Figure 6, is the percentage of food-selection trials with selection and eating of the three target foods for Jack. This figure is formatted in the same manner as Figures 2 and 4. After implementation of the simultaneous presentation and fading procedure, Jack independently selected and ate broccoli and cauliflower. However, he did not select and eat tomato before or during treatment. In all sessions, Jack did not select the alternative food when the target food was broccoli or cauliflower, but when selection trials were presented with tomato being the target food, he selected squash on this trial. On the other three selection trials (across all sessions), with tomato presented, no selection was made. When the target food was broccoli or cauliflower, he either selected the target food on these trials or he did not select a food (in baseline).

Overall, the results showed that: a) the percentage of trials with food acceptance and independent eating was at or near 0% for all participants until treatment was implemented; b) acceptance of the target foods placed at the child's mouth and independent eating of the target foods increased for all children after the simultaneous presentation and fading procedure was implemented; and c) there was an increase in selection and eating of the all of the target foods for Joey and two of the three target foods for Mary and Jack.

Figure 6. Results of the food-selection trials for Jack.



Discussion

The results of the current study demonstrated the effectiveness of the simultaneous presentation and fading procedure on acceptance, independent eating, and selection of target foods for children with autism in a natural environment. From baseline levels of zero trials with responding, all three participants showed an increase to 100% of trials for food acceptance and independent eating of all the targeted foods. There was also a large increase in selection and eating of all of the targeted foods for Joey, and two out of three targeted foods for Mary and Jack. Maintenance of treatment gains with independent eating was measured for two participants, Mary and Jack, one-month and two weeks after treatment, respectively. Both participants showed maintenance of independent eating on these follow-up target-food-alone trials.

The data for food acceptance (food placed at child's mouth) versus independent eating (picking up the food and eating it) indicate that independent eating increased to the same level as food acceptance. These results were somewhat surprising because: a) the independent-eating response required more effort; b) noncompliance on independent-eating trials requires only a passive response (not picking up and eating food placed on the table), while noncompliance on food-acceptance trials required actively avoiding food placed at the mouth; c) there were fewer independent-eating trials than food-acceptance trials (fewer opportunities to practice this response compared to the food-acceptance response); and d) and there was only one fading step for the independent-eating trials (because there were only two independent-eating trials per food). For these reasons, it was anticipated that independent eating might not increase to as high a level achieved for food acceptance.

An important finding for Joey and Mary was that acceptance and independent eating of the target foods presented alone trailed acceptance and independent eating

on the mixed-food trials. For Joey, acceptance and independent eating of banana chip and fruit bar on target-alone trials increased fairly quickly, but acceptance and independent eating of cheese on the target-alone trials trailed acceptance and independent eating of cheese on the mixed-food trials by several sessions. With Mary, acceptance and independent eating of fruit bar and cheese on the target-alone trials trailed acceptance of these foods on the mixed-food trials. Acceptance and independent eating on the target-alone trials for Jack occurred in the first treatment session. For Joey and Mary, there were more fading steps and fewer opportunities for acceptance of the target foods presented alone.

An interesting finding is seen with the third dependent measure, selection and eating of the target foods. There was an increase in this measure for all of the target foods for Joey; and for Mary and Jack, there was an increase for two out of three target foods. On these trials the target foods were never mixed with the preferred food. Food-selection trials and independent-eating trials both involved picking up and eating a food; however they differed in that there was no fading on food-selection trials and an alternative food was concurrently available on the food-selection trials. Since the target foods were not selected on these trials during baseline, but were after implementation of treatment, selection of these foods increased without being targeted directly via the pairing and fading procedure, the effects of treatment appeared to generalize to this response without direct training required.

One possible account for the increase in participants' food-acceptance, independent-eating, and responding on some food-selection trials, is that once they came into contact with the contingency between eating the target food and earning a token, the target foods acquired a S^D function, signaling the availability of a token contingent on eating behavior.

It is also possible that since the participants rarely (if ever) ate these foods (prior to or during baseline), the taste of the target food may have resulted in the novel food becoming a S^D signaling the availability of the now-preferred taste contingent on accepting or taking a bite of the food. Some studies (e.g. Birch & Marlin, 1982) have shown that mere exposure to foods is a basis for increased food acceptance and food preference in typically-developing children.

Another possible explanation for these findings is that the pairing of the preferred food with the target foods led to the target foods' acquiring a reinforcing function via flavor-flavor conditioning. This explanation is consistent with the findings of Havermans and Jansen (2006) who demonstrated flavor-flavor conditioning by pairing some non-preferred foods with a sweetener and not pairing others. In their study, a pre-test and post-test were conducted in which several vegetable flavors were presented by pureeing them and placing the liquid into a small cup. After tasting each of them, the students ranked each as "like" "just okay" or "disliked." Treatment consisted of the presentation of some of the vegetable flavors being mixed with a sweetener and others not mixed. After pairing, an association between the neutral flavor (ranked as "just okay") and the preferred flavor was acquired and preference for the neutral flavor increased. Results indicated that the relative ranking of the flavors mixed with a sweetener during treatment increased, while relative ranking of the flavors not mixed during treatment did not increase. This study demonstrated the effects of simultaneous food presentation on food preference, which was defined as the relative "shift in liking" as demonstrated by the change in the ranking of the flavors.

According to this explanation, there was a transfer of stimulus control from the preferred food to the target foods, resulting in the target foods' acquiring reinforcing properties that come to reinforce eating responses. Future research may involve a

component analysis to separately analyze possible S^D versus S^R functions. Possible components to analyze are pairing, fading, and reinforcement. It is likely that the pairing alone, without the fading, would not result in acceptance of the target foods alone, as seen in Ahearn (2003). It remains to be determined whether pairing in conjunction with reinforcement would be sufficient to increase acceptance.

Response shaping is yet another possible explanation for the increase in acceptance and independent eating during treatment is behavioral shaping (Catania, 1998). As the preferred food was faded, acceptance and independent eating of the target food with less of the preferred food present (successive approximations) was reinforced, until eventually the participants accepted the target foods alone (target response).

Another possible basis for the observed effects of the pairing and fading procedure can be based on the structure of of all pairing and fading sessions. During these sessions, the target foods were always paired with the preferred foods for the first several trials. If performance met criterion, the preferred food was faded during subsequent trials. Presentation of the preferred food paired with the target food during the initial trials may have resulted in behavioral momentum for eating target foods alone.

Even if the foregoing explanations are correct, a question still remains regarding absence of selection of cheese for Mary and tomato for Jack on food-selection trials (target alone), despite acquisition of independent eating for these foods. Three possible explanations are: a) these foods functioned as S -deltas, signaling the absence of a reinforcer given an eating response; b) the choice situation functioned as an abolishing operation (Laraway, Snyckerski, Michael, & Poling, 2003) for these two foods and/or the tokens that could be earned for eating them; or c) the presence of two foods on the

table instead of just one may have been perceived as a new demand (eat both). As far as the first explanation, it is not likely that these two foods were functioning as S-deltas, as there was an increase in independent eating and acceptance of these foods placed at his/her mouth on target-alone trials. It is possible, however, that when cheese (for Mary) and tomato (for Jack) were placed in front of them, along with the alternative foods (on the food-selection trials), the value of these target foods as reinforcers, or the tokens provided for eating them, decreased (resulting in the participants not selecting and eating them). This explanation seems more plausible than the S-delta explanation, given the overall acceptance of these foods on the other two types of trials (food-acceptance and independent-eating trials). The third explanation may be possible as it may be expected that increasing the response effort for eating a food that remains a non-preferred food would result in rejection.

A question remains regarding what is sufficient versus what is necessary to achieve food acceptance and independent eating. The fading steps used in this study were sufficient to obtain independent eating of each of the target foods alone, but which of the parameters of fading were required to achieve these results cannot be determined based on these data. One way to examine this would be to insert probe trials during each session, to determine at which point the fading is no longer needed. A risk of using such probe trials is that if the child does not accept the target food alone on a given probe trial, rejection may be reinforced by presenting the preferred food on a mixed trial next. The risk is still present with fading, but it is minimized because the percentage of the bite comprised of the target food changes in small increments (as opposed to presenting a target-alone probe after acceptance of 40% target:60% preferred).

Similar to Tiger and Hanley (2006), the current study used a fading procedure with only the preferred food faded. The present results are similar to those of Tiger and Hanley in that acceptance of the target foods remained fairly high as the preferred food was systematically reduced. The current study extended Tiger and Hanley's study by demonstrating the effects of this procedure with three participants presenting with developmental disabilities and with food selectivity, and by demonstrating an increase in acceptance, independent eating, and selection responses for three foods by each participant.

The present study also extended the work of Ahearn (2003) who used simultaneous presentation of condiments (preferred food item) and non-preferred food items (vegetables). In the present study, catsup was added to bites of two different vegetables and one fruit for Jack. In both studies, addition of the condiment increased acceptance of target vegetables. Unlike Ahearn's procedure, in which there was no fading of condiment, the present study was able to demonstrate acquisition of eating vegetables without the condiment.

A strength of the current study is its extension of the literature on simultaneous presentation and fading. Particularly, this study extended Patel et al. (2001) by examining the effect of simultaneous presentation and fading without escape prevention. An implication is that simultaneous presentation and fading can be effective for increasing the food repertoires of children with less severe (food selectivity rather than food refusal) feeding difficulties without requiring the use of escape-prevention procedures, which may not always be practical. For example, in a school setting, it may not be practical to use escape prevention because eventually the child will leave school whether s/he has eaten the non-preferred foods or not, which may reinforce avoidance behavior in the presence of novel foods.

Finally, the current study is one of few that has examined the effects of treatment of food selectivity for young children (<10 years of age) with autism, that did not employ escape prevention or response-cost. In the current study, differential reinforcement was used with a token/check and praise provided for eating behavior and no tokens or praise for rejection. Piazza, Fisher, Brown, Shore, Patel, Katz, Sevin, Gulotta, and Blakely-Smith (2003) showed results indicating that positive reinforcement (via differential reinforcement for clean mouth, with contingent access to items selected on a paired-stimulus preference assessment) alone was not sufficient to increase acceptance of foods. One possible reason for this, as Piazza et al. (2003) point out, is that the participants in their study all presented with food refusal. Positive reinforcement alone may be effective for children who demonstrate at least some acceptance of foods during baseline. In the present study, there were one to two occurrences of acceptance of one of the targeted foods during baseline for each participant; however, the overall percentage of trials with acceptance or independent eating did not increase during baseline. The use of the antecedent manipulation (simultaneous presentation and fading) with positive reinforcement (token economy), in the present study, may be differentially effective depending on whether the participant is a selective eater or exhibits food refusal. An implication is that the simultaneous presentation and fading procedure and positive reinforcement may not be effective for children who are food avoidant.

A limitation of the current study concerns interpretation of the data from the food-selection trials. Because the alternative foods presented on these trials were also non-preferred or low-preferred (selected on less than 25% of the assessment trials), it cannot be inferred that a shift in preference occurred for the target foods that were eventually selected after implementation of treatment. Another limitation of the current

study is seen in the social validity of the study. The size of the target food pieces was very small (5mm x 5mm), so the effects observed in this study may not occur when targeting acceptance of larger pieces of food.

Future research may examine the potential effects of the simultaneous pairing and fading procedure on preference for the targeted foods by including preference assessment probes with different alternative foods. This would allow for an assessment of preference versus an assessment of selection and eating of the targeted foods, as was used in the current study. Future research should also include the measurement of problem behaviors as a function of treatment.

In conclusion, results of the current study support the use of a stimulus fading procedure for children who present with food selectivity. This procedure effectively increased acceptance, independent eating, and selection of target foods for all three participants, and the follow-up data indicate that these effects on independent eating generalized to a more natural setting for Mary and Jack. Future research may compare the effects of this procedure when used to treat food refusal versus food selectivity. Since this procedure was also conducted outside of mealtimes (which can be viewed as being a contrived setting), a future study may examine the efficacy of this procedure conducted during mealtimes.

Appendix C

Child: _____ Date: _____

Session #: _____
Feeder/Experimenter: _____

Block # 1 "food" Phase: BL / treatment

Trial	% pref	Trial Type	- / + '
1		FA IE	
2		FA IE	
3		FA IE	
4		FA IE	
5		FA IE	
6		FA IE	
7		FA IE	
8		FA IE	
FA acceptances/non-acceptances			
% of FA acceptances			
IE acceptances/non-acceptances			
% of IE acceptances			

Block # 2 "food" Phase: BL / treatment

Trial	% pref	Trial Type	- / + '
1		FA IE	
2		FA IE	
3		FA IE	
4		FA IE	
5		FA IE	
6		FA IE	
7		FA IE	
8		FA IE	
FA acceptances/non-acceptances			
% of FA acceptances			
IE acceptances/non-acceptances			
% of IE acceptances			

Block # 3 "food" Phase: BL / treatment

Trial	% pref	Trial Type	- / + '
1		FA IE	
2		FA IE	
3		FA IE	
4		FA IE	
5		FA IE	
6		FA IE	
7		FA IE	
8		FA IE	
FA acceptances/non-acceptances			
% of FA acceptances			
IE acceptances/non-acceptances			
% of IE acceptances			

Bibliography

- Ahearn, W. H. (2003). Using simultaneous presentation to increase vegetable consumption in a mildly selective child with autism. *Journal of Applied Behavior Analysis, 36*, 361-365.
- Ahearn, W.H., Castine, T., Nault, K., & Green, G. (2001). An assessment of food acceptance in children with autism or pervasive developmental disorder-not otherwise specified. *Journal of Autism and Developmental Disorders, 31*, 505-511.
- 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.
- Birch, L. L., & Marlin, D. W. (1982). I don't like it; I never tried it: Effects of exposure to food on two-year-old children's food preferences. *Appetite, 4*, 353-360.
- Buckley, S. D. and Newchok, D. K. (2005). An evaluation of simultaneous presentation and differential reinforcement with response cost to reduce packing. *Journal of Applied Behavior Analysis, 38*, 405-409.
- Casey, S. D., Perrin, C. J., Merial, C. L., Lecomte, J. M., Milligan, J., Walsh-Czekalski, M. (2008). Increasing bite acceptance and reducing food refusal in a child with autism: Moving beyond the clinic. *Journal of Behavior Analysis in Health, Sports, Fitness, and Medicine, 1*, 34-44.
- Fisher, W., Piazza, C. C., Bowman, L. G., Hagopian, L. P., Owens, J. C., & Slevin, I. (1992). A comparison of two approaches for identifying

- reinforcers for persons with severe and profound disabilities. *Journal of Applied Behavior Analysis*, 25, 491-498.
- Gilliam, J. E., (1995). *Gilliam Autism Rating Scale: Examiner's Manual*. Austin, Texas: Pro-Ed.
- Havermans, R. C., & Jansen, A. (2006). Increasing children's liking of vegetables through flavour-flavour learning. *Appetite*, 48, 259-262.
- 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.
- Laraway, S., Snyckerski, S., Michael, J., & Poling, A. (2003). Motivating operations: Some further refinements. *Journal of Applied Behavior Analysis*, 36, 407-414.
- Mueller, M. M., Piazza, C. C., Patel, M. R., Kelley, M. E., & Pruett, A. (2004). Increasing variety of foods consumed by blending non-preferred 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.
- Patel, M. R., Piazza, C. C., Kelly, M. L., Ochsner, C. A., & Santana, C. M. (2001). Using a fading procedure to increase fluid consumption in a child with feeding problems. *Journal of Applied Behavior Analysis*, 34, 357-360.
- Patel, M. R., Piazza, C. C., Layer, S. A., Coleman, R., and Swartzwelder, D. M. (2005). A systematic evaluation of food textures to decrease packing and

- increase oral intake in children with pediatric feeding disorders. *Journal of Applied Behavior Analysis*, 38, 89-100.
- Piazza, C. C., Fisher, W. W., Brown, K. A., Shore, B. A., Patel, M. R., Katz, R. M., Sevin, B. M., Gulotta, C. S., & Blakely-Smith, A. (2003). Functional analysis of inappropriate mealtime behaviors. *Journal of Applied Behavior Analysis*, 36, 187-204.
- Piazza, C. C., Patel, M. R., Gulotta, C. S., Sevin, B. M., & Layer, S. A. (2003). On the relative contributions of positive reinforcement and escape extinction in the treatment of food refusal. *Journal of Applied Behavior Analysis*, 36, 309-324.
- 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 non-preferred food to treat food selectivity. *Journal of Applied Behavior Analysis*, 35, 259-270.
- Riordan, M. M., Iwata, B. A., Wohl, M. K., & Finney, J. W. (1980). Behavioral treatment of food refusal and selectivity in developmentally disabled children. *Applied Research in Mental Retardation*, 1, 95-112.
- Riordan, M. M., Iwata, B. A., Finney, J. W., Wohl, M. K., & Stanley, A. E. (1984). Behavioral assessment and treatment of chronic food refusal by handicapped. *Journal of Applied Behavior Analysis*, 17, 327-341.
- Schreck, K.A., Williams, K., & Smith, A.F. (2004). A comparison of eating behaviors between children with and without autism. *Journal of Autism and Developmental Disabilities*, 34, 433-438.

Shore, B.A., Babbitt, 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.

Tiger, J. H., & Hanley, G. P. (2006) Using reinforcer pairing and fading to increase the milk consumption of a preschool child. *Journal of Applied Behavior Analysis, 39*, 399-403.