8-2014

The Effects of Varying Duration of Reinforcement on Novel Selection-Based Mands Versus Topography-Based Mands

Nicholas S. Acker
Western Michigan University, nicholas.s.acker@gmail.com

Follow this and additional works at: https://scholarworks.wmich.edu/masters_theses

Part of the Applied Behavior Analysis Commons, Clinical Psychology Commons, and the Experimental Analysis of Behavior Commons

Recommended Citation
Acker, Nicholas S., "The Effects of Varying Duration of Reinforcement on Novel Selection-Based Mands Versus Topography-Based Mands" (2014). Master's Theses. 515.
https://scholarworks.wmich.edu/masters_theses/515

This Masters Thesis-Open Access is brought to you for free and open access by the Graduate College at ScholarWorks at WMU. It has been accepted for inclusion in Master's Theses by an authorized administrator of ScholarWorks at WMU. For more information, please contact maira.bundza@wmich.edu.
THE EFFECTS OF VARYING DURATION OF REINFORCEMENT ON NOVEL SELECTION-BASED MANDS VERSUS TOPOGRAPHY-BASED MANDS

by

Nicholas S. Acker

A thesis submitted to the Graduate College in partial fulfillment of the requirements for the degree of Master of Arts Psychology Western Michigan University August 2014

Thesis Committee:

Stephanie Peterson, Ph.D., Chair
Richard Malott, Ph.D.
Jessica Frieder, Ph.D.
THE EFFECTS OF VARYING DURATION OF REINFORCEMENT ON NOVEL SELECTION-BASED MANDS VERSUS TOPOGRAPHY-BASED MANDS

Nicholas S. Acker, M. A.
Western Michigan University, 2014

In recent years, researchers have evaluated individuals’ preferences for different mand modalities and its effects on the acquisition of novel mands during functional communication training (i.e., FCT; e.g., Falcomata, Ringdahl, Christensen, & Boelter, 2010). In many of these studies, the modality of responding that Michael (1985) classified as selection-based responding, is preferred by participants (e.g., Falcomata et al., 2010). Wraikat, Sundberg, and Michael (1991) suggest that topography-based responses may be preferable for the acquisition of complex language. However, selection-based verbal responses may have faster acquisition in learning initial verbal operants (Charlop-Christy, Carpenter, Le, LeBlanc & Kellet, 2002). If individuals prefer selection-based modalities of communication, it may be desirable to identify whether their preferences can be influenced in favor of topography-based modalities instead. Peck et al. (1996) demonstrated that by providing a longer duration and higher quality of reinforcement for various mands and problem behavior, response allocation could be shifted towards whichever response resulted in longer duration and high quality of reinforcement. The current study assessed the effects of varying duration of reinforcement on problem behaviors and response allocation between topography-based and selection-based mands during FCT.
ACKNOWLEDGEMENTS

I would like to formally thank some of the many people who have supported me through this project. First, I would like to thank my committee for all of their support over the last year. Each one of them was selected not only for his or her expertise in the area, but also the simple fact that I would not be the behavior analyst I am today without their guidance. Second, I would like to thank my mentor, Stephanie Peterson, for providing me with the opportunities that have led me to where I am now. I will never forget what I owe her. Third, I would like to thank my research lab mates for the support and insight I’ve received from them over the years. In particular, Shawn Quigley who has set aside more unofficial time than anyone else to help me with questions I had. Fourth, I would like to thank Lauren Blair my research assistance who put in many hours scoring video to help this project come to fruition. Lastly, I would like to thank my family and in particular my wife, for always being there to support me throughout my educational training. Without the support of these people I would not be here today. Thank you!

Nicholas S. Acker
# Table of Contents

ACKNOWLEDGMENTS .............................................................. ii  
LIST OF FIGURES .................................................................. v  
CHAPTER  
I. INTRODUCTION .................................................................... 1  
II. METHOD ............................................................................. 9  
   Participants .......................................................................... 9  
   Settings and Materials ......................................................... 9  
   Data Collection .................................................................... 10  
   Dependent Variables ........................................................... 10  
   Interobserver Agreement ..................................................... 14  
   Independent Variables and Experimental Design .................. 15  
   Treatment Integrity .............................................................. 17  
   Social Validity ...................................................................... 17  
   Procedures ........................................................................... 18  
   Preliminary Assessments and Training ................................... 18  
      Preference Assessment ....................................................... 19  
      Functional Behavior Assessment ...................................... 19  
      Interview .......................................................................... 19  
      Antecedent-Behavior-Consequence Assessment ............... 20  
      Functional Analysis .......................................................... 20  
      Duration Sensitivity Assessment ....................................... 20
TABLE OF CONTENTS - CONTINUED

CHAPTER

Functional Communication Training ............................................. 22

Experimental Evaluation of Reinforcement Duration ...................... 25

A Condition (60-s Both Modalities) ............................................. 26

B Condition (60-s/ NP vs. 10-s/P) .............................................. 26

C Condition (10-s/ NP vs. 60-s/P) .............................................. 27

D Condition (60-s/ NP vs. Ext/P) .............................................. 27

III. RESULTS ............................................................................. 29

Preliminary Assessment and Training ............................................. 29

Experimental Evaluation of Reinforcement Duration ...................... 33

IV. DISCUSSION ........................................................................ 35

REFERENCES ........................................................................... 42

APPENDIX ................................................................................ 46
LIST OF FIGURES

1. Social Validity Questionnaire .................................................. 18
2. Functional Analysis .................................................................. 30
3. Duration Assessment .................................................................. 31
4. FCT ......................................................................................... 32
5. Duration Manipulation Participant 1 ........................................... 34
CHAPTER I

INTRODUCTION

In the treatment of problem behavior, a commonly utilized procedure is functional communication training (FCT; e.g., Tiger, Hanley, & Bruzek, 2008). FCT is a form of differential reinforcement for which the individual is taught a replacement behavior (e.g., touching a “break” card, producing the manual sign “break”) that is consequated with the same functional reinforcer as the target problem behavior. This new behavior then competes with the existing problem behavior. Both the problem behavior and the replacement behavior in FCT function as a forms of verbal behavior. Skinner (1957) defined verbal behavior as behavior mediated by other people. In this case both verbal responses (i.e., the problem behavior and the replacement behavior) function as mands or verbal responses under the control of motivating operations of that specified reinforcer.

Carr and Durand (1985) published the seminal article on FCT. In that study, the authors found that if a replacement behavior was selected based on the apparent function of problem behavior, it would more effectively reduce problem behavior than a replacement response that was not associated with the apparent function. Since this seminal work, much more research has been conducted on the effectiveness of FCT and the variables related to displays of target mands. These studies have shown that FCT is a robust procedure that effectively reduces problem behavior and teaches a new response (see Tiger et al., 2008 for a literature review on this topic).
One question that practitioners continue to wrestle with is what topography the mand taught should be. There are several considerations that should, perhaps be taken into account when determining the mand that will be taught as part of an FCT package. One consideration is the relative difficulty of the mand response. Horner and Day (1991) investigated the effects of response effort on the allocation of responding with problem behavior and mastered replacement behavior. The participants in this study were two males and one female, ages 12, 14, and 27 years, respectively, and with multiple disabilities and problem behavior. Participants were taught two topographies of mands: manual signs or touching a communication card. The efforts of these responses were then varied along multiple dimensions (e.g., physical effort and schedule of reinforcement). Results indicated that response allocation shifted in favor of previous aberrant responses when response effort increased for the replacement mand response (e.g., when the schedule of reinforcement was thinned). These results suggest that behaviors within a functional response class are sensitive to a variety of reinforcement dimensions.

Similarly, Peck et al. (1996) found that response allocation amongst behaviors in the same functional response class (e.g., problem behavior and mands) can be affected by quality of reinforcement. In this study, after the function of problem behavior was determined, participants were taught an appropriate mand through FCT by providing a longer duration and quality of reinforcement for the appropriate mand than for problem behavior. After FCT was completed, a secondary or “neutral” mand was taught and the duration and quality of reinforcement was varied in favor of appropriate mand. Then the “neutral” mand received the better quality and duration of reinforcement, and finally to
the original appropriate mand received the better quality and duration of reinforcement. Finally, parents implemented a follow-up FCT treatment package that also manipulated the duration and quality of reinforcement in favor of the appropriate mands. In all cases, response allocation changed such that whatever response received the highest quality and duration of reinforcement occurred most frequently. This research extended Horner and Day (1991) study by demonstrating that varying the duration of reinforcement on concurrently available FR1/FR1 schedules of reinforcement can shift response allocation. In other words, “preference” for one form of communication over another may be controlled largely by the contingencies of reinforcement associated with each concurrently available response.

In more recent years, researchers have also investigated the effects of mand modalities and participant preference for mand topographies. The various mand modalities used in teaching FCT can vary widely (e.g., micro switch press, manual sign, vocal speech, card touch, etc.). Some researchers have conducted mand preference assessments to determine participant preferences between these different mand modalities (e.g., Falcomata et al., 2010; Winborn-Kemmerer et al., 2009). Winborn-Kemmerer et al. (2009) sought to analyze participant preference for different mand modalities when history of reinforcement, response effort, and amount and quality of reinforcement were held constant. Participants were a male and a female, ages 7 and 20 years, with diagnoses of pervasive developmental delays, seizure disorder and mental retardation, who engaged in self-injury and/or physical aggression. Both participants were taught two novel mands (i.e., a micro-switch press and a picture touch) to obtain his or her functional reinforcer. Novel mands were mands that did not functionally exist in the participant’s
repertoire prior to intervention. Once both mand modalities were shown to compete with problem behavior, a preference assessment of mand modalities was conducted, in which both the card and the micro switch were concurrently available on an FR1/FR1 schedule. Results indicated that one participant showed a preference for the card touch and the other for the micro switch press. This study demonstrated that even when history, effort, reinforcer quality and amount of reinforcement are controlled for, preference for a mand modality may vary from one participant to another.

The types of prompts that are used to teach mands can also influence an individual’s preference for mands. Falcomata et al. (2010) conducted a multi-experiment study to assess the effect of prompt schedules on concurrently available mand modalities. In Phase 1 the participant was vocally prompted to engage in one of the three mand modalities (i.e., touching a card, pressing a micro switch, and engaging in vocal speech) an average of 2 times per minute to obtain attention. All of the mand modalities used in the study had received training prior to the beginning of the study, but none was consistently used as a form of communication at the start of the study. Results of the three experiments indicated that each mand modality was functional, as increases in each modality were observed when attention was contingent on the emission of that specific response. Increases in the density of the prompting schedule also increased responding for all mand modalities. Microswitch presses were preferred over vocal responding or card touches by the participant, as responding on microswitch presses was observed to occur at a higher rate than other modalities in both the dense and lean schedules.

In both Winborn-Kemmer et al. (2009) and Falcomata et al. (2010), participant preferences for mand modalities were assessed. Participant preference varied based on
the variables, such as history of reinforcement, schedule of reinforcement, and prompting strategies used to teach the mands. Though the modalities preferred by participants varied, the three participants presented in these studies all showed a preference for what Michael (1985) called selection-based verbal behavior. A response is selection-based when the same response is reinforced for coming under the control of two different stimuli (e.g., an attention card and attention deprivation). For example, if an individual selects an attention card (i.e., a selection-based mand for attention) it requires control from the motivating operation for attention (e.g., deprivation of attention) and the presence of a discriminative stimulus (e.g., a particular attention card). Though the stimulus for which the participant mands may change, the response topography remains the same (e.g., pointing) and is utilized when manding for other reinforcers with this verbal response class (e.g., a “break” or a “toy”) although the card itself would be different. This is in contrast to what Michael (1985) referred to as topography-based responses, which are different forms of verbal behavior (e.g., a manual sign for “break” and a manual sign for “attention”) that are reinforced based on their distinguishable topography under a particular stimulus conditions (e.g., a motivational operation in place for one stimulus or another). For example, if an individual produces a manual sign to obtain attention (i.e., a topography-based mand for attention), it requires the control of a motivating operation for attention (e.g., deprivation of attention) and the production of a specific particular response form (i.e., the manual sign for attention); however, if a motivating operation for another reinforcer were in effect (e.g., a preferred item), then a different response form (e.g., the manual sign for “toy”) would be required to obtain that reinforcer (i.e., the preferred toy). In this way selection-based responses require the
control of two antecedent stimuli, whereas topography based responses require the control of only one antecedent stimulus.

Michael (1985) proposed that topography-based responses may be advantageous over selection-based responses in the learning of complex language skills (e.g., when a verbal repertoire becomes sufficiently large). Michael suggested that the scanning required by selection-based responses could lead a language learner to overlook the appropriate stimulus. By the time scanning has occurred the evocative stimulus (e.g., a discriminative stimulus) may have lost its functional effect. Wraikat et al. (1991) evaluated Michael’s (1985) assertion that training individuals to emit topography-based responding may be beneficial to complex language acquisition (e.g., learning intraverbals or large numbers of possible tacts). Seven participants with developmental disabilities were taught tact and intraverbal responses with manual signs (i.e., a topography-based response) or card exchanges (i.e., a selection-based response). Tacts are defined as verbal responses under the control of nonverbal discriminative stimuli, that are controlled by generalized reinforcers (e.g., praise or attention; Skinner, 1957). Intraverbals are verbal responses under control of verbal discriminative stimuli that do not share point-to-point correspondence (Skinner, 1957). Both intraverbals and tacts were acquired more quickly with the manual signs than with the card exchanges. These results provided some evidence that topography-based responses may have advantages over selection-based responses when it comes to complex language acquisition, as Michael suggested. This may be an important consideration when teaching functional vocal verbal skills (e.g., when conducting FCT). Despite the fact that FCT is generally used to treat problem behavior, one should be aware that the intervention also targets the development of verbal
behavior. As such, it is important to consider issues such as this when selecting the mand response, because the response could be part of developing a comprehensive verbal repertoire.

Despite the findings of Wriahtkat et al. (1991) suggesting that topography-based responding may have advantages for learning complex language skills, there are many reasons interventionists might choose to teach a selection-based response as part of FCT. One advantage to a selection-based system like Picture Exchange Communication Systems (PECS) has is it requires few motor skills and does not require learning another language (e.g., American Sign Language) (Charlop-Christy et al., 2002). This allows communication responses to be acquired quickly, and selection-based responses may require less effort than topography-based responses and, therefore, may compete better with problem behavior. In addition, selection-based responses tend to be easily understood by others, which may produce more generalization to the larger community. For example, many picture icons used in selection-based responses will be self-explanatory to persons with more complex verbal repertoires. Furthermore, increased vocal verbal behavior has been experimentally demonstrated to increase the use of either selection-based communication systems (Charlop-Christy et al., 2002) or other topography-based communication systems (e.g., manual signs; Carbone, Lewis, Sweeney-Kerwin, Dixon, Louden, & Quinn, 2006; Carbone, Sweeney-Kerwin, Attanasio, & Kasper, 2010).

In summary, research suggests that individuals often have specific preferences for one form of mand response over another. Quite often, selection-based responses are more preferred than topography-based responses, perhaps because they are more efficient
for the learner. This is important when designing FCT interventions, because it is important that the mand response taught effectively competes with problem behavior—that is, it requires less effort than the problem behavior. However, a more effortful topography-based response may be more desirable for the development of a more comprehensive verbal repertoire, which in the long run, may compete more effectively with problem behavior. Given this, there may be value in evaluating how to shift response allocation between topography-based and selection-based responding. Previous research (e.g., Peck et al., 1996) demonstrated that by manipulating the duration and quality of reinforcement, response allocation could be shifted between different mands. Reinforcement duration can be considered a dimension of quality and is a definitively objective measure of reinforce quality. The results of Peck et al. (1996) suggest that by providing a longer duration of reinforcement to a novel topography-based mand (e.g., a manual sign) as compared to a novel selection-based mand (e.g., a card touch), response allocation may be shifted towards the topography-based mand (and vice versa). However, Peck et al. (1996) varied other “quality” variables in addition to duration of reinforcement. No studies to date have directly evaluated whether varying the duration of reinforcement alone in favor of novel topography-based responses in FCT will change the concurrent choice outcomes over selection-based responding or problem behaviors. The purpose of the current study was to determine the effects of different reinforcement durations (i.e., 10-s and 60-s) on choice allocation between topography-based and selection-based mands that were taught during FCT, as compared to when reinforcement durations for the two mands were equivalent.
CHAPTER II

METHOD

Participants

All participants were recruited through flyers that were sent to their homes by the school district, in a rural county, in west Michigan. Participants were 3 children diagnosed with a developmental disability, between the ages of 4 and 7 years, who engaged in problem behavior demonstrated to serve a social positive reinforcement function. All participants demonstrated limited verbal behavior skills, and none of the children had more than a few reliable verbal responses (e.g., manual signs, PECS, vocal responses). Each participant demonstrated gross and fine motor imitation skills and did not have any significant visual impairment. Participant 1 was a 4-year-old male with a diagnosis of Down syndrome, who engaged in disruptive behavior, and who could only produce a few vocal or manual sign responses (e.g., saying “cow” or providing the American Sign Language sign “hungry”). Participant 2 was a 6-year-old female, with a diagnosis of autism, who engaged tantrums and self-injury, and demonstrated no functional verbal behavior. Participant 3 was a 7-year-old male, with a diagnosis of autism, who engaged in self-injury and physical aggression, and demonstrated no functional verbal behavior.

Settings and Materials

All sessions were conducted in the participants’ homes. Materials used were preferred items (e.g., iPads, books, stuffed animals, Dora DVDs), rubber bracelets,
laminated communication cards (10.8 X 14.0 cm), a laminated green piece of paper (21.6 X 27.9 cm), a video camera, timing devices (e.g., Motivader®), and basic office supplies (i.e., paper, pencils, and other materials for data collection).

Data Collection

Dependent Variables

All sessions were video recorded to allow for later review, data collection, and interobserver agreement. Data collection was completed by the author, as well as graduate and undergraduate research assistants. The training of research assistants involved scoring data concurrently with the author using a practice video until agreement was consistently 90% or better. Training on each new data collection sheet involved discussion with the researcher, a demonstration of correct and incorrect recording, and practice as described above.

The dependent variables were problem behavior, topography-based mands, and selection-based mands. Problem behavior was individually defined for each participant. Target problem behavior for Participant 1 was disruptive behavior, defined as scratching, screaming (vocalizing a volume that can be heard from 6 meters away), banging toys on tables (loud enough to be heard from 6 meters away), pushing (hard enough to physically move a person of approximate physical size and weight), breaking item apart, throwing items (with enough force to break them or throwing at other people), and hitting people or objects (with an open hand and hard enough to make an audible sound). Examples of disruptive behavior included hitting the table with an open hand hard enough to be heard from 3 meters away or making an audible sound with the vocal muscles so loud it can be heard from 6 meters away. Non-examples included touching the table or putting hand
down on table such that it makes no clearly audible sound or making an audible sound with the vocal muscles that could only be heard from 1.5 meters away

For Participant 2 target problem behaviors included tantrums and self-injury. Tantrums were defined as flopping on the floor/bed or stomping/jumping up-and-down and crying/yelling loud enough to be heard from 3 meters away. Examples included crying loud enough to be heard from 3 meters away and jumping up-and-down or flopping on the bed and crying loud enough to be heard from 3 meters away. Non-examples included crying so quietly it could only be heard from 1.5 meters away or jumping up and down on the bed without crying. Self-injury was defined as closed fist hitting of the head, face, or thigh, with moderate force. Examples included making a fist with both hands and hitting herself in the chin with enough force to move her jaw or making a fist with her right hand and hitting herself in the thigh. Non-examples included hitting her chin with an open hand or hitting her chin with a closed fist with such little force it does not even move her jaw. Though both of Participant 2’s target behaviors were individually defined they were graphed together as “problem behavior” because the functional analysis (see Procedures section below) demonstrated both responses were maintained by the same functional reinforcers.

For Participant 3 target problem behavior included self-injury, physical aggression, and disruptive behaviors. Physical aggression was defined as biting, hitting, or pinching others with enough force to cause tissue damage. Examples of physical aggression included biting down with teeth on the arm of another person or hitting another person in the eye with an open hand hard enough to cause tissue damage. Non-examples included putting mouth on another person’s arm without biting down or hitting
another person in head with such mild force it could not cause tissue damage. Self-injury was defined as hitting with an open or closed fist on the thigh or groin with moderate force. An example of self-injury included hitting himself in the groin with a closed fist. A non-example of self-injury included lightly hitting oneself with an open hand in the chest with mild force. Disruptive behavior was defined as slamming down the iPad and other objects, hits grounds and table with his fist, hard enough to be disruptive or damage property. An example of disruptive behavior included throwing a bucket of foam off the table. A non-example of disruptive behavior included putting an iPad down lightly on the table. Though both of Participant 3’s target behaviors were individually defined they were graphed together under the signifier of “problem behavior”, as assessment demonstrated that both responses were maintained by the same functional reinforcer.

All problem behavior was measured using a 10-s partial-interval recording procedure during the preliminary assessment and training phase. Data were summarized as percentage of intervals with problem behavior by dividing the number of intervals in which problem behavior was observed over the total number of intervals for which data was collected. During the experimental duration manipulation phase problem behavior was measured by occurrence (+) whenever it was observed in that specific trial.

The topography-based mands taught in this study were manual signs. All manual signs taught were novel to the participants (i.e., they were neither observed nor reported to occur prior to the study), but the specific signs taught were determined individually for each participant. For Participant 1 the manual sign taught served as a mand for a Curious George™ video. The sign involved extending the thumb and index finger while keeping the other fingers closed, while the closed fingers faced the chest of the participant, and
touching his throat. This sign was used for its correspondence to the American Sign Language (ASL) sign for “G” and it was held to the throat for its approximation to the ASL sign for “curious.” For Participant 2 the sign taught served as a mand for a Dora the Explorer™ video. The sign involved extending the index finger straight up, while touching the thumb again the remaining closed fingers. This sign was chosen for its correspondence to the ASL sign for “D”, which was selected to correspond to Dora. For Participant 3 the sign taught served as a mand for the iPad and stuffing-foam (i.e., the stuffing in stuffed animals or furniture. The sign involved the participant touching his head with his right palm. This was selected as an imitative behavior within the repertoire of the participant, which was distinct from other signs that may be taught. Correct responses were the independent emissions of the manual signs described above. Incorrect responses were all other responses, particularly those emitted only after prompts were provided and attempts to make completely different response (e.g., a card touch response or a “more” manual sign).

Topography-based mands were measured using an event recording procedure. During sessions, researchers observed the correct or incorrect displays of a mand during each trial and marked either a plus (+) or a minus (-), or to indicate the occurrence of a mand they marked a plus (+). Trial-based data were summarized as percentage of trials in which the mand was displayed, calculated by dividing the total number of manual sign responses observed in a session by the total number of trials in a session.

Selection-based mands were card-touch responses. The card-touch mands were also novel for each participant; novelty was determined by asking each parent if her child used any card-based communication system and all parents said no to this question. For
Participant 1 the selection-based response involved touching a pink card that read “watch Curious George”. For Participant 2 the selection-based response involved touching a tan card that read “watch Dora.” For Participant 3 the selection-based response involved touching a blue card that read “iPad.” Correct responses were the independent emissions of the card-touch response described above. Incorrect responses were all other responses, particularly those emitted only after prompts were provided and attempts to make completely different response (e.g., a manual sign response or a “more” manual sign).

Selection-based mands were measured using an event recording procedure. During sessions, researchers observed the correct or incorrect displays of a mand during each trial and marked either a plus (+) or a minus (-), or to indicate the occurrence of a mand marked a plus (+). Trial-based data were summarized as percentage of trials in which the mand was displayed, calculated by dividing the total number of card-touch responses observed in a session by the total number of trials in a session.

Interobserver Agreement

Interobserver agreement (IOA) was scored by having two people independently view the same session from videotape and score the dependent variables. The interval agreement IOA method was used with any partial-interval data collection (Johnston & Pennypacker, 2009). After data were scored by the two independent observers, the data sheets were compared. Each interval was compared to determine whether or not problem behavior was marked as occurring. Agreements were divided by agreements plus disagreements and multiplied by 100% to obtain the percentage of agreement. Trial-by-trial agreement IOA was used for event recording procedure (Cooper, Heron, & Heward, 2007). Trial-by-trial agreement involved two independent observers scoring each trial for
the occurrence of the two mands. Observers then compared each trial and determined whether there was agreement or a disagreement. The number of agreements was divided by the sum of agreements plus disagreements and multiplied by 100% to obtain the percentage of agreement.

For Participant 1 overall IOA was 99% (range 94%-100%) and IOA was collected for 44% of sessions. For Participant 2 overall IOA was 99% (range 93%-100%) and IOA was collected 39% of sessions. For Participant 3 overall IOA was 99% (range 95-100%) and IOA was collected for 47% of sessions.

Independent Variables and Experimental Design

The independent variables were the duration of reinforcement for each mand modality. Duration of reinforcement for each of the mand modalities was either 60-s, 10-s, or (for Participants 2 and 3) placed on extinction, depending on the experimental condition. Each participant experienced the experimental conditions in a slightly different order on an ABC, and for Participants 2 and 3 ABCD, reversal design. This design was used to evaluate the effects of reinforce duration on the displays of mands; Participant 1 experienced an ABCBA design, Participant 2 experienced an ABCBDADA design, and Participant 3 experienced an ABCBADAD design. During all phases, both mand modalities (topography-based and selection-based) were signaled as available in all conditions and forced exposure to the contingencies associated with each condition occurred before the start of that condition.

The first phase of the experiment was the baseline phase (60-s both modalities) or A in which both mand modalities resulted in 60-s of reinforcement. Data were collected until a clear separation between the modality allocations of the two mands or 10 sessions
had occurred without any clear separation. The mand that was selected more often (for at least 3 consecutive trials) was determined as preferred by the participant. In phase B, 60-s/ Non-Preferred (NP) vs. 10-s/ Preferred (P), the mand determined to be NP (i.e., by being chosen less often in the baseline [60-s both modalities] phase) resulted in 60-s of access to that participant’s functional reinforcer (as determined by the functional analysis). The mand determined to be P (i.e., by being chosen more often in the baseline [60-s both modalities] phase) resulted in 10-s access to that participant’s functional reinforcer. The purpose of this phase was to determine if there would be a change in response allocation with the manipulation in reinforcement duration, as compared to baseline (60-s both modalities). Data collection occurred until a clear separation favoring the NP was observed or 5 sessions had elapsed without any change in response allocation.

The C phase, 10-s/ NP vs. 60-s/ P, consisted of providing 60-s of access to the functional reinforcer for the P modality and 10-s access for the NP. This phase constituted a reversal in reinforcer contingencies. Data collection occurred until a clear separation favoring the P modality was observed or 5 sessions had elapsed without any change in response allocation.

The D phase, 60-s/NP vs. Extinction (Ext)/P, consisted of placing the P mand modality on extinction and not providing any reinforcement unless the NP mand modality was emitted. Data collection occurred until a clear separation favoring the NP occurred or three choice trials occurred in which 5 minutes elapsed without evoking the NP mand and that choice trial was terminated.

All reversals used the exact same criteria as described in the initial description.
All data were graphed and analyzed using visual analysis, through the assessment of trends, variability and level changes.

**Treatment Integrity**

Treatment integrity was assessed by having a rater watch sessions from the videotapes and score on a checklist of the procedural steps involved in that phase whether each step was implemented correctly. The percentage of steps completed correctly was obtained by dividing the number of steps that were scored as correct by the total number of steps for that phase. This provided a treatment integrity score for the experiment. Overall treatment integrity was 99% (range 80%-100) and was collected for 39% of sessions.

**Social Validity**

Social validity of the experimental procedures was assessed by providing the parents with a Likert-scale questionnaire. The questionnaire inquired into the degree to which the rater (i.e., the parent) felt improvements were seen in the behavior targeted and to what degree the methods by which intervention occurred were reasonable (see Figure 1). The numbers for each question was converted into a percentage of strongly agree, agree, unsure, disagree, and strongly disagree. These percentages provided a notion of the acceptability of the procedures used by caregivers. For Participant 1, Participant 2, and Participant 3, 100% of questions were scored as strongly agree with the socially validity of this intervention.
Social Validity Questionnaire

Instructions: Please fill out this form by marking the number that most closely represents your opinion. Do not put your name on the form.

1= Strongly Disagree  2= Disagree  3= Unsure  4= Agree  5= Strongly Agree

1. Do you feel that your child’s participation in this study was valuable?
   1  2  3  4  5
   Strongly Disagree  Strongly Agree

2. Do you feel that the procedures used in this study were effective?
   1  2  3  4  5
   Strongly Disagree  Strongly Agree

3. Do you feel that the study required reasonable demands on you and your child?
   1  2  3  4  5
   Strongly Disagree  Strongly Agree

4. Do you feel the goals of the study were reasonable?
   1  2  3  4  5
   Strongly Disagree  Strongly Agree

5. Will you use the skills taught by the researchers with your child in the future?
   1  2  3  4  5
   Strongly Disagree  Strongly Agree

Figure 1. Social Validity Questionnaire. An example of the questionnaire provided to families when the study was completed to assess acceptability of the study.

Procedures

Preliminary Assessments and Trainings

The purpose of the preliminary assessments and trainings was to determine the target problem behaviors and identify their functions, what toys/activities are preferred by the participant, whether the duration of reinforcement influences a participant’s choice prior to the intervention, and to train a replacement selection-based (i.e., card-touch) response and topography-based (i.e., manual sign) response that competed with participants’ target problem behaviors.
Preference Assessment

The purpose of the preference assessment was to determine which toys/activities were preferred by the participant, so that information could be utilized in the design of later portions of the study (e.g., the functional analysis). A paired-stimulus preference assessment (Fisher, Piazza, Bowman, Hagopian, Owens, & Slevin, 1992) was used for Participants 1 and 2; Participant 3 displayed high rates of problem behavior during the removal of stimuli that occurred as part of the procedure, thus, a free-operant preference assessment (Roane, Vollmer, Ringdahl, & Marcus, 1998) was used for this participant. Items selected as most highly preferred were used in the subsequent functional analysis. Stimuli chosen most often were assumed to be high preferred and the stimuli chosen the least often were assumed to be low preferred.

Functional Behavior Assessment (FBA)

The FBA was conducted in 3 parts: an interview, a direct observation, and a functional analysis. The purpose of this procedure was to operationally define the target problem behavior, form a hypothesis of its function, and experimentally assess the function of problem behavior.

Interview. The interview used in the FBA was the Functional Assessment Interview (FAI; O’Neill et al. 1997). This form identified target problem behaviors, provided an operationally definition of those behaviors, antecedent and consequence conditions which have been correlated with the behavior in the past, as well the participants’ functional verbal behavior and preferred items. Researchers filled out the FAI document while interviewing the parents in person. The interviews lasted approximately 45 minutes.
Antecedent-Behavior-Consequence (ABC) Assessment. The second part of the FBA process was an ABC assessment (Neef, & Peterson, 2007). This consisted of the researcher directly observing each participant in an environment where target behavior was reported to likely occur in the FAI. During the direct observation, antecedents, behaviors, and consequences for target problem behaviors were tracked for their direct co-variation with one another, as well as any stimuli engaged with during that time. This assessment was completed across one to four 45-minute observation periods, depending on the participant.

Functional Analysis. A functional analysis (Iwata et al., 1982/1994) was conducted with each participant to assess the function of his or her current target behaviors. The functional analysis consisted of 4 conditions (an attention condition, an escape condition, a tangible condition, and a free play condition; Carr, 1994).

Only participants who displayed problem behavior for social positive reinforcement reasons continued in the study, all others would have been discharged from the study. All 3 participants demonstrated a socially positive function for their problem behavior. Based on the results of the functional analysis an appropriate topography-based mand (i.e., a manual sign) and an appropriate selection-based mand (i.e., a card touch) were chosen.

Duration Sensitivity Assessment

The purpose of the duration sensitivity assessment was to determine whether the participant was sensitive to different durations of access to his functional reinforcer. The duration sensitivity assessment was based on the reinforcer assessment procedures used by Piazza, Fisher, Hagopian, Bowman, and Toole (1996) and involved 10 concurrent
choice trials between two chairs in a room. One chair was associated with 60-s access to the functional reinforce, and the other chair was associated with 10-s access to the functional reinforcer. Trials began with the participant positioned equidistant from each chair, approximately 1.5 meters away from each. Prior to conducting the actual assessment with each participant forced exposures were conducted, in which each participant was directed to sit at each seat (5 times each) to ensure the participant experienced the contingencies associated with each condition. Following the forced exposure, the duration sensitivity assessment began. In this procedure the participant was told to ‘choose’ where he/she wanted to sit (i.e., between the two choices) and experienced the duration of reinforcement associated with the chair he/she sat in. During the duration sensitivity assessment Chair 1 resulted in 60-s access to the functional reinforcer and Chair 2 resulted in 10-s access to the functional reinforcer. If the participant did not make a choice within 5-s, then the choice was re-presented. If the participant did not make a choice within 5-s after having a choice re-presented, then the participant’s response was recorded as “no choice”. If the participant refused to choose or engaged in problem behavior, for 8 or more of the 10 trials, the analysis ended. If the participant did not appear sensitive to the difference in duration of access to the functional reinforcer, then the analysis was conducted again with a signal for each of the two different reinforcement durations. Signals were a green piece of paper and a white, blank communication card (i.e., it was the same sized card as the communication cards and the same material, but used as a signal). In all other circumstances at the end of the 10 trials showing sensitivity to duration manipulation or 10 trials with a signal, the analysis ended.
Functional Communication Training (FCT)

The purpose of FCT was to train each of two mand modalities to a level of independent responding that was stable and competed with target problem behaviors, so that preference between the two mand modalities could be assessed in the subsequent experimental phases of the study. Functional communication training was divided into single mand in effect conditions and mand in effect changes conditions. In the single mand in effect conditions only one mand modality, either the card-touch (i.e., selection-based mand) or the manual sign (i.e., topography-based mand), was taught for all 10 trials of a session. During mand in effect changes conditions one session was composed of 5 trials of the card touch and 5 trials of the manual sign, presented in counterbalanced fashion. In all FCT sessions both a communication card and a bracelet were presented during choice trials and removed once a choice had been made. The modality that would result in access to the functional reinforcer was signaled by a green piece of paper placed under the communication card when the card-touch would result in reinforcement and under the bracelet when the manual sign would result in reinforcement. During card-touch trials participants were taught to touch a card to obtain 60-s of access to the functional reinforcer that maintained their target behaviors. During manual sign trials participants were taught to produce a manual sign to obtain 60-s of access to the functional reinforcer that maintained their target behaviors.

All mands were taught using a most-to-least three-prompt sequence (physical, gestural/model, and verbal) to decrease the number of errors that occur during training. Problem behaviors that risked causing serious harm (e.g., head banging) were neutrally
blocked and all other problem behaviors were placed on extinction (i.e., they did not result in access to the functional reinforcer).

The setup for the FCT session had multiple components. All FCT sessions consisted of 10 trials. The participant received brief exposure to the functional reinforcer (e.g., a video). Then the researcher stopped the video and said “time to make a choice,” at which time the researcher prompted the participant to place his/her hands in his/her lap and sit still. Next the researcher placed the bracelet and communication card on the table. He then placed the green card underneath the stimulus associated with that trial (i.e., he placed it underneath the bracelet when the manual sign was being taught and reinforced and underneath the card when the card-touch was being taught and reinforced). If the participant engaged in the correct mand response, then he/she was provided with 60-s access to the functional reinforce. If no response or an incorrect response was emitted, the experimenter prompted a correct response. If the participant engaged in the mand response not in effect during that session, then a correction procedure was implemented in which the participant was prompted to complete the correct response, the cards were represented immediately, and another choice was presented during which the researcher prompted the correct response. At the end of each choice trial the green piece of paper, the communication card, and the bracelet were removed until the next trial.

FCT was split into two conditions “single mand in effect during a session” (i.e., a mass trial procedure) and “mand in effect changes” (i.e. a discrimination procedure). In the first condition “single mand in effect” only one mand was taught during the entire 10-trial session. This condition continued until either a) the participant both independently displayed the correct mand under the correct stimulus conditions for 3 consecutive
sessions in an upward trend AND scoring above 80% for at least one session, or b) the participant independently displayed the correct mand under the correct stimulus conditions for 2 consecutive conditions at 100%. The condition also required that problem behavior was less than 10% of that observed in baseline (the condition of the functional analysis that produced the most problem behavior).

For Participants 2 and 3 an additional procedure was required for them to learn the manual sign (though not the card-touch). The participants appeared to be prompt dependent and did not emit the targeted mand in the absence of prompting. Therefore, a transfer-of-stimulus-control procedure was implemented. In this procedure, multiple imitations were evoked with the participant until the participant reliably imitated the manual sign selected for FCT. For example, a participant would be told “do this” while the researcher modeled a response (e.g., touching head). If the participant did not imitate the response within 2 s, the researcher physically prompted an imitation response. Then, the sign was prompted to occur in response to “time to make a choice”, for which prompts were then faded out slowly. This was like the earlier imitation trials except after the participant emitted the FCT sign (e.g., the head touch for Participant 3) the researcher removed the functional reinforcer (e.g., the iPad), and said “time to make a choice” while providing a model prompt for the correct response (e.g., touching his head for Participant 3). Prompting was faded slowly until the participant engaged in the correct response without any additional prompt, whenever the functional reinforcer was removed. When the targeted response was displayed correctly and independently for two sessions, the standard FCT procedure was reinstated.
When both mand modalities occurred reliably in the “single mand in effect” condition, the “mand in effect changes” condition was implemented to determine whether the participant could respond reliably to the relevant stimuli signaling which mand was would be reinforced. The “mand in effect changes” discrimination trials involved the same set up as the “single mand in effect” condition (where only one mand modality was in effect for all 10 trials of a session), however, the mand being reinforced varied from trial to trial across a session until 5 card-touch trials and 5 manual sign trials had occurred. For each trial, the green paper that signaled which response would be reinforced was placed under either the communication card or the bracelet in a counterbalanced fashion. (Left/right positioning of the stimuli was also counterbalanced.) Mands that matched the signal were reinforced. Mands that did not match resulted in the correction procedure described above. Discrimination was assumed when participants responded correctly on 80% or more trials for 3 consecutive sessions or when they responded correctly on 100% of trials for two consecutive sessions.

Experimental Evaluation of Reinforcement Duration

The purpose of this phase was to evaluate the effects of varying the duration of reinforcement for each concurrently-available mand modality between 60 s and 10 s on mand selection/preference. Before each condition, the participant was provided with a forced trial of the contingencies associated with each modality. Mands received only vocal prompts (e.g., “time to make a choice”) during all experimental sessions, and target behaviors resulted in neutral blocking and extinction; prompts to “make a choice” occurred every 30 s until a response was made. During all choice trials both the
communication card and the bracelet were underneath the green piece of paper, signaling the availability of both for reinforcement.

A Condition (60-s Both Modalities)

The purpose of this condition was to evaluate whether the participant had a preference for using the card-touch (i.e., the selection-based mand) or the manual sign (i.e., the topography-based mand) when the duration of reinforcement was the same for each mand. A trial began when the experimenter said, “It’s time to make a choice.” Whichever mand the participant displayed first was reinforced for 60 s on an FR1/FR1 schedule. At the end of a trial, the reinforcers were removed, and another trial began. Mand preference was determined by evaluating the cumulative occurrence of mands. When a stable pattern of response allocation in favor of one mand modality over the other was observed for at least 3 consecutive trials, this sub-phase ended. The mand that was chosen more often was determined to be preferred by the participant. When responding had met these criteria the 60-s/ NP vs. 10-s/ P phase was conducted.

B Condition (60-s/ NP vs. 10-s/P)

The purpose of this condition was to assess whether decreasing the duration of reinforcement for the preferred mand modality would change the participant’s response allocation from the use of his preferred mand modality to his non-preferred mand modality. Non-preferred mands resulted in 60-s access to the functional reinforcer and preferred mands resulted in 10-s of access to the functional reinforcer. When a stable trend favoring the NP modality over the P modality was observed for at least 3 consecutive trials or 5 trials had elapsed without any change in response allocation, this
phase was ended. When responding had met these criteria the 10-s/NP vs. 60-s/P phase was conducted.

C Condition (10-s/NP vs. 60-s/P)

The purpose of this condition was to reverse the contingencies for the P and NP mand and to determine if responding would reverse in accordance with the contingencies of reinforcement or start to vary for the first time. This condition was set up exactly as the 60-s/NP vs. 10-s/P condition except NP modality resulted in 10-s of access to the functional reinforcer and P modality resulted in 60-s of access to the functional reinforcer. When a stable trend separation favoring the P modality over the NP modality was observed for at least 3 consecutive trials or 5 trials have elapsed without any change in response allocation, this sub-phase ended. When responding had met these criteria either the 60-s/NP vs. Extinction (Ext)/P or the reversal trials began.

D Condition (60-s/NP vs. Ext/P)

The purpose of this condition was to determine if response allocation could be shifted when the P mand modality was placed on extinction, demonstrating the functional relationship between the contingencies of reinforcement and the modality selected, despite no shift in allocation from the duration manipulation alone. This condition was set up exactly as the previous experimental conditions except the NP modality resulted in 60-s access to the functional reinforcer and the P modality was placed on extinction (i.e., engaging the P response would not result in access to the functional reinforcer). When a stable trend separation favoring the NP modality was observed for at least 3 consecutive trials or 3 trials had end after 5 minutes elapsed without the participant engaging in the
NP mand modality, this sub-phase ended. When responding had met these criteria reversal trials were continued or began.
CHAPTER III
RESULTS
Preliminary Assessments and Training

Based on the results of the preference assessment and in-home observations the tangibles items selected to be used in the functional analysis were: for Participant 1 Curious George videos, for Participant 2 Dora the explorer videos, and for Participant 3 both an iPad and stuff foam (e.g., the used in stuffed animals).

The results of the functional analysis showed that: for Participant 1 problem behavior was primarily maintained by access to tangible reinforcers; for Participant 2 problem behavior was primarily maintained by both access to tangible reinforcers and escape from demanding situations; for Participant 3 problem behavior was primarily maintained by both access to tangible reinforcers. (See Figure 2.) For Participant 2 only the positive reinforcing function was directly evaluated in this study, though the family was provided with recommendations for the negative reinforcement function.

The duration sensitivity assessment showed that Participant 1 was highly sensitive to the duration of access to the functional reinforcer, as he selected the 60-s of access over the 10-s of access in 9 out of 10 trials; in the last trial, he selected the “no choice” option. Participant 2 was also highly sensitive to the duration of access to the functional reinforcer; as she selected the 60-s of access 9 out of 10 trials and the 10-s of access just once. Participant 3 was not sensitive to duration, as his selection of chairs changed with each trial (i.e., he selected the 10-s choice and then the 60-s choice and again back to the 10-s, etc., etc. throughout the session); this continued even after one white and one green...
piece of laminated paper of differing sizes were added (designated in bottom graph of Figure 3 as “stimuli added”) to the two separate duration choices. (See Fig 3.)

Figure 2. Functional Analysis. The percentage of partial-intervals in a session in which the target behaviors were observed for Participant 1 (Top), Participant 2 (Middle), and Participant 3 (Bottom). Open marker signifies that the validity of that particular session may be in question and the results of that sessions unclear. This can be seen for Participant 1 (a tangible was removed within the escape session affecting the validity of the results) and Participant 2 (the first attention condition signifies that a highly preferred tangible was restricted for this session and most likely affected the results; in the second attention condition it was not restricted).
Figure 3. Duration Assessment. Cumulative record number of times each response was chosen across trials by Participant 1 (Top), Participant 2 (Middle), and Participant 3 (Bottom). For Participant 3 the phase line separates the trials that were unsignaled from those where stimuli were added to signal the contingencies.

The results of functional communication training (FCT) demonstrated that Participants 1, 2, and 3 acquired both mand modalities, as well as discrimination between
which modality was currently resulting in access to the functional reinforcer. However, for Participants 2 and 3, only data collected after the transfer of stimulus control sessions had been completed for the manual sign are included. For Participant 3 this is designated by the break on the x-axis after the third session, signifying the elapse in time that occurred and was not displayed. (See Figure 4.)

**Figure 4.** Functional communication training (FCT). The the percentage of trials in a session that a manual sign or card touch was made independently and accurately emitted,
as well as the percentage of 10-s partial-intervals in a session during which target problem behavior was observed for Participant 1 (Top), Participant 2 (Middle), and Participant 3 (Bottom). The line break along the x-axis in Participant 3’s graph represents the passage of time during which the transfer of stimulus control procedure was used to help acquire the manual sign response prior to further FCT sessions.

Experimental Evaluation of Reinforcement Duration

The experimental evaluation of reinforcement duration demonstrated that Participants 1, 2, and 3 all showed a response modality preference for the card-touch (i.e., selection-based) response over the manual sign (i.e., topography-based) response. For all three participants manipulations in reinforcement durations between 10 s and 60 s did not result in a shift in response modality preference. The use of extinction in the D condition or 60-s/NP vs. Ext/P did result in a shift in response allocation for Participants 2 and 3; Participant 1 was never exposed to this condition. In all conditions where the card-touch (i.e., the preferred mand modality) was not placed on extinction all three participants continued to demonstrate a preference for this modality. (See Figure 5.)
Figure 5. Experimental Evaluation of Reinforcement Duration. Cumulative number of times each response modality was selected for each concurrent choice trial presented for Participant 1 (Top), Participant 2 (Middle) and Participant 3 (Bottom). Open marks signify trials in which forced exposure to all choice contingencies for that condition had not occurred prior to those choice trials. A= 60-s both mand modalities. B= 60-s/non-preferred modality (NP) vs. 10-s/preferred modality (P). C= 10-s/NP vs. 60-s/P. D= 60-s/NP vs. Extinction/P.
CHAPTER IV

DISCUSSION

All participants acquired both a selection-based (i.e., card-touch) and a topography-based (i.e., manual sign) mand that competed with their problem behavior, but manipulation of durations of reinforcement used in this study did not result in shifts between these two new mand modalities. An FBA was conducted to identify the function of problem behavior for all participants and all participants demonstrated a tangible function. Then a duration sensitivity assessment was conducted to determine if prior to the experimental portion of the study participants were sensitive to manipulations in the duration of access to their functional reinforcer; Participant 1 and 2 demonstrated sensitivity between 10-s and 60-s, but Participant 3 did not. Afterward, FCT was successfully taught with the functional reinforcer and each participant demonstrated discrimination between the signals for which mand was receiving reinforcement. Finally, the duration of reinforcement associated with concurrently available mands was experimentally manipulated, but changes in the duration of reinforcement associated with each mand modality demonstrated no effect, though extinction of the preferred response did result in the use of the non-preferred mand modality.

Based on these results it appears that these duration manipulations alone do not necessarily shift response allocation or preference for selection-based vs. topography-based mand modalities. This held true even for participants who demonstrated a high preference to longer durations of access to the functional reinforcer in the duration sensitivity assessment and a mastery of each mand modality during functional
communication training. Yet, participants did shift responding when one response modality stopped being reinforced during the D phase of the experiment (i.e., 60-s/NP vs. Extinction/P), which suggests that response allocation can be shifted with the appropriate contingencies and provides practitioners with a basic method of shifting verbal responses from selection-based to topography-based response, without high rates of resurgence in problem behavior.

Peck et al. (1996) demonstrated that response allocation could be shifted with manipulations in both quality and duration of reinforcement. In the current study only duration was manipulated, to account for the lack of consensus in the field of applied behavior analysis on what constitutes quality (for a brief discussion see Peterson, Frieder, Smith, Quigley, & Van Norman, 2009). However, until another study directly investigates what effect quality manipulations (as conceptualized by Peck et al. and Peterson et al.) in combination with duration manipulations have on response allocation between topography-based and selection-based mand modalities, it is not clear whether the addition of quality will have an effect on response allocation.

Another consideration in regard to shifting response allocation between these two modality types is the potential effects of response history. As alluded to earlier, selection-based responses (e.g., those used in PECS) are often easily acquired because they tend to already exist in the repertoire prior to communication training (e.g., when reaching for an item in front of you). It may be worth considering that the history of selection-based responding may generalize to new selection-based responses, biasing comparisons of the kind demonstrated in the current study between newly acquired topography-based and
selection-based responses, as one (i.e., the selection-based response) may benefit from a
generalized response history that the other does not (i.e., the topography-based response).

Anecdotally, when a behavior becomes more efficient through continuous
practice or training, it is used more often. An example would be when learning to sign
one’s own name in cursive. At first it may seem to involve more effort than signing one’s
own name in print and whenever it is not required it will not be used. However, as one’s
cursive signature becomes more effortless through continuous use it may even be used
when not required. In the same way topography-based responses, with enough use, may
start to compete with the already acquired selection-based responses.

Yet, in considering when a cursive signature becomes the preferred response
used, there may be some component of history and practice that reduce the effort and
ultimately cause the response allocation to shift (from the print to the cursive signature).
Richman, Wacker and Winborn (2001) demonstrated that responding could be shifted to
a topography-based response (i.e., manual-sign) when the selection-based response
involved picking a card up off of the floor and bringing it to the researcher to exchange,
demonstrating that (physical) effort can affect which of these two modalities responding
is allocated towards. Similarly in regard to the effect of history on response effort,
Winborn, Wacker, Richman, Asmus, and Geier (2002) showed that in a mand preferences
assessment scenario with a novel selection-based mand versus an existing topography-
based mand, the participant preferred the topography-based response (i.e., the response
that had a longer history, but superficially would require more effort to complete- that is
if a history of responding does not change the effort of the response). All in all suggesting
that, in addition to the future line of research recommended above, further investigations into the effects of history on response effort should be conducted.

Also, there are some notable limitations to the current study. First, the topography-based response (i.e., the manual sign) was signaled by a combined stimulus and some may argue that you cannot be sure manual signs were necessarily under the motivation of the establishing operation for the stimulus provided. Mands are defined as only under the control of the establishing operation. Michael (1985) criticized selection-based (e.g., a card-touch) response for being under the control of both the establishing operation and stimulus control of the specific selective operandum. He also said this is a reason topography-based response (e.g., manual signs) may be preferable for language training, as it is only under the control of the establishing operation. This is a fair point, but it can be accounted for in two ways. One, the nature of the comparison of a card-touch and a manual sign required the ability to respond to both the signal for the topography-based response (i.e., the manual sign) and the signal for selection-based response (i.e., the card-touch) could be demonstrated to affect the appropriate response in a comparable fashion, so that incorrect responses could be observed for both modalities equally (i.e., so that manual sign could not be made at all time and put on extinction when not in effect, but the card-touch was only signaled when available and an incorrect response of touching the card could not even occur during manual sign in effect trials). In this way topography-based responses could not be biased by being the only modality to experience extinction and correction, since it did not rely on a signal to occur, and therefore manual signs were brought under the control of a stimulus that was always available during choice trials and one that was only available when manuals signs would
result in reinforcement. This is, of course, also why the communication card was available during all trials, but (like the bracelet) the response associated with it only resulted in access to the functional reinforcer when the green card was underneath it.

Two, since the functional analysis determined that the items used functioned as reinforcers, it seemed reasonable to say that their presentation contingent on the correct mand modality (and restriction prior to the emission of that behavior) represented the demonstration of a functional mand.

A second limitation was the low number of trials conducted in each condition of the experimental-duration manipulation phase before moving to the next condition. It may be true that any lack of effect the various duration manipulations had on response allocation could be attributed to the short length of each condition. However, since these conditions were replicating the “mand preference assessment” demonstrated in the 60-s Both condition, 5 trials without change would be an acceptable demonstration of preference between two stimuli being assessed, so the extension to behavior from preference seemed appropriate. Also, participants who demonstrated a clear preference for a longer duration of access to the functional reinforcer during the duration assessment, continued to prefer the same modality, even when forced exposure the contingencies associated with each condition was implemented.

Third, the fact that Participants 2 and 3 required a transfer of stimulus control procedure prior to FCT to acquire the topography-based response, limits the ability of the researcher to say that the topography-based response was taught using FCT. Though true, three points can be made regarding this decision. One, the use of a transfer of stimulus control training is procedure for teaching functional communication skills in verbal
behavior (e.g., Bloh, 2008). Two, FCT was still used to teach discrimination and responding to the specific stimuli associated with specific contingencies. Three, one of the 7 dimensions of behavior analysis outlined by Baer, Wolf, and Risley (1968) is that interventions should be effective. The decision was made that to meet this dimension a further amendment to the original protocol had to be made and this was how it was chosen.

Lastly, but worth noting, it may be seen as a limitation that functional control was not demonstrated in the duration manipulation trials (i.e., conditions B and C) in the experimental evaluation of reinforcement duration. It is true that perhaps by extending the contrast in the duration of reinforcement differences behavior may have shifted. In the same sense, with the procedures described in Richman et al. (2001; i.e., the manipulation of response effort) or those described by Peck et al. (1996; i.e., the manipulation of quality of reinforcement concurrently with duration of reinforcement), a functional relationship could have been demonstrated without the use of extinction. However, the purpose of this research was to evaluate if the same shifting in response allocation observed in those studies could be produced without the addition of these other variables and the extending of the duration contrast seems less tenable in the natural environment. In this sense the lack of a functional relationship demonstrates the ineffectiveness of this intervention alone, but leaves open the door for future researchers to investigate the effects of extending duration differences to determine the effect this may have on response allocation.

This study was very important in providing more questions for our science to answer. Though the initial intervention investigated did not result in clear answers about
the effects of duration manipulations on response allocation, the use of other procedures must still be answered. What is the effect of duration AND quality in response allocation of topography-based versus selection-based responses? What effect does the response history have on effort? By answering these questions our field can once again move closer to helping the people we serve.
REFERENCES


Date: January 15, 2014

To: Stephanie Peterson, Principal Investigator
   Nicholas Acker, Student Investigator for thesis
   Shawn Quigley, Student Investigator

From: Amy Naugle, Ph.D., Chair

Re: HSIRB Project Number 13-11-10

This letter will serve as confirmation that your research project titled “The Effects of Varying Duration of Reinforcement on Novel Selection-Based versus Topography-Based Mands” has been approved under the full category of review by the Human Subjects Institutional Review Board. The conditions and duration of this approval are specified in the Policies of Western Michigan University. You may now begin to implement the research as described in the application.

Please note: This research may only be conducted exactly in the form it was approved. You must seek specific board approval for any changes in this project (e.g., you must request a post approval change to enroll subjects beyond the number stated in your application under “Number of subjects you want to complete the study”). Failure to obtain approval for changes will result in a protocol deviation. In addition, if there are any unanticipated adverse reactions or unanticipated events associated with the conduct of this research, you should immediately suspend the project and contact the Chair of the HSIRB for consultation.

Reapproval of the project is required if it extends beyond the termination date stated below.

The Board wishes you success in the pursuit of your research goals.

Approval Termination: November 20, 2014