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INDICES OF HAPPINESS AND UNHAPPINESS DURING TREATMENT OF PEDIATRIC FEEDING DISORDERS

by

Laura Elizabeth Phipps

A DISSERTATION

Presented to the Faculty of the University of
Nebraska Graduate College
in Partial Fulfillment of the Requirements
For the Degree of Doctor of Philosophy

Medical Sciences Interdepartmental Area
Graduate Program

(Applied Behavior Analysis)

Under the Supervision of Professor Kathryn. M. Peterson

University of Nebraska Medical Center
Omaha, Nebraska

April, 2021

Supervisory Committee:

Cathleen C. Piazza, Ph.D.
Bethany A. Hansen, Ph.D.
Amanda N. Zangrillo, Psy.D.
Kathryn M. Peterson, Ph.D.
Nicole M. Rodriguez, Ph.D.

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INDICES OF HAPPINESS AND UNHAPPINESS DURING TREATMENT OF PEDIATRIC FEEDING DISORDERS

Laura E. Phipps, Ph.D.

University of Nebraska, 2021

Supervisor: Kathryn M. Peterson, Ph.D.

To date, there is no research on the measurement or evaluation of indices of happiness and unhappiness for children receiving behavior-analytic treatment for feeding disorders. The purpose of the current study was to measure child indices of happiness and unhappiness before and during extinction-based treatment and to evaluate the effects of noncontingent reinforcement with extinction-based treatment on indices of happiness and unhappiness. Overall, indices of happiness were idiosyncratic, and indices of unhappiness were initially higher during extinction without noncontingent reinforcement compared to with noncontingent reinforcement. Percentage of acceptance increased for all participants during both treatments, and caregiver treatment acceptability was high overall. Results provided preliminary evidence that noncontingent reinforcement could serve to mitigate indices of unhappiness during the initial implementation of extinction-based treatment, but caregiver preference for minimal treatment components may supersede these temporary benefits. The implications of these findings on clinical practice and future research are discussed.

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INTRODUCTION

In the practice of behavioral science, the variables under study are selected based on their importance to man and society (Baer et al., 1968). Specifically, behavior analysts identify target behaviors and then systematically implement interventions to increase or decrease those behaviors, with the ultimate goal of improving the individual's quality of life. Singh et al. (2004) suggested that *quality of life* could be defined as the number of opportunities for normal functioning in daily life (e.g., eating at a restaurant, attending school), the level of accessibility to external resources (e.g., proximity to grocery stores, hospitals), and the variety of experiences of subjective wellbeing (e.g., the degree to which individuals experience various emotions, such as happiness and unhappiness, during daily routines; Green & Reid, 1999).

Emotions, like happiness or unhappiness, are often referred to as private events or hypothetical constructs, given that they can only be measured by observing the public behavior presumed to correlate with the corresponding internal experience (e.g., crying, smiling; Skinner, 1945). Ekman and Freisen (1975) suggested that there is a universality to recognizing and behaving toward facial expressions that are associated with discrete emotional states, such as happiness. One challenge, however, is that not all individuals demonstrate the same public behavior under similar conditions when they are experiencing emotions (e.g., shedding tears of happiness, smiling during moments of sadness). Because of these differences, it could be difficult to determine whether the majority of individuals would agree upon which types of emotions correlate with specific public behavior.

Several researchers have attempted to operationalize and validate definitions for indices of happiness and unhappiness (Favell et al., 1996; Green & Reid, 1996; Green et al., 1997; Parsons et al., 2012). Green and Reid (1996, p. 69) defined happiness as, "…facial expression(s) or vocalization(s)…including smiling, laughing, and yelling while smiling," and unhappiness as "facial expression(s) or vocalization(s) …such as frowning, grimacing, crying, and yelling

without smiling." Green and Reid also confirmed the validity of these definitions by evaluating whether indices of happiness or unhappiness would occur more or less frequently in the presence or absence of preferred items, respectively. In later studies, researchers included additional measures to validate operationalized definitions by recruiting college students, teacher assistants, and caregivers of adults with developmental delays to observe videos and record their opinions of happiness and unhappiness (Green et al., 1997; Parsons et al., 2012). Although these studies helped to identify operational definitions, they did not evaluate how to increase happiness or reduce unhappiness.

Several studies have shown that staff members working with adults with disabilities in residential settings could increase their client's indices of happiness by presenting preferred items and engaging in high-quality social interactions during leisure time (Darling & Circo, 2015; Davis et al., 2004; Green et al., 1997; Green & Reid, 1996; Ivancic et al., 1997; Moore et al., 2007). For example, Realon et al. (2002) evaluated a Positive Environment Program (Favell et al., 1996) by teaching staff to change their responding toward the facility's residents. Experimenters taught staff to establish eye contact, provide more frequent positive comments, increase and appropriately distribute interactions, respond to communication attempts, and provide greater access to leisure materials. Following training, the residents' happiness ratings increased relative to baseline. Continued research is necessary to determine how to increase happiness during less preferred or more effortful tasks (e.g., adaptive tasks that are essential to daily functioning, such as feeding, hygiene, or chores).

Studies to date, such as Realon et al. (2002), have focused on assessing or intervening on happiness for adults with severe intellectual disabilities (Dillon & Carr, 2007). In one notable exception however, Thomas et al (2019) measured happy behavior (e.g., smiling, laughing) during the assessment and treatment of problem behavior for children diagnosed with autism. Thomas et al. found that happiness was higher when children had access to social interaction than

when they had access to tangible items during intervention for problem behavior that was maintained by access to tangibles.

Outside of the study conducted by Thomas et al. (2019), no other researchers, to our knowledge, have assessed or identified the variables associated with "subjective wellbeing" or happiness in children with autism during and after treatment (Vermeulen, 2014). Moreover, these variables remain entirely unexplored for children with feeding disorders (i.e., avoidant/restrictive food intake disorder [ARFID]; American Psychiatric Association [APA], 2013). Pediatric feeding disorders occur in approximately 20-50% of typically developing children and up to 89% of children with developmental or related disabilities (Benjasuwantep et al., 2013). Mealtime difficulties for children with feeding disorders typically include but are not limited to, refusal to eat or drink sufficient quantities or a variety of food and liquid to sustain appropriate nutrition and growth (5th ed.; DSM-5; APA, 2013; Piazza et al., 2015; Schreck et al., 2004).

Feeding disorders often develop as a result of multiple factors, such as oral-motor skill deficits (e.g., poor lip closure), a history of complex medical conditions associated with painful experiences while eating (e.g., gastroesophageal reflux), resistance to change (e.g., children with autism who refuse non-preferred or novel foods), or a combination of these factors (Ibañez et al., 2021). Furthermore, children with feeding disorders often display multiple topographies of inappropriate mealtime behavior that interfere with timely acceptance (e.g., head-turning, pushing away the utensil) and consumption (e.g., pocketing or spitting out food or liquid). Children with feeding difficulties engage in these challenging behaviors and also may display additional indices of unhappiness (e.g., crying, grimacing) during meals if eating and drinking are challenging or effortful (e.g., due to skill deficits), if their typical experience with eating and drinking has been painful (e.g., reflux), if caregivers present nonpreferred or novel foods (e.g., resistance to change), or if they experience a combination of those factors.

Empirical research on treatment for pediatric feeding disorders has demonstrated that behavior-analytic interventions are highly effective at decreasing inappropriate mealtime

behavior and increasing acceptance of solids and liquids (Kerwin, 1999; Volkert & Piazza, 2012). Researchers hypothesize that inappropriate mealtime behavior is learned and often maintained by social consequences, such as escape from the feeding demand (Piazza et al., 2003). Escape extinction has been identified as the only well-established treatment to reduce inappropriate mealtime behavior (e.g., nonremoval of the spoon; Piazza et al., 2015; Volkert & Piazza, 2012) and is often necessary to increase consumption of healthy, target foods (e.g., Reed et al., 2004) for children with feeding disorders.

Although highly effective and robust, extinction-based interventions have been associated with undesirable side effects. Extinction bursts, characterized as temporary increases in problem behavior or emotional responding (e.g., crying), can occur following extinction implementation (Lerman et al., 1999). For example, Woods and Borrero (2019) observed extinction bursts for three of ten children receiving treatment for food refusal. Thus, despite the effectiveness and significant benefits of escape extinction, there is a risk that caregivers might not use the intervention if they are concerned about increases in emotional responding or if the caregiver does not perceive there to be short- or long-term concurrent improvements in the child's affect (Dillon & Carr, 2007).

Research suggests that noncontingent access to reinforcement can reduce the likelihood of extinction-induced side effects (Carr et al., 2000). One hypothesis is that access to reinforcement decreases the averseness of a demand and ultimately reduces the motivating operation to escape (Wallace et al., 2012). Even though noncontingent reinforcement is an efficacious treatment for aberrant behavior, such as self-injury or aggression (Carr et al., 2000; Roscoe et al., 2013), there are only a few studies that have evaluated the effects of noncontingent reinforcement with extinction procedures on problem behavior specific to feeding (Allison et al., 2013; Berth et al., 2019; Reed et al., 2004; Smith et al., 2019). Reed et al. (2004) demonstrated that NCR in combination with escape extinction resulted in fewer bursts of inappropriate mealtime behavior and near-zero levels of negative vocalizations for all participants. Based on

these findings, there is a need to further evaluate the benefits of adding noncontingent reinforcement at the onset of escape extinction procedures, especially if the addition could reduce or mitigate extinction bursts or other perceived indices of child unhappiness that could negatively affect caregiver commitment to feeding treatment.

To date, there is no research on the measurement or evaluation of child indices of happiness and unhappiness during intensive treatment of pediatric feeding disorders and limited research on the effects of noncontingent reinforcement during feeding interventions. Thus, the purpose of the current study was to (a) determine the reliability and social validity of comprehensive measures for child indices of happiness and unhappiness during treatment for pediatric feeding disorders, (b) investigate whether those measures capture an increase or decrease relative to baseline indices of happiness and unhappiness during function-based treatment, (c) evaluate the mitigating effects of environmental enrichment (i.e., noncontingent access to preferred items and attention) with extinction on indices of unhappiness and the collateral effects on indices of happiness, and (d) determine caregiver preference and treatment acceptability for escape extinction with or without environmental enrichment.

CHAPTER 1: METHOD

Participants

The five children who participated in the study had a diagnosis of avoidant restrictive food intake disorder and attended an intensive day-treatment feeding program 5 days per week from approximately 9:00 a.m. to 5:00 p.m. Inclusion criteria were that the child (a) was between the ages of 8 months and 10 years; (b) was safe for oral feeding based on the results of a swallow evaluation conducted by a swallowing expert (e.g., Speech and Language pathologist); (c) was medically appropriate for the intensive feeding program based on an evaluation by a physician; and (d) had inappropriate mealtime behavior that was maintained by escape from bite presentations, drink presentations, or both. Exclusion criteria were that the child (a) did not meet

inclusion criteria, (b) was unsafe for oral feeding, and (c) did not demonstrate a differentiated escape function in a functional analysis of inappropriate mealtime behavior.

The program dietitian used the children's age and sex to select the appropriate Centers for Disease Control and Prevention (2000) growth chart on which to plot body-mass index, height, and weight. The program dietician reviewed a 3-day food log, completed by the child's caregiver, to assess whether the child met their calorie, fluid, and nutritional needs at admission. Oral consumption fluctuated daily for children who did not meet 100% of their calorie needs despite prescribed g-tube feedings. Phineas and Sutton were 4-year-old males and identical twins diagnosed with cystic fibrosis. Phineas received 78% and 56% of his daily calorie and fluid needs, respectively, via gastrostomy-tube feedings of Peptamin Jr 1.5. Phineas was in the 83rd, 50th, and 72nd percentiles for body-mass index, height, and weight, respectively. Sutton received 79% and 46% of his daily calorie and fluid needs, respectively, via gastrostomy-tube feedings of Boost and Pedialyte and met 5% of his calorie needs via oral consumption of solids. Sutton was in the 77th, 50th, and 66th percentiles for body-mass index, height, and weight, respectively.

Roy was a 4-year-old male diagnosed with autism spectrum disorder. Roy received 56% and 44% of his daily calorie and fluid needs, respectively, via gastrostomy-tube feedings of Nutren Jr and met 19% of his calorie needs via oral consumption of solids and liquids. Roy was in the 51st, 15th, and 22nd percentiles for body-mass index, height, and weight, respectively.

Ayden was a 2-year-old male diagnosed with a global developmental delay. Ayden received 100% of his daily calorie and fluid needs via gastrostomy-tube feedings of Complete Pediatric Blend. Ayden was in the 22nd, 5th, and 5th percentiles for body-mass index, height, and weight, respectively.

Paige was a 4-year-old female with cerebral palsy. Paige consumed 100% and 102% of her daily calorie and fluid needs via oral consumption, however, Paige only consumed foods at a pureed texture and only drank liquids when fed to her by a caregiver. Paige was in the 22nd, 46th, and 40th percentiles for body-mass index, height, and weight, respectively.

Setting and Materials

Feeders conducted meals in rooms in a pediatric feeding disorders program at a university-based medical facility. Each room was connected to a booth with one-way observation and two-way audio and sound monitoring. Rooms included tables, chairs for the feeder and data collectors, developmentally- and weight appropriate seating for the child (i.e., highchair, booster seat, and tomato chair), feeding utensils (e.g., small maroon spoons, cut-out cups), plastic bowls, one orange and one blue picture card, and a food scale. Sutton and Ayden's target foods for the treatment evaluation were chicken, green bean, pear, and potato. Phineas, Sutton, Roy, and Ayden's caregivers selected a calorically, nutritionally, and age-appropriate liquid (e.g., Pediasure) to target for treatment.

Feeders and Observers

Feeders and observers (i.e., data collectors) were staff members in the pediatric feeding disorders program who held or were in pursuit of a Bachelor's, Master's, or Doctoral Degree in psychology, applied behavior analysis, or a related field and who completed Relias™ training (i.e., behavior-technician training approved by the behavior analyst certification board; Relias, 2021). Feeders and observers were not blind to the experimental hypothesis. The first author did not share the data for indices of happiness and unhappiness until the treatment evaluation was complete. The first author used behavioral-skills training to teach feeders and observers to implement the functional analysis, baseline, and treatment protocols and to collect data. Before feeders conducted a functional analysis or implemented treatment with the children, they implemented the functional-analysis conditions and treatment protocol with 80% or greater integrity for three consecutive role-play scenarios. For the dependent variables researchers commonly evaluate in the feeding literature (e.g., acceptance, inappropriate mealtime behavior), observers could serve as data collectors after their interobserver agreement was 80% or greater with a trained data collector for a minimum of three recorded and three live sessions. Observers

collected data on indices of happiness and unhappiness for two recorded sessions of baseline, two initial treatment sessions, and two end-of-treatment sessions until they reached 80% interobserver total agreement with the first author on all six videos. If the observers did not meet 80% interobserver agreement, the first author met with the observer, reviewed the definitions, and provided verbal corrective feedback before the observer collected data on the videos a second or third time.

Response Measurement, Procedural Integrity, and Interobserver Agreement

Response Measurement

Trained observers used laptop computers and DataPal 1.0 software (i.e., a beta version of BDataPro; Bullock et al., 2017) to record bite or drink presentations, acceptance, mouth clean, inappropriate mealtime behavior, negative vocalizations, indices of happiness and unhappiness, and procedural integrity. Observers scored a *presentation* when the feeder touched the utensil to the child's lips not including when the utensil touched the lips during re-presentation. We will use the term *entire presentation* hereafter to refer to the volume of solids or liquids presented on the utensil or in the cup minus a pea-sized volume or smaller. Observers scored the occurrence of *acceptance* when the child opened their mouth in the absence of negative vocalizations, or the child opened their mouth and leaned forward while engaging in negative vocalizations and the entire bite or drink passed the plane of the wet vermillion of the child's lips and was deposited into the child's mouth within 5 s of presentation. Observers scored *mouth clean* when no food or liquid larger than a pea sized amount was in the child's mouth 30 s after the entire presentation entered the child's mouth, not including when the bite or drink entered the mouth during re-presentation. Datapal 1.0 converted acceptance to a percentage for each session after dividing the number of acceptances by the number of presentations. Datapal 1.0 converted mouth clean to a percentage for each session after dividing the number of mouth cleans by the number of bites or drinks that entered the mouth.

Observers scored the frequency of *inappropriate mealtime behavior* when the utensil was within arm's reach of the child, and the child (a) moved the middle of their mouth 45° or more in any direction or 6.4 cm away from the utensil, (b) changed direction or paused for 1 s and then moved their head another 45° in any direction or 6.4 cm away from the previous position, (c) contacted the utensil or any part of the feeder's arm or hand with their hand or another object (e.g., bib), (d) threw the utensil, or (e) placed their hand or arm within 5.1 cm of their mouth (i.e., blocked their mouth). Datapal 1.0 converted the frequency of inappropriate mealtime behavior to responses per minute by dividing the number of inappropriate mealtime behaviors during the session by the duration the utensil was within arm's reach of the child.

Observers scored *negative vocalizations* when the child cried, screamed, whined, cursed, or made negative refusal statements about the meal context at any volume. Observers depressed a key that activated a timer on the data-collection program when the child had negative vocalizations for 3 consecutive seconds and depressed a key that stopped the timer when no negative vocalizations had occurred for 3 consecutive seconds. Datapal 1.0 converted negative vocalizations to a percentage after dividing the duration of negative vocalizations during the session by the session duration.

Observers used a 30-s momentary time-sampling procedure to score the occurrence of an *index of happiness* if the child was not engaging in inappropriate mealtime behavior, negative vocalizations, or using sign language to communicate disapproval, and the child (a) laughed or smiled; (b) communicated approval about the food, feeder, or meal context (e.g., the child said, "Yummy" or signed, "more") via vocal statement or sign; or (c) had physical contact with the feeder that appeared to be affectionate (e.g., high five, hug) initiated by the child or the feeder. Observers scored the occurrence of an *index of unhappiness* when the child (a) grimaced or frowned; (b) communicated disapproval about the food, feeder, or meal context (e.g., the child said, "I hate my bites," or the child signed, "all done") via vocal statement or sign; (c) had physical aggression toward the feeder; (d) had inappropriate mealtime behavior; or (e) made

negative vocalizations. Observers converted indices of happiness and unhappiness per session, respectively, to percentages after dividing indices of happiness or unhappiness, respectively, by the number of 30-s intervals in the session. Observers calculated the number of intervals in a session by dividing the session duration in seconds by 30 and rounding the resulting quotient to the nearest whole number.

Procedural Integrity

Observers scored *correct-utensil placement* during 100% of sessions across children. Observers depressed a key that started a timer in the data-collection program when the feeder met the criterion for correct-utensil placement and depressed a key that stopped the timer when the feeder did not meet criterion for correct-utensil placement for 3 s. Correct-utensil placement occurred across conditions when the feeder (a) presented the utensil to the child's lips at the scheduled interval; (b) removed the utensil after the bite or drink entered the mouth; and (c) held the utensil to the side of the child's mouth if the child coughed, gagged, or vomited and returned the utensil to the child's lips when coughing, gagging, or vomiting stopped for 3 s. Additional condition-specific criteria for correct-utensil placement were as follows. During the function-based baseline, observers scored correct-utensil placement when the feeder removed the utensil from the child's lips within 3 s after the occurrence of inappropriate mealtime behavior. During function-based extinction, observers scored correct-utensil placement when the feeder (a) placed the utensil at the child's lips, (b) held the utensil at the lips until they could deposit the bite or drink into the child's mouth or 10 min had elapsed from session initiation, and (c) used the utensil to re-present expelled bites or drinks into the child's mouth within 3 s of the expulsion (defined as any food or liquid larger than the size of a pea exiting the child's mouth). Datapal 1.0™ converted the duration of correct-utensil placement to a percentage after dividing the duration of correct-utensil placement by the session duration. Mean correct utensil placement across treatment evaluations were 98% (range, 71%-100%) for Phineas' liquids, 98% (range, 66%-99%)

for Sutton's solids, 98% (range, 51%-99%) for Sutton's liquids, 97% (range, 18%-99%) for Roy's liquids, 99% (range, 74%-99%) for Ayden's solids, 99% (range, 74%-99%) for Ayden's liquids, and 99% (range, 98%-100%) for Paige's solids.

Observers measured correct procedure for 100% of sessions across treatment evaluations. Observers scored *correct procedure* when the feeder was scheduled to present the next bite or drink if the bite or drink did not enter the child's mouth, after the mouth-check interval if the feeder was scheduled to present another bite or drink, when the child stopped expelling for 3 s if they had been expelling when the feeder was scheduled to present the next bite or drink, after the child had no food or drink the size of a pea or larger in their but mouth before 10 min elapsed from the start of the session if the child was packing after the fifth bite or drink presentation, or when 10 min elapsed from the start of the session if the child was packing after the fifth bite or drink presentation. Correct procedure occurred if the feeder demonstrated *all* of the following: (a) used the correct utensil with the correct bolus size (e.g., cut-out cup, 2-cc bolus); (b) delivered the vocal instruction, "Take a bite (drink)" when the utensil touched the child's lip at presentation; (c) deposited the bite or drink within 5 s of presentation if the child met the criterion for acceptance; (d) delivered vocal, behavior-specific praise (e.g., "Good job taking your bite!") within 5 s of acceptance and within 5 s of a mouth clean; (e) conducted a mouth-clean check 30 s after the bite or drink entered the mouth; (f) delivered a vocal instruction to, "Swallow your bite (drink)" within 5 s of the mouth-clean check if the child packed (i.e., held food or liquid larger than a pea-sized amount in the mouth); (g) delivered the vocal instruction to swallow every 30 s if the child packed the fifth bite or drink until there were no solids or liquids in the child's mouth or until 10 min had elapsed from session initiation; (h) provided no additional differential consequences for coughing, gagging, or vomiting beyond moving the utensil to the side of the child's mouth when the behavior occurred and back to touching the child's lips when the behavior stopped for 3 s, and the protocol specified keeping the utensil at the child's lips ; (i) presented the next bite or drink within 5 s of the next scheduled presentation interval; and (j) the

correct discriminative stimulus for the function-based treatment condition was present. Datapal 1.0 converted correct procedure to a percentage after dividing the number of presentations with correct procedure by the number of presentations in the session. Mean correct procedure across treatment evaluations were 99.5% (range, 75%-100%) for Phineas' liquids, 100% for Sutton's solids, 99% (range, 80%-100%) for Sutton's liquids, 99% (range, 80%-100%) for Roy's liquids, 99% (range, 80%-100%) for Ayden's solids, 99% (range, 66 %-100 %) for Ayden's liquids, and 98 % (range, 60 %-100 %) for Paige's solids.

Observers measured incorrect procedure for 100% of sessions across treatment evaluations. Observers scored *incorrect procedure* once per bite or drink presentation when the feeder (a) delivered prompts not specified by the protocol or (b) engaged in incorrect vocalizations (e.g., statements of comfort, reprimands, attempts to distract) or incorrect nonverbal behavior (e.g., physical touches of comfort, eye rolls, heavy sighs) within 3 s of inappropriate mealtime behavior, cough, gag, pack, expel, onset of negative vocalizations, vomiting, or the bite or drink entering the child's mouth after 5 s of presentation. Datapal 1.0 converted incorrect procedure to a percentage after dividing the occurrences of incorrect procedure by the number of bite or drink presentations in the session. Mean incorrect procedure for each treatment evaluation was 1% (range, 0%-20%) for Phineas' liquids, 2% (range, 0%-100%) for Sutton's solids, 0% for Sutton's liquids, 0.2% (range, 0%-20%) for Roy's liquids, 0% for Ayden's Solids, 0.2% (range, 0%- 20%) for Ayden's liquids, and 0% for Paige's solids.

Interobserver Agreement

Two observers simultaneously and independently collected data on a mean of 47% (range, 21%-58%) of sessions across treatment evaluations. DataPal 1.0 divided each session into 10-s intervals to calculate interobserver agreement. Data Pal 1.0 calculated total agreement coefficients for acceptance, correct procedure, incorrect procedure, and indices of happiness and unhappiness by dividing the total number of agreements (defined as both observers scored the

occurrence or did not score the occurrence of the behavior in the interval) by the total number of agreements plus disagreements (one observer scored and the other observer did not score the occurrence of the behavior in the interval) and converting this ratio to a percentage. Data Pal 1.0 calculated exact agreement for inappropriate mealtime behavior by dividing the number of exact agreements (defined as both observers scoring the same frequency of the behavior in an interval) by the number of exact agreements plus disagreements (defined as observers scoring different frequencies of the behavior in an interval) and converting this ratio to a percentage. Data Pal 1.0 calculated partial agreement-within-intervals for correct-utensil placement and negative vocalizations by dividing the interobserver agreement per interval (defined as observers scoring the same duration for the corresponding measure) by the total number of intervals and converting this ratio to a percentage. Mean interobserver agreement across participants for acceptance was 97% (range, 94%-98%), for inappropriate mealtime behavior was 94% (range, 91%-97%), for negative vocalizations was 98% (range, 92%-100%), for correct utensil placement was 96% (range, 91%-98%), for correct procedure was 93% (range, 88%-97%), for incorrect procedure was 99% (range, 97%-100%), for indices of happiness was 98% (range, 98%- 99%), and for indices of unhappiness was 99% (range, 98%- 99%).

Experimental Design

We used a pairwise design for the functional analysis to identify the reinforcers for inappropriate mealtime behavior by comparing levels of inappropriate mealtime behavior in each test condition to the control condition (Iwata et al., 1994). We conducted six treatment evaluations, solids treatment evaluations for Sutton and Ayden and liquids treatment evaluations for Phineas, Sutton, Roy, and Ayden based on the child's clinical needs. We used an alternating treatments and reversal designs to compare function-based treatment with and without NCR across children. For Roy's liquids and Phineas' solids evaluation we used an ABAB design, where A was the escape baseline, B was alternating escape extinction with and without NCR. For

Sutton and Ayden's solids and Sutton's liquids evaluation, A was an escape and attention baseline and B was alternating escape and attention extinction with and without NCR. For Ayden's liquids evaluation, we used an ABABC design, where A was an escape and attention baseline, B was alternating escape extinction with and without NCR, and C was alternating escape and attention extinction with and without NCR plus a chin prompt in both function-based treatment conditions. For Paige's' solids evaluation, we used a ABCDAD design, where A was an escape and attention baseline, B was alternating escape and attention extinction with and without NCR, C was alternating escape and attention extinction with an EZ spoon with and without NCR, and D was alternating escape and attention extinction with a .2cc bolus with and without NCR. The alternating treatments design allowed us to compare the effects of both treatment procedures on levels of acceptance and indices of happiness and unhappiness.

General Procedure

Feeders conducted three, 40-min meals and two, 30-min meals per day with at least a 40-min break between meals. Feeders conducted multiple five-bite sessions in meals with solid foods and multiple five-drink sessions in meals with liquids with approximately 1 min between sessions so observers and feeders could prepare for the next session (e.g., reset data-collection program). The number of sessions per meal varied because the duration of each session depended on child behavior.

For meals with solids, the feeder presented 1 ml of pureed food, which was table food blended until smooth with liquid added as needed, on a small maroon spoon. To obtain the correct amount of food on the spoon, the feeder scooped food onto the spoon, scraped the bowl of the spoon upwards on the side of the dish to flatten the bolus, and scraped the bottom of the bowl of the spoon on the dish to remove residual puree (Haney et al., 2021). Feeders presented chicken, green bean, pear, and potato and arbitrarily selected the presentation order of the four foods before each session. Feeders presented three foods once and one food twice during each session.

The feeders used the same four foods in every condition and phase to control for potential differences in child behavior as a function of food type (Patel et al., 2002). For meals with liquids, the feeders presented 2 ml for Sutton and Roy and 1 ml for Ayden of the caregiver-selected drink (e.g., Pediasure) in a cut-out cup.

At the start of the session, the feeder presented a bite or drink by touching the child's lips with the utensil and saying, "Take a bite (drink)." If the child accepted the bite or drink, the feeder delivered behavior-specific praise (e.g., "Good job taking your bite!"). The feeder activated a 30-s timer after the entire presentation entered into the child's mouth. The feeder conducted a mouth-clean check when 30 s elapsed by saying, "Show me" and modeling an open mouth. If the child did not open their mouth within 3 s of the verbal and model prompt, the feeder inserted a rubber-coated baby spoon between the child's lips and gently turned the spoon 90° to prompt the child to open their mouth. The feeder delivered behavior-specific praise (e.g., "Good job swallowing your bite!") if the child had a mouth clean or said, "You need to swallow your bite (drink)" if the child was packing, then presented the next bite or drink. If the child was packing after the feeder presented the fifth bite or drink, the feeder conducted a mouth-clean check with a vocal instruction to swallow every 30 s until there was no food or liquid larger than a pea in the child's mouth or 10 min elapsed from the start of the session. If the child coughed, gagged, or vomited while the spoon was touching the lips, the feeder moved the utensil to the side of the child's lips until the child stopped coughing, gagging, or vomiting but did not deliver additional differential consequences.

Functional Analysis

We conducted functional analyses of inappropriate mealtime behavior for solids and liquids using the procedure Kirkwood et al. (2021) described. We observed caregivers provide escape or escape and attention following inappropriate mealtime behavior during unstructured and structured meal observations. Thus, we conducted escape and attention test conditions with

all children. Feeders followed the general procedures in addition to the specified procedure described below.

For the attention and control conditions, the feeder presented and held the utensil for 30 s in the position in space in which the feeder touched the child's lips if the child did not open their mouth such that the feeder could deposit the bite or drink. The feeder placed a preferred item on the table or tray and interacted with the child throughout the session by singing, commenting on the toy, and playing with the child and presented a bite or drink approximately every 30 s if acceptance did not occur during the control condition. In the attention condition, the feeder delivered 30 s of the type of attention the caregivers provided during direct observations immediately after the first instance of inappropriate mealtime behavior. The feeder removed the bite or drink for 30 s immediately after the occurrence of inappropriate mealtime behavior during the escape condition. The feeder presented the next bite or drink in the attention and escape conditions (a) after the 30-s reinforcement interval, or (b) 30 s after the previous presentation if the child did not accept the bite and did not engage in inappropriate mealtime behavior.

Treatment Evaluation

Function-Based Baseline

The feeder used the procedure for the escape condition of the functional analysis for Phineas and Roy as escape was identified as the reinforcer for inappropriate mealtime behavior. The feeder combined the contingencies of the escape and attention conditions of the functional analysis for Sutton and Ayden as escape and attention were identified as the reinforcers for inappropriate mealtime behavior. The feeder removed the bite or drink and delivered attention as described above for 30 s following inappropriate mealtime behavior during the escape and attention baseline for Sutton and Ayden.

Discriminative Stimuli

Each function-based treatment condition was associated with a discriminative stimulus, a blue or orange card for function-based treatment without and with NCR, respectively. The feeder placed the appropriate discriminative stimulus on the table or the wall out of the child's reach but in their line of sight. The feeder ensured the child attended to the card by instructing the child to orient to it (e.g., touch the card) for the first session of the first meal of the treatment conditions. The feeder stated the contingencies associated with the condition before each session. The feeder said, "We are on blue right now, so I cannot talk to you or give you toys right now" or "We are on orange right now, so I can talk to you and give you toys right now" for function-based without and with NCR sessions, respectively.

Function-Based Extinction

Escape extinction was the function-based treatment for Phineas and Roy whose inappropriate mealtime behavior was maintained by escape. Escape and attention extinction was the function-based treatment for Sutton and Ayden whose inappropriate mealtime behavior was maintained by escape and attention. Although the procedure for escape extinction and escape and attention extinction was identical structurally, children whose inappropriate mealtime behavior was maintained by escape and attention experienced a change from the feeder providing attention following inappropriate mealtime behavior during baseline to the feeder providing no differential attention following inappropriate mealtime behavior during escape and attention extinction.

The feeder implemented the general procedure. Following presentation, the feeder kept the utensil touching the child's lips. If the child did not accept the bite or drink, the feeder gently applied slight pressure with the tip of the spoon or cup lip to the child's lips; moved the spoon or cup horizontally across the lips; and periodically rotated the spoon bowl or cup lip approximately 20° to the left and right, which we refer to as wiggling the spoon or cup. The feeder used these maneuvers to find an opening between the child's lips such that the feeder could deposit the bite or drink as quickly as possible to minimize escape. If the child did not close their lips around the

spoon bowl when the feeder inserted the spoon into the mouth, the feeder placed the bowl of the spoon against the upper front teeth, then pulled the spoon out of the mouth by gently dragging the bowl against the upper front teeth while lifting the spoon handle up as the spoon exited the mouth to deposit the bite on the upper front teeth (Ibañez, 2021). If the child did not close their lips around the cup, the feeder placed the cup lip against the child's lower lip and slowly tilted the bottom of the cup upward such that the liquid entered the child's mouth. The feeder re-presented expelled bites or drinks by scooping up the food or liquid with the utensil within 3 s of expulsion and re-depositing the food or liquid when the child opened their mouth. If the child continued to expel the bite or drink at the next scheduled bite or drink presentation, the feeder vocally instructed the child to swallow the bite or drink every 30 s until the bite or drink remained in the child's mouth for 3 s, in which case the feeder presented the next bite or drink, or until 10 min elapsed from the start of the session, in which case the feeder ended the session.

Function-Based Extinction plus NCR

Therapists conducted a paired-stimulus preference assessment (Fisher et al., 1992) to identify the child's preferred items. Before each session, the feeder presented the child's three most preferred items identified in the paired-stimulus preference assessment and prompted the child to pick one. If the child did not select an item, the feeder randomly selected one. The feeder implemented function-based extinction with the following changes. The feeder placed the item the child or feeder selected in the presession preference assessment on the table or tray and interacted with the child without pausing for more than 3 s by conversing with the child; making positive statements about the child; interacting with and commenting on the preferred item; and singing songs. If the child threw or pushed the preferred item off the table or tray, the feeder did not retrieve or replace it.

Blocking for Phineas and Roy

Phineas and Roy engaged in high levels of inappropriate mealtime behavior during the function-based treatments such that the feeder's correct-utensil placement integrity was below 85% for three consecutive sessions. Therefore, a therapist stood behind the child and hovered their arms approximately 2.5 cm above the child's arms, such that the child would contact the therapist's arms before contacting the utensil or cup during treatment beginning with Session 16 for Roy and Session 23 for Phineas. After we completed the treatment evaluation, the clinical team faded the second therapist from sessions so that caregivers could implement the treatment independently.

Additional Treatment Components for Ayden and Paige

Feeders observed that Ayden was not closing his lips after liquid entered his mouth during liquids sessions, and the liquid was running out of his mouth. Therefore, feeders added a chin prompt (Wilkins et al., 2013) in which they placed their thumb vertically below Ayden's lip and applied gentle pressure while moving the thumb upwards to prompt the lips to close. For Paige's solids treatment evaluation, the functional analysis and baseline included the presentation of a bite on a flipped small Maroon spoon because Paige accepted bites from an upright small Maroon spoon without inappropriate mealtime behavior, but engaged in high levels of expulsion, during the initial structured meal observations at the beginning of her day-treatment admission. With the introduction of a flipped small Maroon spoon to target expulsions, we observed Paige's inappropriate mealtime behavior increase to high levels, which warranted the introduction of function-based extinction. The flipped-spoon procedure involved placing the bottom of the bowl of the spoon on the back and center portion of her tongue, flipping the spoon (i.e., rotating the spoon 180°) to deposit the bolus directly on the tongue, and gently pulling the spoon out of the child's mouth in a downward motion (Ibañez et al, 2020). However, the first author observed that feeders were not consistently depositing the entire bolus centrally on the child's tongue off the small Maroon spoon, possibly due to the large size and shape of this spoon. Therefore, after 22

sessions, feeders switched to a flipped EZ spoon. Paige continued to engage in variable levels of acceptance and high and prolonged indices of unhappiness with the flipped EZ spoon, therefore the bolus size of 1 cc reduced to a .2 cc amount of pureed solid on the flipped EZ spoon.

Social Validity Measures

Caregivers

Caregivers completed a three-item treatment-acceptability questionnaire on three occasions during the treatment evaluation: (a) after they observed at least one session in the function-based baseline condition conducted before beginning treatment, (b) after they observed the first session of function-based treatment without NCR and function-based treatment with NCR, and (c) after they observed at least one session where acceptance was 100% after a return to function-based treatment without NCR and function-based treatment with NCR. Caregivers completed the treatment-acceptability questionnaires (e.g., a total of 5 questionnaires) for either a solids or liquids treatment evaluation to prevent caregiver frustration with filling out multiple questionnaires. The questionnaire items were: (a) I am motivated to try this treatment, (b) This treatment is reasonable for the inappropriate mealtime behavior I encounter at home, and (c) Overall, the treatment is beneficial for my child. Caregivers used a 6-point Likert scale to rate each item (i.e., 6 = strongly agree, 5 = agree, 4 = slightly agree, 3 = slightly disagree, 2 =disagree, and 1 = strongly disagree), such that the highest possible score on the questionnaire was 18.

Feeders asked the caregiver to return the completed questionnaire in a sealed envelope. Feeders delivered the sealed envelope to the first author without reviewing the results. The first author reviewed the questionnaires at the end of each child's treatment evaluation and then approached the caregiver by asking whether they preferred the function-based treatment with or without NCR and implemented the procedure the caregiver chose. If the caregiver expressed difficulty with making a decision, the first author offered to display the results for acceptance on a graph, such that the caregiver could observe potential differences between the two treatments to

help inform their decision. If the caregiver asked the first author for a recommendation (e.g., "What would you choose?), the first author stated, "I cannot give you a recommendation, but I assure you that there is no right or wrong answer."

Practitioners

The first author contacted five pediatric dental residents and five dental faculty from a university-based medical facility via e-mail and invited them to provide an additional validity measure for the study. The first author sent three video samples from Ayden's solids treatment evaluation to the pediatric dentists who chose to participate (i.e., one dental resident, four dental faculty). The first author obtained consent from Ayden's caregiver and used a protected server and video-storage system to share the video while maintaining patient privacy and compliance with HIPAA regulations. We invited pediatric dentists to participate because they regularly work with children with and without autism or related disabilities and regularly conduct potentially nonpreferred but medically necessary routines and procedures that focus on the mouth (e.g., dental workup, dental X-rays).

The videos included one session with relatively high indices of happiness (i.e., 37% for Ayden) and one session with relatively high indices of unhappiness (i.e., 60% for Ayden). The first author randomized the order in which each dentist was instructed to watch the videos to control for sequence effects. The purpose of the ratings was to assess whether untrained observers who were not associated with the child's feeding treatment or team agreed with the operational definitions for indices of happiness and unhappiness.

Like the procedure Green et al. (1996) used, the first author asked the pediatric dentists to rate indices of happiness and unhappiness in each video using a 6-point Likert scale (i.e., extremely happy = 6, mildly happy = 5, moderately happy = 4, moderately unhappy = 3, mildly unhappy = 2, extremely unhappy = 1). The first author compared the dentists' ratings to those of the trained observers to assess agreement. The dentist's rating agreed with the trained observer if

the dentist scored a 5 or 6 for the video with high indices of happiness and a 1 or 2 for the video with high indices of unhappiness. The dentist rating disagreed with the trained observer if the dentist scored 1, 2, 3, or 4 for the video with high indices of happiness and 3, 4, 5, or 6 for the video with high indices of unhappiness.

CHAPTER 2: RESULTS

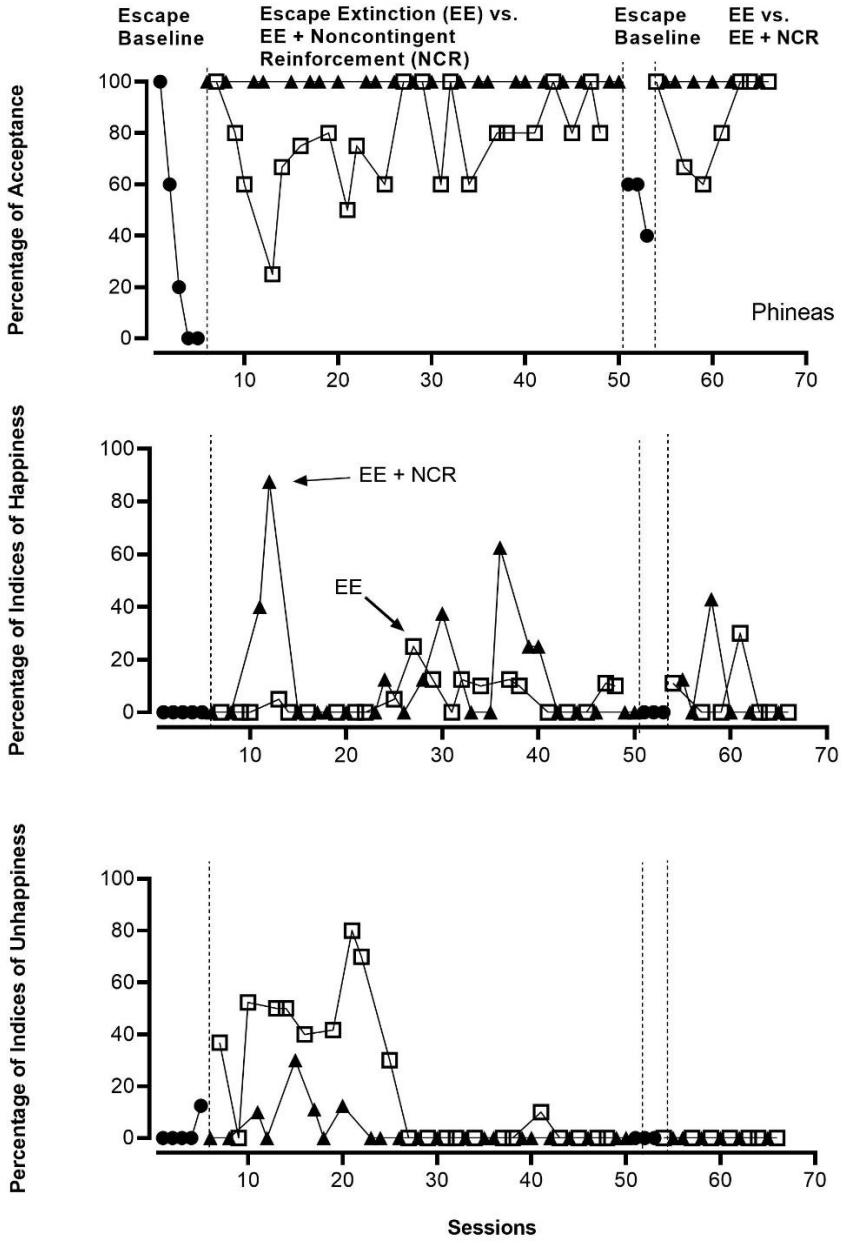
Treatment Evaluations

The figures show data for the primary targets of the study, acceptance (top), indices of happiness (middle), and indices of unhappiness (bottom). Figure 1 displays results of Phineas' solids treatment evaluation. During baseline, percentage of acceptance was on a decreasing trend (*M* = 36%*;* range, 0%-100%), indices of happiness were zero, indices of unhappiness were low (*M* = 3%; range, 0%-13%), rate of inappropriate mealtime behavior was on an increasing trend (*M* = 16; range, 0-36), and percentage of negative vocalizations were zero. During escape extinction, percentage of acceptance (*M* = 77%; range, 25%-100%) and indices of happiness (*M* = 5%; range, 0%-25%) and unhappiness (*M* = 23%; range, 0%-80%) increased, rate of inappropriate mealtime behavior decreased (*M* = 11; range, 0-51), and percentage of negative vocalizations was low (*M* = 0.9%; range, 0%-20%). During escape extinction with NCR, percentage of acceptance (*M* = 100%) and indices of happiness (*M* = 13%; range, 0%-88%) increased, indices of unhappiness were low (*M* = 3%; range, 0%-30%), rate of inappropriate mealtime behavior decreased (*M* = 5; range, 0-19), and percentage of negative vocalizations was zero. When feeders reversed to baseline contingencies, percentage of acceptance (*M* = 53%; range, 40%-60%) decreased, indices of happiness and unhappiness were zero, rate of inappropriate mealtime behavior (*M* = 9; range, 5-12) increased, and percentage of negative vocalizations was zero. During the re-introduction of escape extinction, percentage of acceptance increased (*M* = 87%; range, 67%-100%), indices of happiness were low (*M* = 6%; range, 0%-30%), indices of unhappiness remained at zero, rate of

inappropriate mealtime behavior (*M* = 1; range, 0-7) decreased, and percentage of negative vocalizations remained at zero. During the re-introduction of escape extinction with NCR, percentage of acceptance (*M* = 100%) and indices of happiness (*M* = 9%; range, 0%-43%) increased, indices of unhappiness remained at zero, and rate of inappropriate mealtime behavior and percentage of negative vocalizations was zero.

Figure 1

Phineas' Solids Treatment

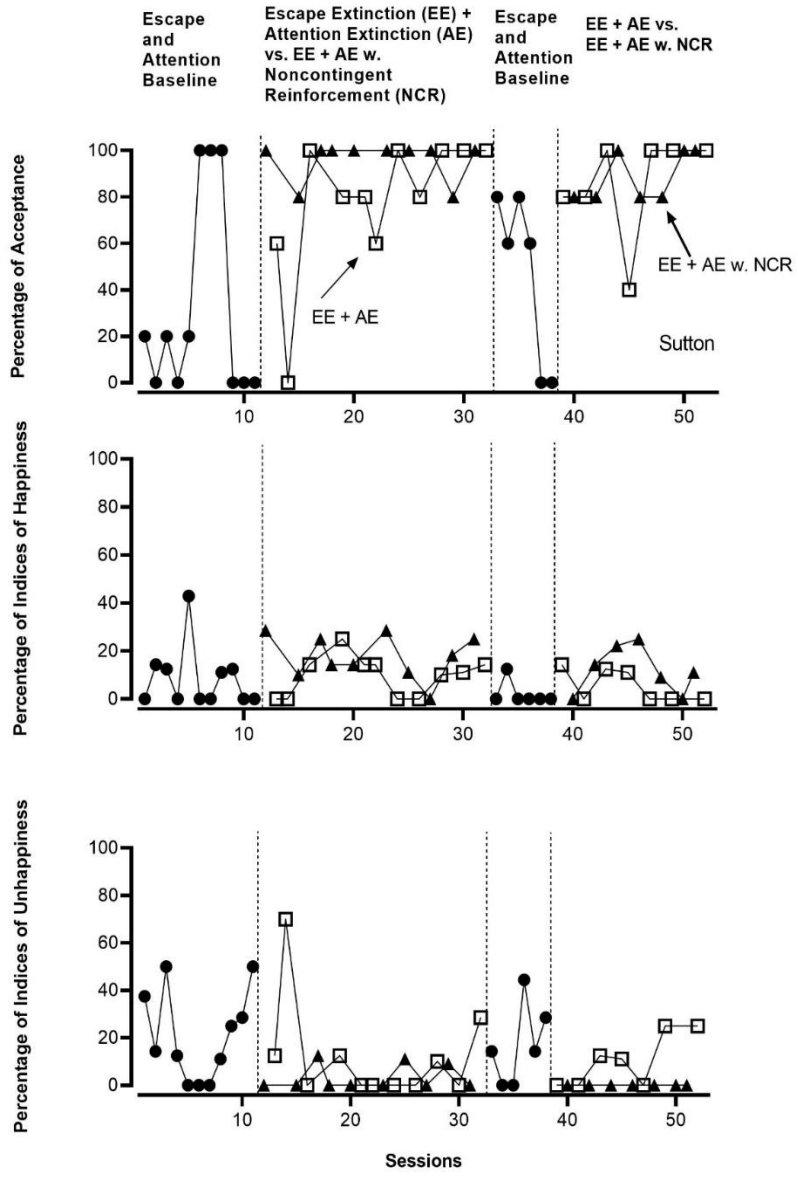


Note. Percentage of acceptance and indices of happiness and unhappiness during treatment for escape-maintained inappropriate mealtime behavior.

Figure 2 displays results of Sutton's solids treatment evaluation. During baseline, percentage of acceptance (*M* = 32%*;* range, 0% -100%), indices of happiness *(M* = 8%; range, 0%-43%), and indices of unhappiness (*M* = 21%; range, 0%-29%) were low, rate of inappropriate mealtime behavior was on an increasing trend (*M* = 13; range, 0-22), and percentage of negative vocalizations was zero. During escape and attention extinction treatment, percentage of acceptance increased (*M* = 78%; range, 0%-100%), indices of happiness (*M* = 9%; range, 0%-25%) and unhappiness (*M* = 12%; range, 0%-70%) remained low, rate of inappropriate mealtime behavior decreased (*M* = 7; range, 0-24), and percentage of negative vocalizations increased for one session (*M* = 3%; range, 0%-33%). During escape and attention extinction with NCR, percentage of acceptance (*M* = 96%; range, 80%-100%) and indices of happiness (*M* = 18%; range, 0%-29%) increased, indices of unhappiness (*M* = 3%; range, 0%-13%) and rate of inappropriate mealtime behavior (*M* = 0.7; range, 0-5) decreased, and percentage of negative vocalizations was zero. When feeders reversed to baseline contingencies, percentage of acceptance (*M* = 47%; range, 0%-80%) and indices of happiness (*M* = 2%; range, 0%-13%) decreased, indices of unhappiness (*M* = 17%; range, 0%-44%) and rate of inappropriate mealtime behavior (*M* = 12; range, 3-28) increased, and percentage of negative vocalizations was zero. During the re-introduction of escape and attention extinction, percentage of acceptance (*M* = 86%; range, 40%-100%) and indices of happiness (*M* = 5%; range, 0%-14%) increased, indices of unhappiness (*M* = 11%; range, 0%-25%) and rate of inappropriate mealtime behavior (*M* = 3; range, 0-16) decreased, and percentage of negative vocalizations remained at zero. During the re-introduction of escape and attention extinction with NCR, percentage of acceptance (*M* = 88%; range, 80%-100%) and indices of happiness (*M* =12%; range, 0%-22%) increased, indices of unhappiness decreased to zero, rate of inappropriate mealtime behavior decreased (*M* = 1; range, 0-4), and percentage of negative vocalizations remained at zero.

Figure 2

Sutton's Solids Treatment

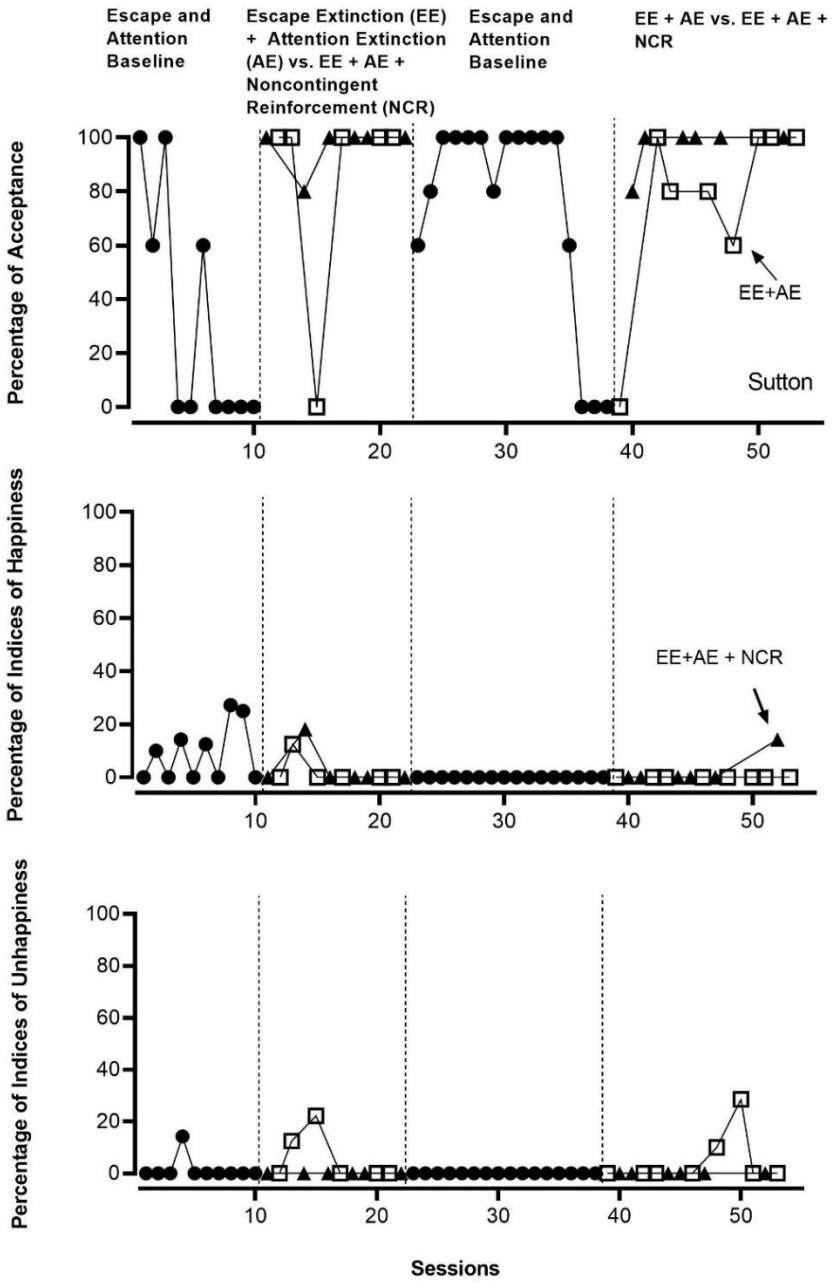


Note. Percentage of acceptance and indices of happiness and unhappiness during treatment for escape- and attention-maintained inappropriate mealtime behavior.

Figure 3 displays results of Sutton's liquids treatment evaluation. During baseline, percentage of acceptance (*M* = 32%*;* range, 0%-100%) and indices of happiness (*M* = 9%; range, 0%-27%) and unhappiness (*M* = 1%; range, 0%-14%) were low, rate of inappropriate mealtime behavior was on an increasing trend (*M* = 9; range, 0-13), and percentage of negative vocalizations was zero. During escape and attention extinction, percentage of acceptance increased (*M* = 83%; range, 0%-100%), indices of happiness (*M* = 2%; range, 0%-13%) decreased, indices of unhappiness (*M* = 6%; range, 0%-22%) increased, rate of inappropriate mealtime behavior decreased (*M* = 2; range, 0-13), and percentage of negative vocalizations increased (*M* = 7%; range, 0%-45%). During escape and attention extinction with NCR, percentage of acceptance increased (*M* = 97%; range, 80%-100%), indices of happiness decreased (*M* = 3%; range, 0%-18%), indices of unhappiness were zero, rate of inappropriate mealtime behavior decreased (*M* = 0.3; range, 0-2), and percentage of negative vocalizations was zero. When feeders reversed to baseline contingencies, percentage of acceptance decreased (*M* = 73%; range, 0%-100%), indices of happiness and unhappiness were zero, rate of inappropriate mealtime behavior increased (*M* = 4; range, 0-35), and percentage of negative vocalizations was zero. During the re-introduction of escape and attention extinction, percentage of acceptance increased (*M* = 78%; range, 0%-100%), indices of happiness remained at zero, indices of unhappiness increased (*M* = 5%; range, 0%-29%), rate of inappropriate mealtime behavior decreased to zero (*M* = 4; range, 0-13), and percentage of negative vocalizations was zero. During the re-introduction of escape and attention extinction with NCR, percentage of acceptance increased (*M* = 97%; range, 80%-100%), indices of happiness were low (*M* = 2%; range, 0%-14%), indices of unhappiness remained at zero, rate of inappropriate mealtime behavior decreased to zero (*M* = 0.2; range, 0-1), and percentage of negative vocalizations was zero.

Figure 3

Sutton's Liquids Treatment

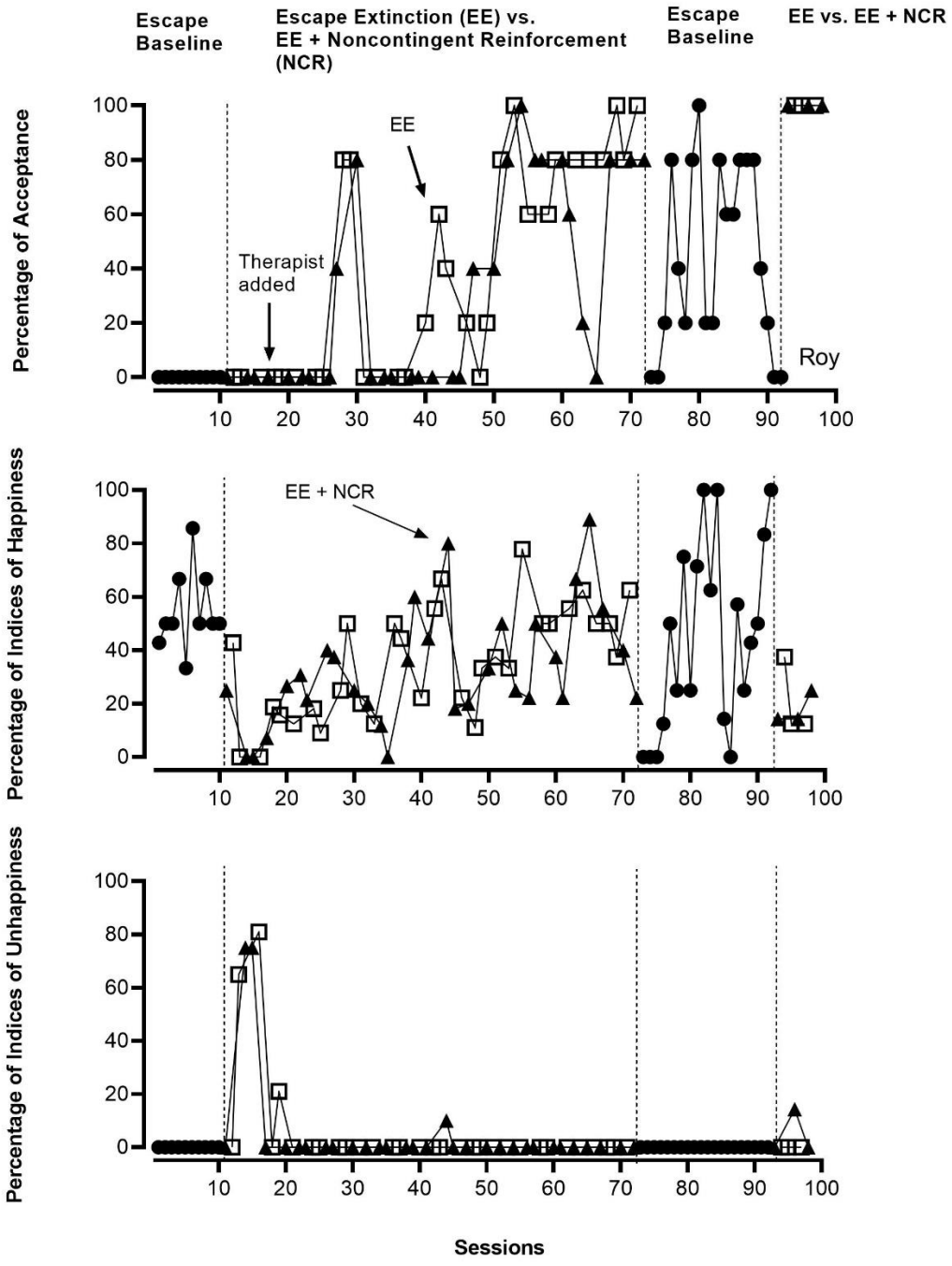


Note. Percentage of acceptance and indices of happiness and unhappiness during treatment for escape- and attention-maintained inappropriate mealtime behavior.

Figure 4 displays results of Roy's liquids treatment evaluation. During baseline, percentage of acceptance was zero, indices of happiness were high (*M* = 55%; range, 33%-85%), indices of unhappiness were zero, rate of inappropriate mealtime behavior was high (*M* = 25; range, 12-39), and percentage of negative vocalizations was zero. During escape extinction, percentage of acceptance increased (*M* = 40%; range, 0%-100%), indices of happiness decreased (*M* = 35%; range, 0%-78%), indices of unhappiness increased (*M* = 5%; range, 0%-81%), rate of inappropriate mealtime behavior decreased (*M* = 1; range, 0-20), and percentage of negative vocalizations increased briefly (*M* = 5%; range, 0%-75%). During escape extinction with NCR, percentage of acceptance increased (*M* = 30%; range, 0%-100%), indices of happiness decreased (*M* = 32%; range, 0%-89%), indices of unhappiness increased (*M* = 5%; range, 0%-75%), rate of inappropriate mealtime behavior decreased (*M* = 2; range, 0-25), and percentage of negative vocalizations increased (*M* = 1%; range, 0%-16%). When feeders reversed to baseline contingencies, percentage of acceptance was on a decreasing trend (*M* = 44%; range, 0%-100%), indices of happiness were high (*M* = 45%; range, 0%-100%), indices of unhappiness were zero, rate of inappropriate mealtime behavior increased (*M* = 9; range, 0-65), and percentage of negative vocalizations was zero. During the re-introduction of escape extinction, percentage of acceptance increased (*M* = 100%), indices of happiness decreased (*M* = 21%; range, 13%-38%), indices of unhappiness were zero, and rate of inappropriate mealtime behavior and percentage of negative vocalizations were zero. During the re-introduction of escape extinction with NCR, percentage of acceptance increased (*M* = 100%), indices of happiness decreased (*M* = 18%; range, 14%-25%), indices of unhappiness remained low (*M* = 5%; range, 0%-14%), rate of inappropriate mealtime behavior decreased (*M* = 2; range, 0-3), and percentage of negative vocalizations was zero.

Figure 4

Roy's Liquids Treatment



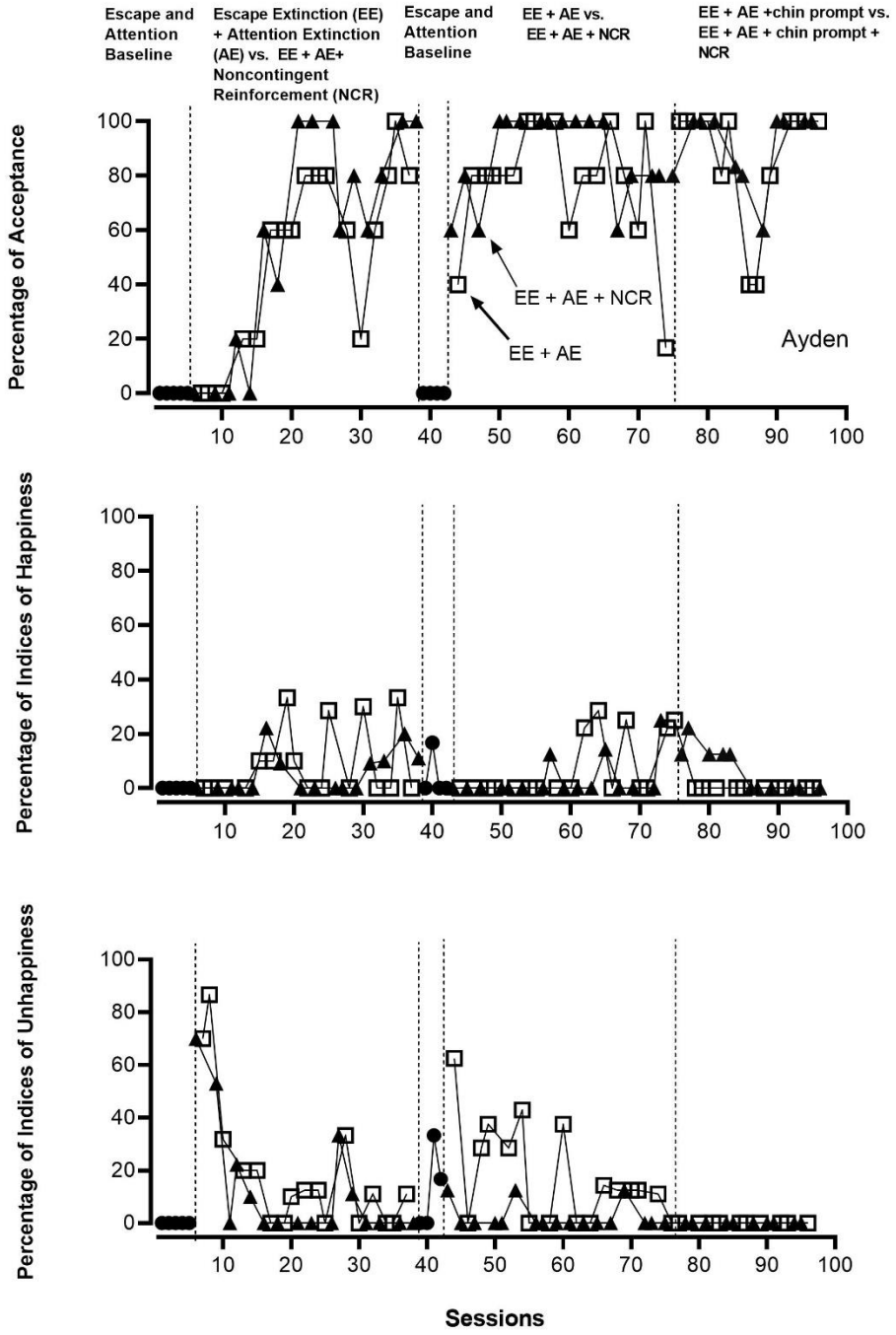
Note. Percentage of acceptance and indices of happiness and unhappiness during treatment for escape-maintained inappropriate mealtime behavior.

Figure 5 displays results of Ayden's liquids treatment evaluation. During baseline, percentage of acceptance, indices of happiness, and indices of unhappiness were zero, rate of inappropriate mealtime behavior was high (*M* = 51*;* range, 36-72), and percentage of negative vocalizations was low (*M* = 0.2%; range 0%-1%). During escape and attention extinction, percentage of acceptance increased (*M* = 51%; range, 0%-100%), indices of happiness (*M* = 9%; range, 0%-33%) and unhappiness (*M* = 19%; range, 0%-87%) increased, rate of inappropriate mealtime behavior decreased (*M* = 16*;* range, 4-46), and percentage of negative vocalizations initially increased and then decreased (*M* = 17%; range, 0%-66%). During escape and attention extinction with NCR, percentage of acceptance increased (*M* = 56%; range, 0%-100%), indices of happiness (*M* = 5%; range, 0%-22%) and unhappiness (*M* = 12%; range, 0%-70%) increased, rate of inappropriate mealtime behavior increased (*M* = 13*;* range, 1-36), and percentage of negative vocalizations initially increased and then decreased (*M* =14%; range, 0%–81%). When feeders reversed to baseline contingencies, percentage of acceptance was zero, indices of happiness (*M* = 4%; range, 0%-17%) and unhappiness (*M* =13%; range, 0%-33%) were low, rate of inappropriate mealtime behavior increased (*M* = 77*;* range, 13-94), and percentage of negative vocalizations were low (*M* = 2%; range, 0%-7%). During the re-introduction of escape and attention extinction, percentage of acceptance increased (*M* = 77%; range, 17%-100%), indices of happiness (*M* = 6%; range, 0%-29%) and unhappiness (*M* = 11%; range, 0%-63%) were low overall, rate of inappropriate mealtime behavior decreased (*M* = 5*;* range, 0-9), and percentage of negative vocalizations increased (*M* = 5%; range, 0%-35%). During the re-introduction of escape and attention extinction with NCR, percentage of acceptance increased (*M* = 88%; range, 60%-100%), indices of happiness (*M* = 3%; range, 0%-25%) and unhappiness (*M* = 1%; range, 0%-13%) were low, rate of inappropriate mealtime behavior decreased (*M* = 3*;* range, 0-14), and percentage of negative vocalizations was zero. When feeders added the chin-prompt to escape and attention extinction, percentage of acceptance increased (*M* = 85%; range, 40%-100%), indices of happiness (*M* = 7%; range, 0%-22%) remained low,

indices of unhappiness were at zero, rate of inappropriate mealtime behavior was low (*M* = 5*;* range, 0-18), and percentage of negative vocalizations was low (*M* = 2%; range, 0%-21%). When feeders added the chin-prompt to the escape and attention extinction with NCR, percentage of acceptance increased (*M* = 91%; range, 60%-100%), indices of happiness decreased (*M* = 2%; range, 0%-25%), indices of unhappiness were zero, rate of inappropriate mealtime behavior was low (*M* = 3*;* range, 0-9), and percentage of negative vocalizations was zero.

Figure 5

Ayden's Liquids Treatment

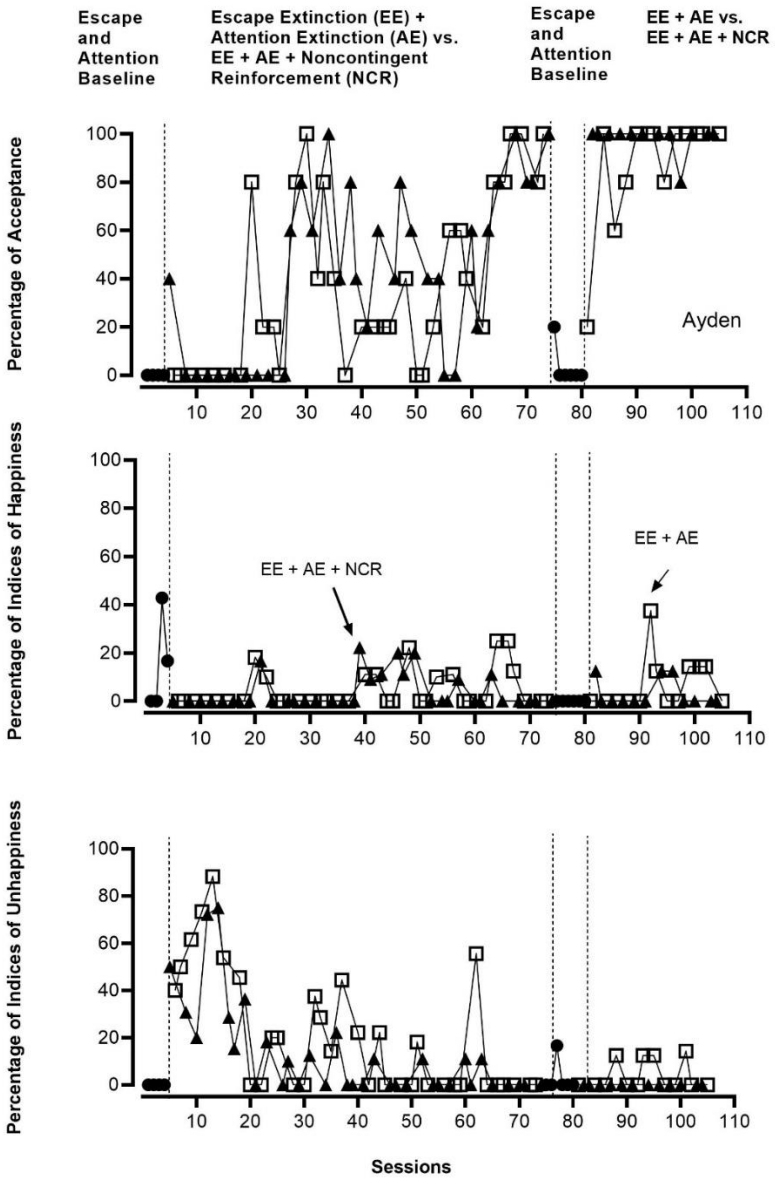


Note. Percentage of acceptance and indices of happiness and unhappiness during treatment for escape- and attention-maintained inappropriate mealtime behavior.

Figure 6 displays results of Ayden's solids treatment evaluation. During baseline, percentage of acceptance was zero, indices of happiness were low (*M* = 15%*;* range, 0%-43%), indices of unhappiness were zero, rate of inappropriate mealtime behavior was high (*M* = 67*;* range, 60-70), and percentage of negative vocalizations was zero. During escape and attention extinction, percentage of acceptance increased (*M* = 38%; range, 0%-100%), indices of happiness decreased (*M* = 4%; range, 0% to 22%), indices of unhappiness increased (*M* = 20%; range, 0%-88%), rate of inappropriate mealtime behavior decreased (*M* = 15; range, 0-34), and percentage of negative vocalizations increased (*M* = 18%; range, 0-68%). During escape and attention extinction with NCR, percentage of acceptance increased (*M* = 41%; range, 0%-100%), indices of happiness decreased (*M* = 4%; range, 0%-22%), indices of unhappiness increased (*M* = 12%; range, 0%-72%), rate of inappropriate mealtime behavior decreased (*M* = 12; range, 0-38), and percentage of negative vocalizations increased (*M* = 9%; range, 0%-55%). When feeders reversed to baseline contingencies, percentage of acceptance decreased (*M* = 3%; range, 0%-20%), indices of happiness were zero, indices of unhappiness were low (*M* = 3%; range, 0%- 17%), rate of inappropriate mealtime behavior increased (*M* = 37; range, 14-49), and percentage of negative vocalizations decreased (*M* = 1%; range, 0%-4%). During the re-introduction of escape and attention extinction, percentage of acceptance increased (*M* = 88%; range, 20%-100%), indices of happiness (*M* = 7%; range, 0%-38%) and unhappiness (*M* = 4%; range, 0%-14%) were low, rate of inappropriate mealtime behavior decreased (*M* = 6; range, 0-17), and percentage of negative vocalizations decreased (*M* = 0.8%; range, 0%-8%). During the re-introduction of escape and attention extinction with NCR, percentage of acceptance increased (*M* = 98%; range, 80%-100%), indices of happiness increased (*M* = 3%; range, 0%-13%), indices of unhappiness were zero, rate of inappropriate mealtime behavior decreased (*M* = 3; range, 0-15), and percentage of negative vocalizations was zero.

Figure 6

Ayden's Solids Treatment



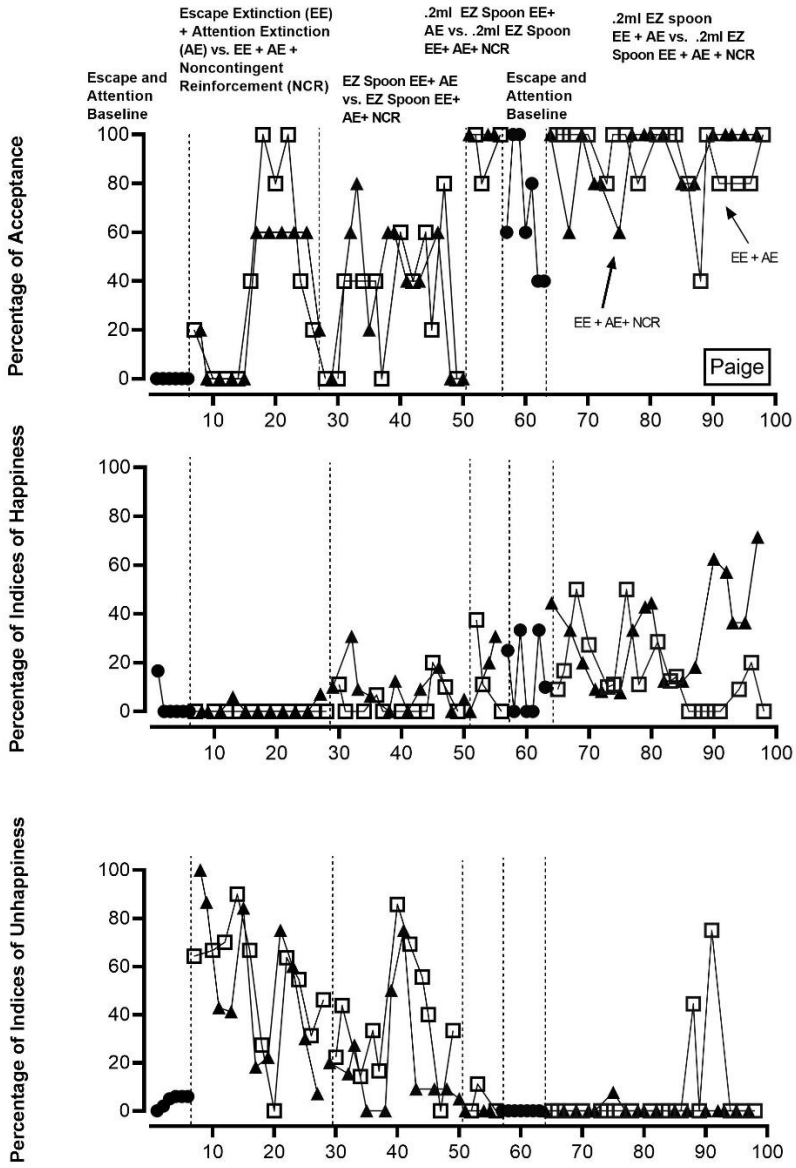
Note. Percentage of acceptance and indices of happiness and unhappiness during treatment for escape- and attention-maintained inappropriate mealtime behavior.

Figure 7 displays results for Paige's solids treatment evaluation. During baseline with a flipped, small Maroon spoon and 1-ml bolus, percentage of acceptance was zero indices of happiness (*M* = 2.7%*;* range, 0%-16.6%) and unhappiness (*M* = 4.1%; range, 0%-6%) were low, rate of inappropriate mealtime behavior was high (*M* = 17; range, 13.7-23.26), and percentage of negative vocalizations was high (*M* = 76%; range, 8%-99%) During escape and attention extinction with a flipped small Maroon spoon and 1-ml bolus, percentage of acceptance increased (*M* =36.6%; range, 0%- 100%), indices of happiness were zero, indices of unhappiness increased (*M* = 52%; range, 0%-70%), rate of inappropriate mealtime behavior decreased (*M* = 13; range, 2-20), and percentages of negative vocalizations decreased (*M* = 57%; range, 11%-96%). During escape and attention extinction with a flipped small Maroon spoon and a 1-ml bolus plus NCR, percentage of acceptance increased (*M* = 30.9%; range, 0%-60%), indices of happiness were low (*M* = 1.1%; range, 0%-7.1%), indices of unhappiness increased (*M* = 51%; range, 18.1%-86.6%), rate of inappropriate mealtime behavior decreased (*M* = 13; range, 9-16), and percentage of negative vocalizations decreased (M = 60%; range, 19%-92%). During escape and attention extinction with the flipped EZ spoon and a 1-ml bolus, percentage of acceptance was variable (*M* =34.5%; range, 0%-80%), indices of happiness were low (*M* = 4.3%; range, 0%-20%), indices of unhappiness were high (*M* = 37%; range, 0%-69.2%), rate of inappropriate mealtime behavior decreased (*M* = 6; range, 1-12), and percentage of negative vocalizations decreased (*M* = 39%; range, 0%-73%). During escape and attention extinction with the flipped EZ spoon and a 1-ml bolus plus NCR, percentage of acceptance was variable (*M* = 42%; range, 0%-80%), indices of happiness were low (*M* = 9%; range, 0%-30.7%), indices of unhappiness (*M* = 19.9%; range, 0%-75%) decreased, rate of inappropriate mealtime behavior decreased (*M* = 7; range, 0-12), and percentage of negative vocalizations decreased (*M* = 28%; range, 0%-81%). During escape and attention extinction with a flipped EZ spoon and a 0.2-ml bolus, percentage of acceptance (*M* = 93.3%; range, 80%-100%) and indices of happiness (*M* = 16.2%; range, 0%-37.5%) increased, indices of unhappiness (*M* =

3.7%; range, 0%-11%) decreased, and rate of inappropriate mealtime behavior and percentage of negative vocalizations were zero. During escape and attention extinction with the flipped EZ spoon and a 0.2-ml bolus plus NCR, percentage of acceptance increased (*M* =100%), indices of happiness remained low (*M* =16.9 %; range, 0%-30.7%), indices of unhappiness were zero, rate of inappropriate mealtime behavior was low (*M* =2%; range, 0 to 5), and percentage of negative vocalizations was zero. When the feeder returned to baseline contingencies with a flipped, small Maroon spoon and a 1-ml bolus, percentage of acceptance decreased (*M* = 68%; range, 40%-100%), indices of happiness remained variable (*M* =14.5 %; range, 0%-33.3%), indices of unhappiness were zero, rate of inappropriate mealtime behavior was low (*M* = 4; range, 0-7), and percentage of negative vocalizations were zero. With the re-introduction of escape and attention extinction with flipped EZ spoon and a 0.2-ml bolus, percentage of acceptance increased (*M* = 90%; range, 40%-100%), indices of happiness (*M* = 14.9%; range, 0%-28.5%) and unhappiness (*M* = 6.6%; range, 0%-75%) remained low, inappropriate mealtime behavior decreased (M = 1; range, 0-6), and percentage of negative vocalizations increased (M = 8%;range, 0-86%). During the re-introduction of escape and attention extinction with flipped EZ spoon and a 0.2-ml bolus plus NCR, percentage of acceptance increased (*M* = 90%; range, 60%-100%), indices of happiness increased (*M* = 32%; range, 7.3%-61.4%), unhappiness (*M* = 0.4%; range, 0%-7.6%) remained low, rate of inappropriate mealtime behavior decreased (M = 2; range, 0-8), and percentage of negative vocalizations increased (*M* = 1%; range, 0-11).

Figure 7

Paige's Solids Treatment



Note. Percentage of acceptance and indices of happiness and unhappiness during solids treatment for escape- and attention-maintained inappropriate mealtime behavior.

Social-Validity Measures

Caregivers

Table 1 displays the treatment-acceptability ratings after the caregiver observed baseline, the first session of the function-based treatments with and without NCR, and the removal and re-introduction of both treatments. Treatment-acceptability ratings remained the same across baseline and the first phase of treatment for all participants' caregivers except Roy. For Roy's caregiver, treatment acceptability decreased for the function-based treatment without NCR and remained the same for the function-based treatment with NCR relative to baseline. After observing the removal and re-introduction of both treatments, treatment-acceptability ratings increased relative to baseline for Phineas, Roy, and Ayden's caregivers. Treatment-acceptability ratings for Sutton's caregiver during treatment did not change from baseline.

Phineas, Sutton, and Aydens' caregivers selected the function-based treatment *without* NCR for solids. These caregivers reported that although they liked to see their child happy, they ultimately did not want their child to *need* toys or continuous attention during meals with solids. Sutton, Roy, and Ayden's caregivers selected the function-based treatment *with* NCR for liquids, reporting that they were comfortable giving their child access to toys, attention, or both during meals for liquids.

Table 1

Caregiver Treatment Acceptability

Child	Questionnaire #1	Questionnaires #2 and #3		Questionnaires #4 and #5	
		Function-Based Tx	Function-Based Tx with NCR	Function-Based Tx	Function-Based Tx with NCR
Phineas	15	15	15	18	18
Sutton	15	15	15	15	15
Roy	15	8	15	13	16
Ayden	14	14	14	18	17

Note. This table displays ratings on the treatment-acceptability questionnaires (a) after the caregiver observed at least one session in the first baseline condition, (b) after the caregiver observed the first session of each of the two treatments, and (c) after the caregiver observed at least one session where the child demonstrated 100% acceptance following a return to both treatments.

Practitioners

Table 2 displays the ratings from the dentists who watched videos of treatment. Agreement between the dentists and our trained data collectors was 100% for the video with high indices of happiness and for the video with high indices of unhappiness.

Table 2

Practitioner Likert-scale Ratings

	High Indices of Happiness	High Indices of Unhappiness
Dentist #1	5 mildly happy	1 extremely unhappy
Dentist #2	5 mildly happy	1 extremely unhappy
Dentist #3	5 mildly happy	1 extremely unhappy
Dentist #4	6 extremely happy	2 mildly unhappy
Dentist #5	5 mildly happy	1 extremely unhappy

Note. This table displays the Likert-scale ratings reported by practitioners for two videos of treatment sessions.

CHAPTER 3: DISCUSSION

Age-appropriate feeding is an important life skill that impacts a child's health, social development, and family dynamics. Thus, a diagnosis of avoidant/restrictive food intake disorder can have a significant negative impact on the diagnosed child and their family. The inadequate intake of calories, fluids, nutrients, or a combination that are characteristics of a feeding disorder can have a serious and deleterious effect on the child's behavior, development, growth, and physical health (Volkert & Piazza, 2012). Although timely treatment can avoid or mitigate these negative consequences, some have raised concerns about the empirically supported treatment that may produce the most rapid treatment effects, escape extinction. One reason for this criticism is that its rapid treatment effects may be accompanied by temporary increases in inappropriate mealtime behavior, negative vocalizations, or both. To better understand the positive and negative effects of escape extinction, we assessed the effects of function-based extinction with and without NCR using indices of happiness and unhappiness as proxies for the child's experience of subjective well-being before and during treatment.

In the current study, we modified operational definitions for indices of happiness and unhappiness to assess those behaviors in children who were receiving intensive, function-based intervention as a treatment for their feeding disorders. The operational definitions for indices of happiness and unhappiness differed from previous definitions by including the child's behavior towards the feeder (i.e.., affection or aggression), the child's meal-specific verbal behavior, and problem behavior specific to meals (e.g., batting at the utensil). We also validated the operational definitions by recruiting dentists, who were familiar with conducting medically necessary procedures that involve a child's mouth, and determined 100% agreement between data collectors and dentists on levels of happiness and unhappiness.

Previous studies have identified that variables such as increased access to leisure items and high-quality social interaction can be effective at increasing happiness or decreasing

unhappiness for adults with disabilities (Green et al., 2005; Realon et al., 2002). In the current study, feeders implemented function-based extinction with and without noncontingent access to preferred items and continuous attention. Overall, we observed idiosyncratic differences in happiness across interventions and slightly higher, but temporary, increases in unhappiness for function-based treatment relative to enriched function-based treatment. Also, we observed mostly similar increases in the percentage of bite or drink acceptance across interventions and participants. The only exceptions were Phineas' and Sutton's solids treatment evaluations, during which the percentage of acceptance was higher in the function-based treatment with enrichment.

Given both treatments were effective at increasing acceptance, the first author asked the children's caregivers to identify which treatment they preferred and continued with the treatment they chose. In four of seven cases, caregivers elected to continue function-based treatment without environmental enrichment. Specifically, caregivers preferred treatment without environmental enrichment during solid meals. Moreover, caregiver treatment acceptability for function-based treatment with and without environmental enrichment increased or remained the same throughout the treatment evaluation for 80% of participants. In two cases (Roy and Paige), caregivers provided slightly higher ratings for enriched function-based treatment and in one case (Ayden), the caregiver provided slightly higher ratings for function-based treatment without enrichment.

These findings are noteworthy given that no studies, to our knowledge, have defined or assessed the public behavior suspected to correlate with child indices of happiness and unhappiness during behavior-analytic treatment of feeding disorders. It is important to investigate ways to define happiness, and then to identify the variables that could serve to improve happiness or reduce unhappiness for children receiving necessary medical or behavioral treatments. Low levels of child happiness or high levels of unhappiness could cause practitioners or caregivers to question whether to continue the use of an intervention, even if the intervention is effective at treating the target behavior. In the case of pediatric feeding disorders, research has shown that

function-based treatment, such as escape extinction, is highly effective and often necessary to increase acceptance and consumption. For children with feeding problems, discontinuing or delaying effective intervention could have serious and deleterious effects on the child's growth, nutrition, development, behavior, and overall health (Volkert & Piazza, 2012).

In the current study, overall indices of happiness were idiosyncratic across children and did not differ between the two treatments. Indices of happiness remained the same or slightly increased across children with the introduction of treatment. Only one child showed a decrease in happiness during treatment. One explanation for this finding is that neutral behavior (i.e., no indices of happiness or unhappiness) co-occurred with the emergence of appropriate feeding behavior (e.g., accepting bites, swallowing) during treatment.

Although increasing happiness during behavior-analytic treatment may be socially important, it is equally, if not more, relevant to identify interventions that address indices of unhappiness, especially during non-preferred but necessary activities. Green et al. (2005) evaluated a treatment involving noncontingent access to preferred leisure materials to decrease indices of unhappiness during non-preferred or neutral daily routine activities and observed significant reductions in indices of unhappiness, but variable effects on happiness. Reed et al. (2004) evaluated the effects of noncontingent reinforcement with escape extinction on negative vocalizations (i.e., crying) during feeding and discovered a potential mitigation effect. In the current study, we extended Green et al and Reed et al by using noncontingent access to preferred items, with the added component of attention, to decrease indices of unhappiness (e.g., crying, aggression) during what could be conceptualized as a non-preferred activity (i.e., eating non-preferred foods) for children with feeding disorders.

In looking closely at child responding during treatments, we observed that indices of unhappiness temporarily increased with the introduction of treatment but decreased to zero within two to eight sessions, which was equal to 20 min to 1 hr and 20 min of treatment. Subsequently, indices of unhappiness remained low or at zero across participants. These data are consistent with

those of Woods and Borrero (2019) in that the undesirable side effects of extinction were short lived. Bursts of inappropriate mealtime behavior only occurred for one session for two children and two sessions for one child in Woods and Borrero. Negative vocalizations increased from zero during baseline to 16% and 21%, respectively, for two children for one session and to 23% for one child for seven sessions. Similar to the results of the current study, percentage of negative vocalizations subsequently decreased to zero for the three children. Out results also replicated findings from Piazza et al. (2003) and Reed et al. (2004) in that corollary behavior was lower for some children when nonremoval of the spoon included a reinforcement component.

Even though function-based extinction with NCR was associated with lower percentages of indices of unhappiness relative to no NCR overall, percentage of acceptance increased and inappropriate mealtime behavior decreased rapidly independent of the presence or absence of NCR. Perhaps for this reason, caregivers indicated that they did not want to use NCR during solid meals. Caregivers said that they placed greater value on the *long-term* practicality of the intervention. Results of the current study are consistent with those of Ahearn et al. (1996) in which caregivers preferred the feeding treatment that was associated with shorter meal durations (i.e., the more practical one). It could be that caregivers were less interested in having toys or additional attention as part of the treatment when it was ultimately not necessary to increase bite or drink acceptance. Some caregivers reported to the first author that they hoped the child could consume meals in a similar manner as other family members of the household, who did not have additional toys or continuous conversation in all parts of the meal. This is an important finding that warrants further investigation, as adding reinforcement-based components may not be necessary or could be more cumbersome for some caregivers to include (Kirkwood et al., 2021)

The importance of adding NCR at the start of extinction-based treatment might depend on whether increases in emotional responding are concerning for the caregiver. In the current study, we observed generally high levels of caregiver-treatment acceptability across both treatment conditions, with only two exceptions for Roy and Paige's treatment evaluations. Caregivers

maintained relatively high levels of acceptability throughout the study. Interestingly, those levels remained unchanged even after caregivers observed higher levels of unhappiness at the start of treatment (e.g., Sutton's solids evaluation). Given these results, perhaps practitioners could describe possible undesirable side effects of extinction before starting treatment and allow caregivers to decide whether to include NCR a priori. One caveat, however, is that behavioral momentum theory predicts that response resurgence may occur if the caregiver subsequently removes NCR from the extinction treatment. Future research should evaluate this possibility so caregivers can make informed decisions about including or removing NCR during function-based treatment of their child's feeding disorder.

Happiness, given it has been linked to things such as *quality of life* or *subjective wellbeing*, could be attributed to many different events or conditions. For some individuals, increased independence, increased opportunities for meaningful social interactions (e.g., having lunch with friends), or being free of chronic illness, could constitute a good quality of life. Caregivers of children with feeding disorders have likely experienced a long history of challenging mealtimes involving conflict with their child over eating, persistent child problem behavior such as crying or aggression, or anxiety that their child is not consuming enough calories for growth. Research has shown that caregivers of children with feeding disorders experience high levels of stress (Greer et al., 2008). In these cases, temporary signs of child happiness or unhappiness may not be as important as the long-term improvements in appropriate eating or even neutral states of emotion during meals. Thus, it is important for practitioners to discuss these dimensions of happiness with caregivers, which may help to place temporary increases in unhappiness into a broader perspective.

One limitation of the current study is that we do now know whether observed levels of happiness and unhappiness corresponded to those of typically eating children given that the goal of treatment is for the child with a feeding disorder to become an age- or developmentally typical feeder. Crist and Napier-Phillips (2001) compared caregiver reports of the mealtime behaviors of

children with and without a feeding disorder using the Behavioral Pediatrics Feeding Assessment Scale. Caregivers of young children reported the same amount of whining and crying independent of whether their child had a feeding disorder. Results of Crist and Napier-Phillips suggest that typically eating young children whine and cry during meals. Perhaps the levels of unhappiness observed of the young children in the current study were not different than those of typically eating young children, and this should be a direction for future research. Data on indices of happiness and unhappiness for same-aged typically eating children could inform the goals we set and the expectations we have to progress children with feeding disorders to age-appropriate feeding behavior.

Future research could address the limitations of the current study. First, the current study focused on caregiver and not child preference, which may differ. For example, Owen et al. (2021) found that the preferences of children receiving behavior-analytic treatment for problem behavior maintained by social-negative reinforcement were different than their caregivers. Another possible limitation is that caregivers did not use the treatments to feed their child before indicating their preference. Caregiver preference could be influenced by their child's preference for treatment or by their experiences implementing the treatment. The current study also combined attention and preferred items, however, caregivers may have differential preferences for the type of NCR (e.g., attention only) that could lead to different outcomes in indices of happiness and unhappiness and treatment acceptability. Lastly, the alternating treatments design did not allow us to rule out potential carry-over effects. Perhaps, indices of happiness were lower in the function-based extinction with NCR condition due to carry-over from the function-based extinction without NCR condition. Alternatively, perhaps, indices of unhappiness were higher because the feeder withdrew attention and removed the toys in the function-based extinction without NCR condition Thus, future researchers should continue to evaluate indices of happiness and unhappiness during function-based extinction with and without NCR using different design options.

Overall, the current study contributes to the ongoing literature on how to develop socially valid interventions. Given that feeding is a biological necessity and greatly integrated into our social culture (e.g., birthday parties, holidays), addressing emotional wellbeing during feeding interventions is relevant. Ideally, behavior-analytic treatments for pediatric feeding disorders would improve a child's quality of life both by increasing adaptive functioning (e.g., appropriate eating) *and* by maintaining or improving subjective wellbeing (i.e., increasing indices of happiness, decreasing indices of unhappiness; Van Houton et al., 1988). Based on the current findings, future research should continue to look into how measurements of child indices of happiness and unhappiness during feeding treatment can be used to improve the treatment experience (e.g., displaying results to caregivers, determining a criterion by which it is appropriate to change intervention approaches based on indices). In addition, another next step could be to apply physiological measures (e.g., skin conductance response, heart rate) to further validate measurements of private events, such that child or caregiver distress could be monitored and targeted during intensive stages of treatment. Understanding the treatment experience as well as identifying socially valid treatment components based on these new measures could be helpful to establish long-term success and a high quality of life for children and families alike.

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