Communication intervention for children with severe neurodevelopmental disabilities: An application of telehealth as a service delivery mechanism

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Dedication

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Abstract

The current study examined the efficacy of a parent-implemented communication assessment and intervention package with coaching via telehealth (i.e., video conferencing) on the acquisition of early communication skills for three young children (3- 4 years old) with severe neurodevelopmental disabilities. Assessment included a structured descriptive assessment (3 participants) and functional analysis (2 participants) to identify communicative contexts and idiosyncratic/potentially communicative responses for the participants. Following assessment, three communicative contexts with high levels of idiosyncratic responses were embedded with Functional Communication Training (FCT). To investigate the efficacy of FCT, participants' use of aided augmentative and alternative communication (AAC) responses and idiosyncratic responses were measured in an adapted multiple probe design across contexts. All three participants acquired the targeted AAC responses; whereas, prior to intervention, none of the participants engaged in easily recognizable communication forms. Idiosyncratic responses were functionally related to the reinforcers in the communicative contexts, as demonstrated by changes to response patterns during differential reinforcement. Parents implemented the interventions with a high level of fidelity to the coached procedures. At the conclusion of the study, parents rated the interventions as 'highly acceptable.' These results provide empirical evidence to telehealth-coached, parent-implemented FCT as an intervention to improve early communication skills for young children with severe neurodevelopmental disabilities. Implications are considered in regards to telehealth as a mechanism to improve access to communication intervention.

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Chapter 1

INTRODUCTION

Neurodevelopmental disabilities are defined as impairment in brain function that results in motor, cognitive, and/or communicative impairment, and includes disabilities such as autism spectrum disorder (ASD) and Rett syndrome (RTT; World Health Organization, 2011). Children with neurodevelopmental disorders, particularly autism, experience a range of severity of impairment; the current study focuses on children with autism and related neurodevelopmental disorders who experience severe communication impairment (i.e., few, if any verbal words and no formal augmentative or alternative communication methods). Due to the pervasiveness of the effects of neurodevelopmental disorders, early (i.e., services beginning in early childhood; in the range of birth to five years old) and intensive intervention is strongly recommended for children to acquire sufficient communication skills (Surgeon-General, 1999; Individuals with Disabilities Education ACT; IDEA, 2004; National Research Council, 2001; American Academy of Pediatrics, 2007). For children with ASD, early and intensive intervention grounded in behavioral principles is linked to improvements in communication (Cohen, Amerine-Dickens, & Smith, 2006; Sallows & Graupner, 2005), IQ (Sheinkopf & Siegel, 1998; Sallows & Graupner, 2005, Cohen et al., 2006, & Eldevik, Eikeseth, Jahr, & Smith, 2006), and related positive child (Harris & Handleman, 2000) and family outcomes (Remington et al., 2007).

However, there are numerous barriers to accessing needed communication intervention that is intensive, high in quality, and provided early in life. These barriers

result in families waiting for, or not receiving, what is widely acknowledged as best practice for children with severe neurodevelopmental disorders. The emerging field of telehealth involves technology that remotely connects interventionists to children and families. Thus, the use of telehealth to assist in the delivery of communication interventions could bridge some of the barriers separating children and families from crucial intervention services.

In this chapter, I first describe the need for early communication intervention for young children with severe neurodevelopmental disabilities focused on ASD and RTT. Second, I discuss the numerous barriers to service access that result in many children not receiving sufficient services in a timely manner. Third, I introduce the conceptualization of telehealth as a potential service delivery mechanism for parent-implemented communication intervention to overcome barriers to and limitations of current service delivery models, ultimately to reach more children and families.

Need for early communication intervention

Early intervention is federally mandated under the reauthorization of the Individuals with Disabilities Act Parts C (EI; ages birth to 2) and B (ECSE; ages 3 to 5; IDEA; 2004). The IDEA mandate places high priority on intervention that occurs in natural settings (e.g., the home environment) with a focus on family-centered services. Current diagnostic and service delivery models; however, challenge the feasibility of providing high quality, early childhood special education services in natural, family-centered settings (Newschaffer & Curran, 2003). Nationally in 2011, it was estimated that only approximately three percent of the 13 % of children ages birth to two who likely

would have qualified for EI services received them (Rosenberg, Robinson, Shaw, & Ellison, 2011; National Early Childhood Technical Assistance Center; NECTAC, 1987–2012. 2012b. Retrieved from http://www.nectac.org/partc/partcdata.asp). A similar trend was reflected in Minnesota; approximately only three percent of an eligible 23% of children received EI by 24 months of age (Rosenberg et al., 2011). Taken altogether, EI and ESCE are federally mandated services that many eligible children are either unable to access or are delayed in accessing until later into childhood, resulting in missed windows of precious developmental time.

Even assuming access to high quality EI and ECSE, research and recommendations indicate that early intervention needs to be delivered as a more intensive, individualized, and specialized service for children with neurodevelopmental disorders (e.g., ASD) for optimal results (Rogers, 1998; Lord & McGee, 2001; National Research Council; NRC 2001; American Academy of Pediatrics, 2007). The members of the National Research Council (NRC; 2001) recommend that children with ASD should receive a minimum of 25 hours per week of intervention for the full calendar year. This recommendation is echoed by the American Academy of Pediatrics, which in 2007 issued guidelines that included: (1) beginning treatment when ASD is a serious consideration and beginning treatment before a formal diagnosis is given if needed, (2) a minimum of 25 hours of intensive intervention per week for the full 12 months out of the year, and (3) parent involvement, education, and training as components of the intervention services (retrieved from pediatrics.aappublications.org).

There is far less evidence guiding effective communication intervention specific

to children with severe multiple neurodevelopmental disabilities, such as RTT (Horn & Kang, 2012; Sigafoos et al., 2009; Snell, Chen, & Hoover, 2006). However, there is agreement amongst stakeholders that communication intervention for this population is of high importance. The National Joint Committee for the Communicative Needs of Persons with Severe Disabilities (1992) urged prioritizing communication development and provided recommendations for intervention planning that included communication opportunities across the child's life experiences and inclusion of service-delivery in collaboration with family members in the natural environment.

For all young children with disabilities, there is the equally important need for intervention services to be delivered in family-centered settings that are natural to the child (IDEA, 2004; NRC, 2001; AAP, 2007; Horn, Lieber, Sandall, 2002). The position statement of the American Speech-Language Hearing Association (ASHA; 2011) echoes this sentiment, stating that early communication intervention should help to increase the child's communication and functioning within his/her daily life.

Taken altogether, for children with severe neurodevelopmental disabilities, including ASD and RTT, optimal communication intervention needs to be: (1) delivered early in life, (2) of an intensive nature, (3) delivered in natural settings, and (4) inclusive of families in education and training.

Statement of problem: Barriers to service access

Without early and effective intervention, children with severe disabilities are at risk for poor outcomes (Howlin, Goode, Hutton, & Rutter, 2004) and an overall poor quality of life (Brown, Gothelk, Guess, & Lehr, 1998). To promote optimal outcomes

there is an important push to diagnose severe neurodevelopmental disabilities, particularly ASD, as early as possible. For example, the American Academy of Pediatrics (AAP; 2007 policy statement) recommends early screening for ASD between the ages of 18 and 24 months of age. Best practice is moving towards the use of diagnostic tools to detect neurodevelopmental disabilities earlier, with the aim of beginning intervention earlier (see the modified version of the Checklist for Autism in Toddlers; MCHAT, Robbins, Fein, Barton, & Green, 2001 for an example).

However, following diagnosis, many children and families experience difficulties with accessing services in a timely or adequate manner. Among other factors, roadblocks to services may include long provider waitlists, limited access or delay in attaining funding (i.e., insurance coverage), and residing outside of geographic locations of service providers. In addition to these roadblocks, children with severe neurodevelopmental and multiple disabilities, such as RTT, likely have limited access to providers with adequate expertise to target their more complex and low incidence needs. In a 2004 study regarding barriers to services for children with developmental disabilities, the majority of parents reported unmet communication and behavioral management concerns for their children (Betz et al., 2004). Parents reported perceived barriers for these unmet needs related to a 'lack of available information on services' and a 'lack of availability of appropriate services.'

Waitlists. Despite the growing prevalence of ASD (Chasson, Harris, & Neely, 2007) access to interventions and treatment remains costly and limited. ASD impacts an estimated 1/68 children nationally (Center for Disease Control and Prevention, CDC,

2012), and an estimated 1/72 children in Minnesota (MDE, 2011). Service providers have not been able to keep up with the increased need, leading to a shortage of available evidence-based services (Sperry, Whaley, Shaw, & Brame, 1999; Symon, 2001; Dingfelder & Madnell, 2011; Kazdin, 2008). Families seeking services may be placed on a waitlist or may need to otherwise delay service onset.

Keating and colleagues (1998) described the greatest concerns reported by stakeholders regarding time spent on waitlists as: (1) delay in the onset of early intervention services considering the clear benefits associated with early intervention, (2) lost time in the window of childhood development, and (3) stress and uncertainty on families during the waiting process. The lost time spent waiting for services, spent locating or training service providers, or time spent without appropriate intervention likely has negative outcomes for the impacted children and families.

Shortages of clinical personnel. Early and intensive communication intervention requires the knowledge and oversight of trained professionals. Communication intervention based in behavioral principles is often over-seen by clinicians with a master's level or higher education and/or licensure, including Board Certified Behavior Analysts (BCBAs) and Speech-Language Pathologists (SLPs). The majority of 57 special education coordinators surveyed across the country reported there had been a vast increase in requests for ASD evaluations and for early intervention services for ASD in their states since 2007 (Wise et al., 2010). A high percentage of coordinators also reported a shortage in ASD-related trained clinical providers including behavioral therapists (reported from 89% of states) and SLPs (reported from 82% of states).

BCBAs are highly trained professionals who have completed at a minimum: coursework, supervised training, a board examination, continuing education, and certification in applied behavior analysis methodology. BCBAs provide training, program development, progress monitoring, and oversight to clinical interventions based in behavioral principles. Nationally, many private insurance companies and some state waivers require a BCBA to oversee the treatment planning and intervention for children with ASD who receive early intensive behavioral intervention. However, there are few BCBAs to satisfy this funding requirement in many states, including Minnesota. As of June 2015, there were only 120-registered BCBAs in Minnesota (retrieved from http://www.bacb.com) to address the needs of the children with ASD. In July, 2015 the Minnesota Department of Health issued a statement on the shortage of early intensive developmental and behavioral intervention providers to address the needs of children with ASD in MN (retrieved September, 2015 from: http://www.dhs.state.mn.us/main/). These disparities are reflected in surrounding states in the upper Midwest as well (see Figure 1). The small number of BCBAs and providers in MN limit the reach of early

intensive behavior intervention services and the capacity of service providers.

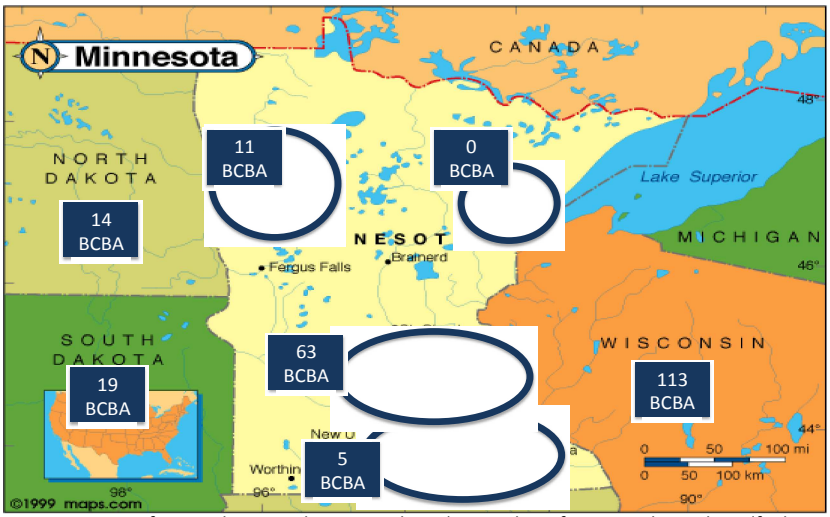

Figure 1. Map of MN and surrounding states depicting number of registered Board Certified Behavior Analysts (BCBA) residing within 50 miles of the major cities, and total BCBA in surrounding states. Retrieved June, 2015 from: http://www.netstate.com/states/geography/mapcom

There is also a dire shortage of licensed SLPs to guide and oversee communication intervention for children with severe neurodevelopmental disabilities (ASHA healthcare survey, 2005). In-home SLPs are of the most need, with the highest number of unfilled positions. Among existing SLPs, there is also a shortage of personnel who have training in augmentative and alternative communication (AAC) for children with severe disabilities. In 2011, ASHA reported that pediatric SLPs dedicated only five percent of time on AAC intervention.

There is a critical shortage of trained personnel and special educators for children with severe and multiple disabilities (Ludlow, Conner, & Schechter, 2005; McLeskey, Tyler, & Flippin, 2004). However, it is recommended that providers with expertise serving these populations oversee communication intervention due to the complexity of needs from co-morbid impairment (Horn & Kang, 2014). Therefore, children with severe, multiple, and low incidence disabilities are at particular disadvantage in accessing

professionals with specialization or expertise in providing the intensive and individualized intervention they require (Ludlow, Conner, & Schechter, 2005).

Limited access due to geographic location. Children and families outside of major metropolitan areas often face limited service provider options and therefore are less likely to access early and intensive treatment for ASD (Symon, 2001; Thomas, Ellis, McLaurin, Daniels, & Morrissey, 2007). For example, the majority of BCBA clinicians in MN reside within the Twin Cities metropolitan areas, with few living in or practicing in rural areas in the northern and southern counties (see Figure 1). Therefore, geographic location can be a significant barrier to accessing services, leaving children and families outside of metropolitan areas at a striking disadvantage.

Disparities in service access across racial and ethnic groups. Finally, there are striking disparities among racial and ethnic groups in access to early intervention services. For example, at 24 months of age, black children with developmental delay are less likely than white children and other groups to receive early intervention services (Rosenberg, 2008; Feinberg, Silverstein, Donahue, & Bliss, 2011). Children with ASD in minority racial and ethic groups and with low levels of parent education are less likely to access effective ASD treatment (Thomas et al., 2007). Even within metropolitan areas, there are discrepancies in access to services amongst neighborhoods with higher proportions of racial and ethnic groups (Rosenberg, Zhang, & Robinson, 2008).

Costs of delay to intervention

The short- and long-term consequences of restricted access to intervention are costly. In the short-term, delays or lack of access to services may worsen challenging

behavior that often begins at an early age for children with developmental disabilities (Rogers & Wallace, 2011). While waiting, families may experience prolonged or exacerbated stress and uncertainty (Keating et al., 1998). In the long-term, the failure to gain some form of communication by age 6 is closely related to poor outcomes for adults with ASD (Howlin, Goode, Hutton, & Rutter, 2004). In future school experience, children may require greater special education supports (Sallows & Graupner, 2005). Clearly, the benefits of early intervention far outweigh the costs. For example, in a cost-benefit analysis in Texas, three years spent in early and intensive behavioral intervention for all children with ASD in the state would be associated with a projected $2.09 billion dollar direct savings in the need for special education services over the children's school-age years (Chasson, Harris, & Neely, 2007). The consequences of restricted access to services have great costs to children, to their families, and to society.

Telehealth as a service delivery mechanism for parent-implemented intervention

A potential solution to facilitate the cost-effective provision of services to more young children and their families lies in the use of telehealth technology. Previous research has demonstrated telehealth as a promising and efficacious service delivery mechanism to remotely coach parents through assessment and intervention for challenging behavior for children with ASD in their homes (Wacker et al., 2013a; 2013b). These studies resulted in marked decreases in challenging behavior and replicated effects of the same procedures delivered with interventionists in the home and in the clinic. Parents implemented the interventions with an acceptable level of fidelity to the intervention procedures and rated the treatment as highly acceptable (Seuss et al.,

2014; Wacker et al., 2013a; 2013b). Clearly, if interventions mediated by telehealth continue to result in favorable outcomes, this method could revolutionize the current models of service delivery. An investigation of efficacy of telehealth as a service-delivery mechanism for remotely delivered intervention should be extended to parent-implemented intervention aimed at increasing early communication skills for young children with severe neurodevelopmental disabilities.

Purpose of study and research questions

This study aimed to expand the current evidence-base on communication interventions delivered via telehealth through investigating: (1) functional assessment and analysis to identify contexts in each child's daily life and potentially communicative idiosyncratic responses the child engaged in (e.g., reaching for or leading an adult to desired items) within those contexts, (2) functional communication training (FCT) intervention embedded into three of the identified communication contexts to apply differential reinforcement to an augmentative and alternative (AAC) request, and (3) evaluation of collateral effects on the children's and parents' behavior, parent fidelity, and parent ratings of treatment acceptability. The overall purpose of the current study was to determine the efficacy of parent-implemented communication assessment and intervention package with coaching via telehealth on the acquisition of early communication skills for young children with severe neurodevelopmental disabilities.

Primary research question. What are the effects of parent-implemented functional communication training embedded into communicative contexts delivered by researchers via telehealth on acquisition of AAC requests of three young children (ages 3-5) with

severe neurodevelopmental disabilities (2 with ASD and 1 with RTT) and with limited or no verbal communication?

Secondary research questions. The secondary questions concerned whether collateral changes in the participants' and parents' behavior were observed during intervention, the level of the caregiver's fidelity to the coached procedures, and the caregiver ratings of treatment acceptability.

Collateral changes in observed indices of happiness. Were there collateral changes in the children's' observed happiness during the baseline and intervention phases in the study?

Collateral changes in observed quality of play. Were there collateral changes in the observed quality of the parents' interaction with the child during the baseline and intervention phases of the study?

Parent fidelity with and acceptance of intervention procedures. What were the levels of the parents' fidelity during baseline and intervention procedures? What were the parents' ratings of treatment acceptability at the conclusion of the study?

Chapter 2

REVIEW OF THE LITERATURE

In Chapter One, I discussed both the importance of early and intensive communication intervention for children with severe neurodevelopmental disabilities and the problems associated with accessing this needed intervention in a timely and adequate manner. In Chapter Two, first, I provide a brief introduction to the literature related to idiosyncratic and potentially communicative behavior for children with severe neurodevelopmental disabilities. I also introduce the use of reinforcement- and augmentative and alternative-based (AAC) communication interventions to improve communication for this population. Second, I provide a thorough and systematic review of the extant literature related to parent-implemented functional communication training (FCT) for young children with severe neurodevelopmental disabilities. In this systematic review I examined the literature on parent-implemented FCT for participants within the studies that met a specific and homogenous inclusion criteria. Specific areas of this systematic review included: (1) participant characteristics, (2) parameters of the interventions related to the dependent and independent measures investigated, and (3) an examination of the reported information on the procedures and modality of training provided to the parents. Third, I describe additional literature related to the use of telehealth as a service delivery mechanism for behavioral assessments and interventions. I conclude this chapter with a rationale for the current study that involves a parent-implemented functional assessment and FCT intervention package delivered with live coaching via telehealth aimed at improving initial communication skills for young

children with severe neurodevelopmental disabilities.

Communication and severe disabilities

Children with severe disabilities who do not develop or acquire recognizable forms of communication (e.g., verbal communication, sign language, or other augmentative and alternative communication modalities) may engage in potentially communicative acts through displays of idiosyncratic responses (Sigafoos, Tucker, Roberts-Pennell, & Pittendreigh, 2000; Sigafoos et al., 2011). Idiosyncratic and potentially communicative acts (herein referred to as idiosyncratic responses) are responses within an individual's repertoire that may take on communicative properties through caregivers responding reliably with differential environmental and social consequences. Examples of forms of idiosyncratic responses may include challenging behavior topographies, eye-gaze, reaching, or stereotypic topographies.

Through structured interviews with caregivers, many parents reported that their children with severe disabilities use nonverbal idiosyncratic responses to communicate (Brady & Halle, 1997; Stephensen & Dowrick, 2000; Urbanowicz et al., 2014). Forms of idiosyncratic responses reported by parents include their children using eye-gaze, eye-pointing, facial expressions, vocalizations, and challenging behavior to express a variety of communicative messages such as discomfort and happiness, making choices, requesting items, requesting activities, and requesting attention (Urbanowicz et al., 2014).

However, judging and interpreting the intentionality of idiosyncratic responses in the severe disability population is notably difficult and subjective (Iacono, Carter, & Hook, 1998). Iacono, Carter, and Hook (1998) examined the communicative intent of

four children with severe multiple disabilities through modified communicative sampling, consisting of set stimulus conditions to elicit communicative attempts and videotaped sessions coded using a priori operational definitions differentiating the following: (1) communicative acts, (2) intentionality of the communicative act, (3) communicative modality, and (4) the function of the communicative act. The authors recorded communicative acts when the participant shifted eye-gaze between a referent and the interventionist, and when the participant persisted at the response, and/or appeared happy or stopped engaging in the response once the item/activity/referent had been obtained. They concluded that only a very low rate of intentional communicative acts occurred, and these were only observed in two of the four participants.

In an effort to systematically evaluate functions of idiosyncratic responses of individuals with RTT using objective procedures, Sigafoos and colleagues (2000) designed conditions to maximize the likelihood of communication with three adolescents with RTT. Although none of the participants had any spoken language, their caregivers reported several idiosyncratic responses they perceived as communicative, and observations indicated that these responses were differentially sensitive to environmental conditions. This study suggested that the idiosyncratic responses may have served a communicative function, but did not rule out the possibility that the responses were physiological or orienting responses. When the researchers compared agreement between caregivers on the form and function of each participant's idiosyncratic responses, most agreed on the forms of the responses, but agreement on the functions was poor.

Byiers, Dimian, and Symons (2014) tested and confirmed the functional reinforcers of idiosyncratic responses by conducting functional analyses (FA; Iwata, Dorsey, Slifer, Bauman, & Richman 1982/94) with three participants with RTT. The researchers subsequently delivered communication intervention informed by the FA results by teaching the participants to press a microswitch to receive the functional reinforcer; all three participants acquired the communicative response. Implications from this study include that there was a functional relation between the idiosyncratic responses and identified social reinforcers.

Augmentative and alternative communication (AAC). AAC responses are non-verbal communication strategies that are used as communication responses for individuals with severe disabilities. The purpose of AAC is to "compensate (either temporarily or permanently) for the impairment and disability patterns of individuals with severe expressive communication disorders" (American Speech-Language-Hearing Association [ASHA], 1989, p.107). In order to utilize the form of AAC that is the best fit for a child's motor or sensory skills, intervention planning must assess different AAC forms and the related benefits and limitations on an individualized basis (Beukleman & Mirenda, 2013). Nonverbal communication forms include unaided responses (e.g., signs, gestures, vocalizations) and technology-aided responses encompassing both low technology (e.g., pictures, 2D icons, 3D objects) and high technology (e.g., speech-generating devices, computer-based interfaces) (Mirenda, 2003).

There may be advantages to aided AAC communication forms for children with severe neurodevelopmental disabilities to facilitate access, minimize response effort, and

increase intelligibility for a variety of communication partners (Mirenda, 2003). Additionally, if the child forms approximations of gestures or signs, he or she may be less intelligible to a variety of communication partners (Saunders, Questad, Kedziorski, Boase, Patterson, & Cullinan, 2001). Aided AAC techniques have been shown to be more effective for familiar and novel communication partners to use and understand (Lancioni, O'Reilly, & Basili, 2001; Mirenda, 2003). With aided AAC strategies, the communication partner may not need to be in close proximity to the communicator as they would with unaided forms (e.g., to watch for a gesture or other indication of communication that is less salient than aided strategies).

Although selection of the form of communication is of high importance for children with severe neurodevelopmental disabilities, instructional methods on how to teach the motoric communication response, what communication messages to teach and prioritize, and how to teach the appropriate communication context are equally important (Brady & Halle, 1997). Warrick (1988) argued that the provision of an AAC system and the physical ability to access it should alone not imply that a user would communicate effectively without proper intervention efforts. Therefore, the focus of AAC research should not be on technology alone but should be based on sound, evidence-based intervention practices (Light & McNaughton, 2012).

Reinforcement-based communication intervention for severe disabilities

In a review of the quality of evidence on communication interventions for children and adults with severe disabilities, Snell and colleagues (2010) found that of the 116 included studies between 1997 and 2007, 96% of the interventions resulted in what

the authors defined as an immediate positive increase in communication skills from the intervention strategies. One important finding is the ability of people with severe disabilities to acquire initial communication skills. However, only 16 % of the studies included interventions with caregivers serving as interventionists, and only 28 % of the studies occurred in the home environment. Future investigations need to examine the effectiveness and efficiency of communication interventions that are conducted in contexts and routines that are a part of the person's daily life and that involve caregivers.

Reinforcement-based models of intervention have been documented to increase communication for persons with communicative impairment and severe intellectual and developmental disabilities (Durand, 1999; Johnson, Reichle, & Evans, 2004). Functional communication training (FCT; Carr & Durand, 1985) is an empirical, evidence- and reinforcement-based approach to replacing inappropriate or challenging behavior, such as aggression, with an appropriate communicative response. FCT has been successfully used for persons with severe developmental disabilities who engage in challenging behavior (Drasgow, Halle, Ostrosky, & Harbers, 1996).

Requests/mands. Among early communicative functions acquired, requests are an important communication function that provides the child with opportunities for environmental access, choice making, and a base upon which to build increasingly complex communication skills. Skinner (1957) referred to requests as a type of verbal operant called a 'mand'. Under Skinner's definition, mands are forms of responses that are "under the control of relevant conditions of deprivation or aversive stimulation" (p 36). Establishing operations (EO) are environmental events, deprivation or satiation

states, or stimulus conditions that temporarily alter dimensions of reinforcement (Hall & Sundberg, 1987; Michael, 1987). EOs function to occasion the opportunity for an individual (e.g., a child) to engage in a response that results in access to a functional reinforcer related to the EO condition (Brown et al., 2000). Therefore mands, (herein referred to as requests), are communication responses that give the speaker (the child) access to items, activities, attention, or stimuli when they are in a deprived state or a means to escape aversive stimulation. Put simply, the ability to make a request allows a child to engage in early self-determinism skills.

Generalized requests are context-dependent requests that apply across a variety of situations (Reichle & Sigafoos, 1991). Examples of generalized requests include asking for *more* across different situations with a deprivation EO or rejecting with *no* across different situations with an aversive EO (Laraway, Snycerski, Michael, & Poling, 2003; Michael, 1987). There are limitations to relying only on generalized requests; the child will be limited to context-dependent communication and therefore highly limited with respect to the specificity of his/her request. The child may also be limited to communicating only with highly familiar caregivers and providers who may need to anticipate the child's needs. Finally, there is the risk of misinterpreting a request, which could lead to frustration and a lack of autonomy and control for the child. Generalized requests are frequently recommended as initial targets of intervention due to the inherent generalizability and utility for providing the child with a repertoire to use throughout their day. In FCT generalized requests may be recommended when explicit requests

would be deemed more effortful due to the need to discriminate between response options.

Explicit requests involve a child producing requests for specific environmental events (Mirenda, 2003). Explicit requests are less context-dependent than generalized requests, which provides potential benefits for communicating specific requests for items, events, or people that may not be in view. In a conditional discrimination, there is the presence of a S+ (the stimuli related to the correct response that leads to the desired outcome in the environment) and a S- (the stimuli related to the incorrect communication response that does not lead to the desired outcome in the environment); Etzel & LeBlanc, 1979; Dietz & Malone, 1984). Discrimination within explicit requesting requires a child to differentiate: (a) between responses (i.e., understanding the difference between how to ask for *cookie* or *chips*), (b) appropriate context (i.e., understanding when and where different items are available), and, particularly for aided AAC (c) stimulus options (i.e., discriminating the features of a *cookie* or *chips* on a graphic symbol). These levels of discrimination likely hold a higher cognitive effort than that of a generalized request, and thus are a critical area of continued exploration. Although explicit requests are likely more difficult and time consuming skills to teach, the increasing of a child's communication competence is related to many benefits pertaining to quality of life.

Functional communication training (FCT). Maladaptive or challenging behavior can take on communication properties for children with disabilities and impaired communication (Carr & Durand, 1995; Durand, 1999). Challenging behaviors may result in positive reinforcement (access to attention, preferred objects or activities),

or negative reinforcement (escape/avoidance of adverse events). When positive reinforcement, negative reinforcement, or both result maintain patterns of challenging behavior, it is necessary to teach an alternate, appropriate communicative response that will produce the functional reinforcer.

Functional assessment. Assessment of the context in which challenging behavior occurs often yields information about what environmental events function to reinforce the challenging behavior. Assessment of contiguous events can be conducted to identify events that co-vary with the challenging behavior (functional behavior assessment; FBA; Newcomer & Lewis, 2004). Alternately, assessment can be conducted to isolate and manipulate events in a systematic manner in order to identify dependent functional relations between challenging behavior and specific events (functional analysis; FA; Iwata, Dorsey, Slifer, Bauman, & Richman 1982/94). FBA occurs prior to implementation of FCT. In the FBA process, the interventionist employs indirect (i.e., parent or teacher interviews of rating scales) and direct observation methods of data collection. The interventionist uses these data to inform a hypothesis of the social function(s) served by the target response (often challenging behavior). One form of observational assessment that has demonstrated utility in identifying correlational relations between environmental events and target behavior is a structured descriptive assessment (SDA; Anderson & Long, 2002; Freeman, Anderson, & Scotti, 2000). In a SDA, there are not programmed consequences; however, antecedent events or stimuli (such as those reported in a functional assessment interview by caregivers) are manipulated in a quasi-experimental manner. Potential benefits to a SDA include

identifying environmental events associated with increased levels of target behavior to inform a subsequent experimental analysis (FA; Anderson & Long, 2002) or to help interpret non-differentiated data from a FA (Anderson & Long, 2002; Mace & Lalli, 1991).

Functional analysis. Functional analysis (FA; Iwata, Dorsey, Slifer, Bauman, & Richman 1982/94), the final step of functional assessment, involves systematic and controlled manipulations of programmed consequences on the target response (i.e., the dependent variable) within a multi-element experimental design to observe for changes in trend, level, and variability in response patterns. In the FA, differentiated data across programmed consequences in analog conditions representing contingent access to positive reinforcement (i.e., attention, tangible) and negative reinforcement (i.e., escape) verify a functional reinforcer(s) of the target behavior. The results of the FA inform intervention planning by identifying which functional reinforcer(s) will be delivered contingent on the alternative communicative behavior during FCT.

FCT. After a function of the challenging behavior is hypothesized (through FBA) or verified (through FA), FCT targets an alternative communicative response for the person to obtain the functionally equivalent reinforcer(s) (Carr and Durand, 1995; Drasgow & Halle, 1996; Wacker, Berg, & Harding, 2002). For example, a child with challenging behavior (e.g., engaging in aggression) that is maintained by a reinforcement history of escaping aversive events (e.g., nonpreferred tasks) could be taught to use an alternative communicative response (e.g., asking for a break) to escape the aversive task. FCT has also been recommended as a high priority first step for communication

intervention with beginning communicators because it can decrease challenging behavior while teaching an appropriate communicative alternative behavior (Wacker et al., 2002).

Functional equivalence is the underpinning behavioral principle to the success of FCT (Beukleman & Mirenda, 2005; Carr, 1988). For a communicative alternative behavior to be acquired in place of the current behavior form, the communicative alternative should be matched across dimensions of: (1) effort, (2) immediacy of reinforcement, and (3) magnitude of reinforcement (McDowell, 1988; Fisher & Mazur, 1997). Therefore, the communicative alternative must result in contingent access to or removal of, (in the case of negative reinforcement) the maintaining social reinforcer. The communicative alternative must have a comparable response effort and efficiency to the challenging behavior (Horner & Day, 1991; Richman, Wacker, & Winborn, 2001). If the communicative alternative is much more effortful or takes longer to complete than the challenging behavior, it will likely not replace the challenging behavior.

For example, for a child with severe communication impairment who bites her wrist and who receives immediate access to parent attention, a communicative alternative should be of relatively equal or less effort and efficiency than biting her wrist. If the communicative alternative for this child were to stand up and bring a picture icon with the phrase “can you talk to me please?” across the room to a parent, this response would likely have a much higher response effort and would likely be less efficient than wrist-biting while remaining seated in her high chair. Whereas a less effortful and more efficient response for this child may be to press a microswitch located at her high chair

tray that activates voice output stating "come here." This example highlights the importance of careful intervention planning to increase the likelihood of FCT success.

AAC response methods have been found to be effective when combined with FCT procedures. Snell, Chen, and Hoover (2006) reviewed the literature from 1997-2003 on AAC interventions for children ages birth to 21 with severe disabilities. Of the 40 studies located, 95% included contingent reinforcement methods to increase communicative behavior and 50% of the studies focused on reducing problem behavior. Therefore, for children with little to no verbal communication, when considering the response effort and efficiency of functional equivalence AAC responses should be examined as alternative communication.

FCT has been well documented as an intervention approach to reduce challenging behavior with children with ASD (and related disabilities) because it provides differential reinforcement of the functional reinforcer for an appropriate communicative behavior and can be individualized for people with even the most severe motor impairments (Horner & Carr, 1997). FCT (or related function-based reinforcement intervention) has demonstrated effectiveness across a wide range of settings, including inpatient (Asmus et al., 2004) and outpatient clinics (Derby, 1992; Kurtz et al., 2003), residential (Bailey, McComas, Benavides, Lovascz, & Thompson, 2002) and home settings (Derby et al., 1997; Wacker, Berg, Harding, Derby, Asmus, & Healy, 1998; Wacker et al., 2005). Results consistently demonstrated 90% or better reductions in challenging behavior and concomitant increases in appropriate responses such as communication and task completion (Wacker et al., 1998; 2005; 2011).

In a review of the literature on FCT for children with ASD, Mancil (2006) reported that all of the 30 included studies reported decreases in challenging behaviors (challenging behaviors were the targeted dependent measure for all of the studies). Relatively modest findings with respect to increased communication skills were reported for three of the 30 studies; however, each of these studies only focused on one communication request for each participant. Mancil also reported that of the 30 located studies: (a) participants represented in the studies were between the ages of 2.7 and 15 years old, (b) only two studies had interventionists other than researchers, with a teacher (Wacker et al., 1990) and a parent (Wacker et al., 2005) serving as interventionists, and (c) only two studies occurred in naturalistic settings, including a classroom (O'Neill & Sweetland-Baker, 2001) and in the participant's home (Wacker et al., 2005).

Kurtz, Boelter, Jarmolowicz, Chin, and Hagopian (2011) reported similar results in a review of the literature regarding the efficacy of FCT at decreasing challenging behavior; communication skills were not included in the review. A gap identified in the literature was that of the 80 participants (adults and children with intellectual disabilities) represented in the studies included for review, only approximately 15% of the participants had parents serving as interventionists (n = 13), and only approximately 10% (n = 8) included interventions occurring in the home or community settings.

Implications from these reviews indicate that further investigation is needed of FCT in more natural settings (i.e., home and community) with more natural interventionists (i.e., parents) to examine the generalizability of the effects of FCT when in a child's natural environment, with natural change agents. Additionally, parent-

implemented intervention that occurs in the child's home adheres to the recommendations of early intervention delivery of being both family-centered and delivered in natural settings (IDEA, 2004; NRC, 2001; AAP, 2007; Horn, Lieber, Sandall, Schwartz, & Worley, 2002). Another implication from these reviews is the need to investigate the effects of FCT on increasing communication skills related to requests, as many of the studies included in the FCT reviews focused either solely or primarily on reductions in challenging behavior (Kurtz et al., 2011; Mancil et al., 2006).

FCT as a communication intervention. Most of the extant literature has focused on FCT as an intervention to reduce challenging behavior. However, there is emerging efficacy evidence for the use of FCT as a communication intervention (Byiers, Dimian, & Symons, 2014; Keen, Sigafoos, & Woodyatt, 2001; Tait, Sigafoos, Woodyatt, O'Reilly, & Lancioni, 2004). As a communication intervention, an appropriate communicative alternative is targeted to replace idiosyncratic behavioral responses that are not necessarily identified as challenging but are difficult to interpret and expand upon (e.g., eye gaze and reaching; Byiers, Dimian, & Symons, 2014; Drasgow, Halle, Ostrosky, & Harbers, 1996; Keen, Sigafoos, & Woodyatt, 2001). Idiosyncratic responses can serve as 'behavioral indicators' of environmental events that serve as motivating for children without verbal or other established communication repertoires (Drasgow, Halle, Ostrosky, & Harbers, 1996). If a child leads (i.e., takes an adult's hand and pulls it towards an item or area) an adult towards the fridge to access juice, it would likely be advantageous to teach the child a more recognizable communicative response (i.e., AAC response) to gain access to the juice.

Keen, Sigafoos, and Woodyatt (2001) demonstrated the utility of FCT to shape idiosyncratic responses into more recognizable communication with three participants with ASD who were nonverbal. Idiosyncratic responses were identified for each participant and an alternative behavior was targeted in the same context. For example, researchers shaped the idiosyncratic response of a participant who used eye-gaze to gain attention into a communicative alternative that consisted of waving a hand to gain attention. The shaping of potential communicative acts may be an important strategy to begin communication intervention for children with severe neurodevelopmental disabilities because the child has already demonstrated that he/she can has the motor skills to complete the communication response.

The shaping of existing idiosyncratic responses may also be an important approach to begin communication intervention for children with severe neurodevelopmental disabilities because the child has already demonstrated that the function serves as a reinforcer for the idiosyncratic response. Byiers, Dimian, and Symons (2014) experimentally analyzed the social function of varying idiosyncratic behavior forms of girls and women with RTT using functional analysis and subsequent functional communication training intervention; they found that all 3 participants engaged in idiosyncratic behavior emissions more during individualized conditions designed to enable access to different social reinforcers, (i.e., head massage, attention, and TV), contingent on a targeted idiosyncratic responses. Although limited, the available evidence suggests that idiosyncratic responses can be shaped into more recognizable communication through FCT as an initial communication intervention strategy.

The application of FCT to communication skills may have potential significance as a model for initial communication intervention for children with severe neurodevelopmental disabilities who do not have an easily recognizable method of communication. FCT may be a feasible and efficient method to begin communication intervention that builds upon contexts of the child's current motivation to attempt communication (Drasgow et al., 1996). The communicative alternative response can serve as initial communication skill to later expand upon (Mace & Roberts, 1993; Schieltz et al., 2011). Additionally, FCT that is aimed at shaping idiosyncratic responses into more recognizable communicative behaviors can occur within a child's natural environment and can be easily tailored and embedded into natural routines and activities within their day. This intervention may have particular relevance as a feasible initial communication intervention for caregivers to implement in the home with their young children with severe neurodevelopmental disabilities.

Parent-implemented FCT*: A systematic review of the literature*

In the realm of early intervention, parents are the most important change agents for their young children with disabilities (Barton & Fetting, 2013; Powell & Dunlap, 2010). Additionally, parent-implemented intervention adheres to the recommendations of early intervention as both family-centered and delivered in natural settings (IDEA, 2004; NRC, 2001; AAP, 2007; Horn, Lieber, Sandall, Schwartz, & Worley, 2002). FCT is documented as an intervention that parents of children with developmental disabilities can effectively implement (Derby et al., 1997; Wacker et al., 1998; Wacker et al., 2013a). However, in previous reviews of the literature on FCT (Kurtz et al., 2011; Mancil, 2006),

parents infrequently served as the interventionists with their children and interventions were rarely delivered in natural settings. Therefore, in the current systematic literature review I focused on studies with parent-implemented FCT for young children with moderate to severe communication impairment and developmental disabilities to describe the state of the literature on the: (1) participant characteristics, (2) intervention parameters investigated, and (3) parent-training practices and modalities reported across the participants in the studies.

Parent-implemented FCT search methods. I conducted a systematic search of the literature using a three-step process. First, PsychInfo (yield 78 studies) and Pubmed (yield 68 studies) were searched using the following terms *FCT + parent, FCT + developmental disabilities + children, FCT + autism + children, FCT + AAC + children.* Next, an ancestral search in Google Scholar was conducted of 7 researchers who authored 2 or more of the included studies. Last, an ancestral search was conducted of 5 journals that published 2 or more of the included studies.

Studies met the following inclusion criteria to have participants included in the systematic review; studies were: (1) located in a peer-reviewed journal, (2) employed a single case experimental design involving FCT and graphic data must have been reported for the participant (studies or participants were excluded if IV manipulations did not occur on FCT or if graphic data were not displayed but were summarized in descriptive statistics), (3) included children age 8 and younger with a developmental disability and moderate to severe language impairment, (4) parents implemented the intervention, (5) the intervention had active components of FCT (an alternative communication response

was taught to the child to replace a pre-existing challenging or idiosyncratic response). Studies or participants within the study were excluded if the inclusion criteria were not satisfied; therefore, individual participants within a study may have been included or excluded. Of the 146 studies located through the initial search procedure, 13 studies were identified for inclusion and a total of 32 participants within these studies were identified for inclusion.

Table 1. Participant Characteristics (13 studies; n = 32)

Code	n	Percentage of participant sample
Gender		
Female	10	31
Male	22	69
Age		
Birth-2.11	9	28
3 to 5.11	21	66
6 to 8	2	6
Developmental Disability Category		
Autism	11	34
Fragile X	1	3
PDD-NOS*	6	19
Intellectual disability	5	16
Cerebral Palsy	7	22
Other	0	0
Developmental disability unspecified	7	22
Challenging behavior		
Self-injury	12	38
Aggression	10	31
Property destruction	8	26
Tantrum	3	9
Other idiosyncratic responses	6	19

Note. PDD-NOS was included as a disability category in this review because it was described as a diagnosis of 6 participants; however, it should be noted that PDD-NOS was removed as a diagnosis from the Diagnostic and Statistical Manual of Mental Disorders (DSM V, American Psychiatric Association, 2013). Categories of gender and age were mutually exclusive across codes (i.e., participants could only be represented under one code). Categories of developmental disability, challenging behavior and idiosyncratic responses were not mutually exclusive (i.e., participants were counted under each code that was reported in the study. Therefore, a participant could have a diagnosis of ASD and intellectual disability and would be reported in both categories in the current review).

Participant characteristics. Table 1 summarizes specific findings pertaining to the participants included in this review (n = 32). The participant sample included a higher

proportion of male children (n = 22, 69%). This proportion was expected, as ASD, which was the highest percentage disability category in the participant sample, is more prevalent in males than females. Participants were between the ages of 1 year 3 months to 6 years 7 months old (*M* = 3.7). The highest percentage of participants were in the category of ages from 3 to 5 years, 11 months old (n = 21: 66%), followed by ages birth to 2 years old, 11 months (n = 9, 28%), and few participants ages 6 to 8 years old (n = 2, 6%). The developmental disability category with the most participants was ASD (n = 11, 34 %), with Cerebral Palsy and unspecified developmental disabilities reported as the next highest categories (n = 7, 22 % for each).

A variety of challenging behavior topographies was reported amongst the participant sample; the most frequently reported were self-injury and aggression (n = 12, 38%; n = 10, 31%, respectfully). Tantrums were reported the least frequently (n = 3, 9%). Idiosyncratic responses (referred to as prelinguistic behaviors in Tait et al., 2004) were reported in the one study (n = 6, 18.8) that focused on FCT as a communication intervention (Tait et al., 2004). Across the participants, there were 18 total idiosyncratic responses reported in the study, including: (1) eye gaze towards items (e.g., toys), (2) reach towards items, (3) body movements, (4) spitting, and (5) vocal sounds.

Parent-implemented interventions likely hold benefit to children with varying developmental disabilities and ages. In particular, a high potential for benefit is young children who are not yet of school age. For these children, parent-implemented training and intervention is in-line with early intervention recommendations that include the child's family, routines, and natural environment. Parent training empowers parents as

change agents for their children and potentially helps to overcome or bridge gaps in access to services (e.g., intervention for the child while on a waitlist for services). Parents can utilize effective intervention strategies to start the child on a better trajectory, through intervening on or preventing challenging behavior and in teaching early communication skills.

Assessment and intervention parameters

Table 2 presents summaries of the reported parameters that constituted assessment and intervention for the included participants.

Table 2. Assessment and intervention parameters and parent-training practices (13 studies: n = 32)

Code	n	Percent	Code	n	Percent
Assessment			**Number of Communication**		
Descriptive assessment	6	18.8	**Responses**		
Preference assessment	5	15.6	**Targeted**		
Antecedent-based	4	12.5	1	20	62.5
Consequent-based FA	24	75	2	4	12.5
Function			3	7	21.8
Escape	7	21.9	4 or more	1	3.1
Tangible	6	18.8	**Interventionist**		
Attention	6	18.8	Mother	20	62.5
Combined	13	40.6	Father	0	0
Non-socially mediated	0	0	Both	0	0
Independent Variable			Not reported	12	37.5
FCT/DRA Only	13	40.6	**Setting**		
FCT + Demand fading	9	28.1	In home	24	75
FCT + Schedule thinning	3	9.4	In clinic	8	25
FCT + Time out	2	6.3	**Maintenance measured**		
FCT + Other components	6	18.8			

Primary Dependent Variable(s)		
Challenging behavior only	9	28.1
Communication only	6	18.8
Challenging behavior and communication	17	53.1
Collateral Gains		
Task completion	9	36
Positive social responses to parent	4	12.5
Appropriate engagement/toy play	4	12.5
Spontaneous verbalizations	0	0
Parent responsivity	4	12.5
Other	4	12.5
AAC		
Yes	25	78
No	7	21.8
Communication response		
Verbal	8	25
Picture card/graphic	4	12.5
Microswitch	5	15.7
Sign	10	31.3
High-tech speech-generating device	1	3.1
Yes	12	37.5
No	20	63.5
Generalization measured		
Across settings/stimuli	3	9.3
Across people	0	0
Across responses	9	28
Not measured/reported	20	62.5
Parent Acceptability		
Yes	14	43.8
No	18	56.2
Parent-training practice		
Parent intervention fidelity	11	34
monitored	10	31
Routines-based	9	28
Collaborative progress	20	62.5
monitoring	0	0
Modeling	1	3
Self-reflection	32	100
Role-play	20	62.5
Provide opportunities to practice	13	40.6
new skills		
Performance-based feedback	23	71.9
Building motivation for practice	11	34.4
between training sessions		
Written directions or manuals	8	25
Problem solving discussions	24	75
Parent-training modality		
Clinic visit	7	21.8
Home visit	24	75
Live coaching via telehealth (video-conferencing)	6	18.8

Telehealth: Other component (Video or online trainings)	4	12.5

Functional Assessment. Assessment procedures that reported descriptive assessment methods, such as functional assessment interview (FAI; O'Neill, Horner, Albin, Sprague, Storey, & Newton, 1997) were only reported for 6 (18%) of the participants. Descriptive assessment may be an important method to utilize prior to consequent-based analysis to determine idiosyncrasies related to the challenging behavior and the environmental conditions, allowing researchers to construct analog conditions more representative to the child's natural environment.

Derby and colleagues (1997) investigated the effects of descriptive functional assessment, antecedent and consequent-based FA and parent-implemented FCT on the challenging behavior and communication requests of four young children (ages 2 to 3 years old) with moderate to severe developmental disabilities. The researchers found improvement in the challenging behavior and in the requests for three out of the four participants and long-term effects of the intervention for all participants (following some additional assessment and intervention at follow up). It was noted that the addition of the descriptive, functional assessment procedures allowed the researchers to construct interventions analogous to the participant and families' daily routines. This thorough assessment may have improved the long term and generalized effects of the intervention. FCT informed by pre-intervention functional assessment can lead to a more robust effect (Carr et al., 1999; Newcomer & Lewis, 2004).

Other assessments reported prior to FCT included preference assessments (n = 5; 15 %) and antecedent-based FA (n = 4; 12%). Preference assessments were used for the following purposes: (1) to rank items into high and low preference toys (Dalmau et al.,

2011; Harding et al., 2009), (2) to identify multiple tangible items both to teach multiple requests and to prevent satiation (Mancil et al., 2006). Antecedent-based FA were used to evaluate varied levels of parental attention and task difficulty (Derby et al., 1997).

Functional analysis (FA) and function of target response(s). Consequent-based, analog FA (Iwata et al., 1982/1994) allows researchers to verify a functional relation between a target response and an environmental consequence. The recommendation of Durand and Carr (1985) to conduct a FA prior to FCT for optimal results has been consistently replicated through multiple studies (Asmus et al., 2004; Kurtz et al. 2003; Wacker et al., 1998; Wacker et al., 2013a). In the current review, a consequent-based FA was implemented prior to intervention for the majority of the participants to determine the function of the target behavior (n = 24, 75%). Of these FAs, combined functions were reported the most frequently (n = 13, 40%), followed by escape, tangible, and attention functions occurring for a similar number of participants (n = 7, 6, 6, respectfully).

Independent variable. FCT intervention packages were delivered with varied components. FCT with traditional differential reinforcement of the alternative response (DRA) and extinction of the target (i.e., challenging or idiosyncratic) response was reported for all of the participants (n = 33, 100%). The DRA schedule-only (without other components added to the package) was the reported intervention for thirteen participants (40%). Simultaneous exposure of the target response to extinction whilst reinforcement is occurring for the alternative communicative response results in the combined effects of strengthening the alternative response and weakening of the target response. Although

there are variations to how FCT is implemented, extinction or punishment of the challenging response is considered necessary for optimal inhibition of the challenging behavior (Derby et al., 1997; Fisher et al., 1993; Northup et al., 1994; Wacker et al., 1990).

Traditional FCT is implemented on a continuous reinforcement (CRF) or fixed-ratio of 1 (FR1) schedule (i.e., each response of the alternative communication is provided with contingent access or removal of the functional reinforcer; herein referred to as FR1). Although FR1 schedules are important to establish the appropriate communicative response, these schedules do not optimize maintained or persistent effects. The appropriate response may weaken when exposed to the thinned, intermittent, or variable reinforcement schedules of real-world life.

Robust interventions likely require components of reinforcement schedule thinning, exposure to generalization components, and/or other fading components. Following FCT, eleven participants experienced interventions with a component of either demand fading (n = 9, 28%) or schedule thinning (n = 3, 6%). Demand fading, comprised of including compliance to a task/demand prior to the availability of a requesting opportunity and incremental lengthening of the task, was the most commonly reported method for intervention fading reported. For example, Dalmau and colleagues (2011) found that both participants retained improvement in independent requests and decelerated levels of destructive behavior from initial FCT as demand fading extended from 5 to 10 tasks (n =1) and as high as 20 tasks (n = 1).

Wacker, Harding, and Berg (2008) examined a preliminary form of schedule thinning through varying duration of parental attention from 12s to 30s in a reversal design (n = 2, 6%). The researchers observed higher levels of requests during the 12s parental attention conditions, suggesting that when shorter periods of parental attention were available the participants' requests increased to maintain a stable rate of attention. Rispoli and collegues (2014) utilized schedule thinning following FCT for behavior maintained by access to ritualistic routines for a child with ASD (n = 1, 3%) The schedule thinning procedure involved setting a timer following interruption of the routine to indicate when a request for reinstatement of the ritual would be honored starting with 5 s and increasing time until the child was able to tolerate a 2 min delay prior to requesting the reinstatement of a ritual. The challenging behavior remained low during fading; however, the communication response also decreased (although, this was likely due to fewer opportunities to engage in the response during the session as the delay time was increased).

In addition to FCT, 10 participants (31%) were exposed to additional intervention components. Two participants (6%) experienced a time-out from positive reinforcement (negative reinforcement) component to the FCT. The twelve (37%) remaining participants experienced intervention components including: (1) choice allocation analysis between Spanish and English (Dalmau et al., 2011) and between communication responses (Harding et al., 2009) and (2) FCT across contexts (Moes & Frea, 2002; Tait et al., 2011) and across multiple explicit tangible requests (Mancil et al., 2006).

Harding and colleagues (2009) investigated choice allocation between a FCT condition for escape (with complete removal of task/demand components) compared to a FCT condition with combined reinforcement (with completion of task/demand components followed by escape and access to tangible reinforcers) for two young participants (both 4 year old males with developmental disability). Functional analyses indicated functions for escape (n = 1) and escape plus tangible reinforcement (n =2). A preference assessment was conducted to indicate other positive reinforcers that could be combined with negative reinforcement. During a choice assessment, the participants both allocated more time to the combined reinforcement FCT condition, even considering this condition required task/demand completion prior to escape.

Primary dependent variable(s). Challenging behavior and communication responses were investigated as the primary dependent variables for the majority of the participants (n = 17, 53 %). Challenging behavior only was investigated for 28% of the studies, and communication only was investigated for 19% of the studies.

Parent-implemented FCT for communication. Studies were evaluated as being implemented with a primary communication focus when requests or communication was noted as a core feature of the purpose of the study. Three studies (n = 8; 25%*)* focused on the appropriate communicative alternative (the request(s) as the primary purpose of the study (Falcomata, Wacker, Ringdahl, Vingquist, & Dutt, 2013; Tait et al., 2004; Wacker, Harding, Berg, 2008).

Tait and colleagues (2004) investigated the effects of parent-implemented FCT embedded into multiple contexts on AAC requests for six young children with cerebral

palsy (ages 16 to 47 months; 50% male). None of the children engaged in verbal language nor had they been taught other forms of formal communication (i.e., AAC) prior to the study. Researchers interviewed parents to identify idiosyncratic responses, the potential functions of these responses, and contexts. The mothers of the children were provided with a FCT package that included an in-service training, consultation, and feedback. Researchers monitored the children's progress and the mother's treatment integrity throughout the study and during two maintenance probes. Participants' AAC requests increased and idiosyncratic responses decreased during the parent-implemented FCT intervention. Of all of the studies included in this review, Tait and colleagues (2004) was the only study that focused on identifying idiosyncratic responses through functional assessment and analysis and implemented parent-implemented FCT into routines related to the functional reinforcers of the idiosyncratic responses to improve communication.

Wacker, Harding, and Berg (2008) examined the effects of varying reinforcement magnitude on requests emitted following parent-implemented FCT for three participants. One participant from this study was included in the current review; the boy, age 5.5 years, was diagnosed with fragile X, pervasive developmental delay, and intellectual disability. His communication was limited (one to two-word utterances) and he received 5 months of parent-implemented FCT with reductions in destructive behavior to a minimum of 90%. The researchers then taught the boy a verbal mand ("please") to access parental attention. In a comparison of FCT with reinforcement magnitude of either 12s and 30s of parental attention contingent on verbal mands; the boy engaged in higher levels of manding during the 12s condition. Interestingly, the boy engaged in levels of

manding that produced similar total durations of attention received between the two conditions (i.e., he emitted higher levels of verbal mands in the 12s condition to approximate the same total duration of parental attention as was available in the 30s condition).

The researchers suggested that the findings supported a hypothesis pertaining to motivational operations. Specifically, the researchers speculated that the participant's level of requests matched what was required to receive a relatively equal proportion of reinforcement (parental attention) across the two conditions (Laraway et al., 2003; Michael, 1987; Wacker, Harding, & Berg, 2008).

Falcomata, Wacker, Ringdahl, Vingquist, & Dutt (2013) examined shaping procedures for training sign language requests without the use of physical or gestural prompting and examined the generalization of the requests across functional contexts. One participant, a two-year old boy with developmental delay and a limited communication repertoire, was included from the Falcomata and colleagues (2013) study in the current review. The participant engaged in destructive behavior that included topographies of aggression, self-injury, and tantrums, which were maintained by multiple functions of positive reinforcement including tangible, attention, and negative reinforcement. The researchers coached his mother to implement a training procedure to initially teach the boy to touch a communication card and then to make a manual sign for "want" to gain access to tangibles.

Collateral gains during FCT. In addition to improvements in challenging behavior and communication, FCT has been evaluated for whether it may correlate to

improvement in other desirable changes for the child and the family. The majority of studies included in this review (n = 18; 56.3%) measured additional collateral behaviors related to positive outcomes for the child and/or the parent. Improvement in the child's compliance and/or demand completion was measured and demonstrated for 36 percent of the participant sample (n = 9). For these participants, a demand-fading component of the study was included once initial decreases in the challenging behavior were observed that involved incrementally increasing the number of tasks the child was required to perform (Dalmau et al., 2011; Schieltz et al., 2011; Wacker et al., 2013a). It was reported that in addition to improvement to the targeted response classes of challenging behavior and communication the participants also demonstrated an improvement in compliance to instructions/demands during the intervention with the demand fading components.

Derby and colleagues (1997) measured improvement in the child's positive social responses and positive engagement in toy play during initial parent-implemented FCT and follow-up. These collateral responses were measured as cumulative recording of the first occurrence of a new topography of positive social responses and toy play and an on-going partial interval recording of the continued demonstration of either category. All four participants demonstrated collateral gains across the positive social responses and toy play. However, as noted by the researchers, the two participants with positive reinforcement functions responded with a greater number of novel (e.g., "first occurrence") responses and a higher level of overall collateral responding than the two participants with negative reinforcement functions. In the current review, these findings represented 12 percent of the participant sample (n = 4).

Mancil and colleagues (2007) measured collateral spontaneous verbalizations of a 4-year-old boy with pervasive developmental disorder during parent-implemented FCT across four specific tangible requests. The targeted AAC responses consisted of picture card exchanges. The intervention package consisted of initial FCT, in which the parent was instructed to give a verbal instruction at the onset of each trial, e.g., "Do you want the train? If you want the train, you can ask." Following the initial FCT, a phase was introduced intended to increase the spontaneity of card exchange, during which the parent was instructed to implement a 10s time delay prior to giving a verbal instruction. For three of the requests, a final phase was implemented during which a distractor icon was introduced to the array. Initially the tantrums decreased, and then proceeded to maintain at low levels throughout the remainder of the intervention phases. In addition to improvement in the communicative response of the picture card exchange, the researchers found the child's spontaneous verbalizations increased from a total of 2 words during baseline sessions, to a total of 50 words during the fourth request that was targeted. Similar to Derby and colleagues (2007), the collateral gains were not measured in an experimental manner, therefore caution should be taken when interpreting these findings. In the current review, these findings represented 3 percent of the participant sample (n = 1).

Schieltz and colleagues (2011) investigated parent-implemented FCT for collateral effects on non-targeted disruptive behavior (e.g., stereotypic responses) for ten participants (of which three participants are included in this review) with ASD. Destructive behavior (e.g., self-injury, aggression) was targeted during the FCT and FCT-

fading phases of the study. Demand fading consisted of moving from two, to four, to eight demands prior to provision of an opportunity to request a break. As destructive behavior decelerated, a correlated deceleration in the non-targeted disruptive behaviors was observed for all three participants. Extinction probe phases were embedded into the design to test the durability of the intervention on the reduction in destructive and disruptive responses. For the three participants, overall disruptive responding was correlated with levels of destructive responding during the extinction probes. However, for two of the participants, disruptive responding was more likely than destructive responding to increase in the extinction probes. Perhaps this observed effect was due to the weaker response-reinforcer relation between the disruptive behavior and the functional reinforcer of escape.

Richman, Wacker, and Winborn (2001) investigated response efficiency during a parent-implemented FCT intervention with a three-year old with ASD. The researchers utilized an adapted concurrent schedule design that consisted of a BAB comparing reinforcement during a FCT with a picture card condition and a condition with reinforcement for aggression. A subsequent concurrent schedules design compared the three responses (picture card, sign, and aggression) by reinforcing either the picture card or the sign when aggression was on extinction. The results indicated that although both communication alternatives were effective at reducing the challenging behavior, response efficiency of signs was demonstrated as the highest responses per min when the card and signs were on a concurrent schedule. When on a concurrent schedule of reinforcement, the child engaged in the signed requests more frequently than the picture card exchange;

thus implying that the sign request was a more efficient response than the picture card exchange.

Parent responsivity was not a collateral measure for any of the included participants. However, collateral gains in parent responsivity to may be an important measure for future research. Parent responsivity to prelingusitc responses of their children is an important component of language development for young children (Harwood, Warren, & Yoder, 2002; Yoder & Warren, 1998). Although not included in any of the studies in this systematic review, parent affect has been evaluated within a multiple probe design for parents of young children with ASD involved in a one-week intensive training for Pivotal Response Training (PRT; an early communication intervention; c). Following the PRT training, parental use of PRT strategies and children's verbal language improved; collateral ratings of parents affect improved (this rating consisted of a composite of parent/child interactions for perceived happiness, interest, and stress of the parent; Koegel, Symon, & Koegel, 2002). Clearly, potential for collateral gains in parent responsivity or affect would be an important area to study for parent/child interactions during FCT intervention.

Similarly, none of the participants included in this review measured changes in quality of life for the participant. Communicative competence is directly related to quality of life. Although it was not included in the current review, a potential indicator of quality of life that has been measured for individuals with severe disabilities is the observed indices of happiness (IOH). IOH is a measure that includes operationalized definitions of positive affect (i.e., smiles, laughter) and relies on direct observation and

coding (for an example of measuring indices of happiness with individuals with severe disabilities see Lancioni, Singh, O'Reilly, Oliva, & Basili, 2005; Stasolla, De Pace, Damiani, Di Leone, Albano, Perilli, 2014). Collateral gains in higher levels of IOH have occurred in communication intervention studies for participants with Rett syndrome (Stasolla et al., 2013; Stasolla et al., 2014). To date, however, IOH has not been included as a collateral measure during FCT with children.

Communication response and AAC. At least one form of AAC was targeted for 78 percent (n = 25) of the participants; verbalizations were targeted for the remaining participants (n = 8). Of the targeted AAC responses, the modality varied. Signs were targeted most frequently at 30 percent of the participant sample (n = 10). Microswitch and picture/graphic cards were targeted at similar percentages (15.6 % and 12.5 %, respectively). The use of a high-technology, speech-generating device was used for only 3 percent of the sample (n = 1).

Olive, Lang, and Davis (2008) investigated parent-implemented FCT targeting requests on the speech-generating device for parental attention across four separate activitieswith a 4-year-old girl with ASD. FCT resulted in decreased destructive behavior. Requests improved for the first two activities during intervention and response generalization occurred in the remaining two activities prior to FCT (during extended baseline).

Interventionist and setting. Mothers most frequently served as interventionists (n = 20, 62.5%); fathers were not explicitly reported as interventionists for any participants; however, some studies simply stated 'parent' and did not specify which

parent implemented. The majority of the interventions took place in a family home setting (n = 24, 75%) and for the remaining participants interventions took place in a clinic setting (n = 8, 25%).

Maintenance, generalization, and parent acceptability. Maintenance was measured for 12 of the participants (37.5%). Maintenance probes ranged from 2 weeks (n = 1; Rispoli, Camargo, Machalicek, Lang, & Sigafoos, 2014) to 2 months (n = 2; Moes & Frea, 2002), 6 to 9 months (n = 8; Derby et al., 2007; Tait et al., 2004) to as high as 17 to 20 months (n = 2; Derby et al., 2007). Overall, for the participants with reported maintenance data, the reductions in challenging behavior remained low during maintenance phases. However, for several of the participants for whom the communication responses were measured in maintenance, the responses were less likely to maintain at as high of levels as had occurred during intervention. This decrease in responding was noted by Rispoli and colleagues (2014; n = 1, 3%) and by Tait and colleagues (2004) for two of the six participants included for review within one of the three contexts targeted.

Generalization measures were used for 12 participants (37.5%). Of these participants generalization was examined across settings or stimuli for 3 participants (9.3%) and across responses for 9 participants (n =28). Generalization across participants was not explicitly measured for any of the studies. In addition to the investigation of prompting procedures for signed requests, Falcomata and colleagues (2013) examined the generalization of trained sign language requests across functional contexts. In a multiple baseline design across functional contexts, the researchers examined whether the first

trained request ("want") would generalize under extinction to the untrained contexts of attention and escape. Generalization of the trained request was noted in the attention condition but not in the escape condition. The researchers then used the same procedures to teach manual signs for "break" and for "mother" in the other two conditions.

A measure of parent acceptability of treatment was collected for 14 participants (43.8%). Measures included Treatment Acceptability Rating Form-Revised (TARF-R; Reimers & Wacker, 1988; Suess et al., 2014), Behavioral Intervention Rating Scale (BIRS; Treuting & Elliot, 1997; Olive, Lang, & Davis, 2008) and interviews regarding the acceptability and contextual fit of FCT with the families' routine (Moes & Frea, 2002). Overall, across studies, participants, and measures, parents consistently rated FCT as an acceptable treatment. Wacker and colleagues (2013) found that parents rated FA plus FCT delivered in a clinic with live and remote coaching via telehealth as *highly acceptable* (an average rating was reported for the 80% of the participants' parents surveyed as 6.47 out of 7 on the TARF-R). Olive, Lang, and Davis (2008) found similar results; the mother who implemented FCT rated the intervention as acceptable and effective for her daughter on the BIRS.

FCT Parent-training practices. Table IV summarizes the synthesized data reported for the participants in this review related to parent training practices during the studies. In a systematic review of the parent-implemented early intervention literature, Barton and Fettig (2013) reported the features of parent training used. The authors reported that of the 24 studies included in their review, the majority included either live or video modeling of skills, performance-based feedback (n and opportunities to practice

new skills (19, 19, and 17 studies, respectfully). While fewer studies reported providing routines-based instruction, role-play, problem-solving discussions, and self-reflection (7, 5, 2, and 1, respectfully). In the current review, I used the Barton and Fetting measures to describe the training practices reported in the parent-implemented FCT literature.

Parent implementation fidelity. Fidelity data were collected on parent's adherence to the intervention protocols for approximately half of the child participants represented in this review (n = 11, 34%). When fidelity was reported, it often was in the ranges of either 80 percent (Derby et al., 1997) or 90 percent (Olive, Lang, & Davis, 2008; Rispoli, Camargo, Machalicek, Lang, & Sigafoos, 2014). However, fidelity not being reported for the majority of the participants (n = 21; 66%) is a concerning finding.

Most frequently reported parent-training practices. These parent-training practices were reported for at least 50 percent of the participants in the sample: (1) Providing opportunities to practice, (2) written directions/manuals, (3) performance-based feedback, (4) modeling, (5) problem-solving discussions, (6) building motivation for practice between sessions. All of the participants' parents were provided with opportunities to practice the new skills they were developing during the interventions (n = 32, 100%).

Written and/or manualized instructions were provided to 23 participants' parents (71.9%). A component of the interventionists demonstrating the assessment or intervention procedure to the parents were reported as a practice for 20 participants (62.5%). Parents were provided with performance-based feedback either given live during implementation or following the completion of an intervention session for 20

participants (62.5%). Related to this, parents were provided with problem-solving discussions for 11 participants (34.4%).

Less frequently reported parent-training practices. These parent-training practices were reported for fewer of the participants in the sample: (1) routines-based interventions, (2) collaborative progress monitoring, (3) role-play, and (4) self-reflection. Progress monitoring processes that included the parents were included for 9 participants (28%). Examples of collaborative progress monitoring included reviewing weekly data with parents and asking parents to record data to share with interventionists/coaches. One participant's parent was asked to engage in a role-playing exercise as a training strategy (3% of sample). Asking parents to engage in self-reflection was not reported as a training practice for any of the participants included in this review.

Although embedding intervention into the family routines is a recommended practice in early intervention (IDEA, 2004; NRC, 2001; AAP, 2007; Horn, Lieber, Sandall) only 33 percent of the studies in the Barton and Fetting review included procedures or planning for the parents to use the intervention practices during routines. In the current review, only three studies (Derby et al., 1997; Moes & Frea, 2002; Tait et al., 2004) included explicit instructions or procedures for the parents to embed the intervention into the routines, representing 31 percent of the participant sample (n = 10). In these studies, descriptive assessment procedures to increase *contextual fit* of the FCT into the routine surrounding the social reinforcer. *Contextual fit* (Albin, Lucyshyn, Horner, & Flannery, 1996; Lucyshyn, Albin, & Nixon, 1997) for parent-implemented interventions can be defined as the consistence and relevance of the intervention to the

values and skills of the caregivers/interventionists and the *resources* available in the setting (p. 403, Horner, 1997). Derby and colleagues (1997) noted that the descriptive assessment was useful in selection of the specific activity routines that would be targeted during the FA and intervention (Mace and Lalli, 1991).

The primary purpose for Moes and Frea (2002) was to examine parent-implemented intervention in both the traditional FCT model and what the authors referred to as 'contextualized FCT' (C-FCT) on the disruptive and communicative behavior of three children with ASD. The participants (2 boys and 1 girl) were between the ages of 3 and 5. FCT occurred in a traditional format, with the mothers observing the authors prompting and reinforcing the communicative alternative (verbalizations and signs.). C-FCT was embedded into routines in which the families had reported disruptive behavior problems, examples of routines included going for a walk, and eating a meal at the table. C-FCT also included planning and instructional targets for the parents to attend to during the intervention, including facilitating interaction between siblings, working on other skills within the routine (e.g., fine motor skills of holding a fork), and goals that the family had (e.g., both parents implementing the intervention). The researchers found that the children responded in similar patterns to the FCT and the C-FCT; decreases in disruptive behavior were observed while communicative behavior increased. These results maintained over a 1-year follow up with the participants. In a follow-up survey of the parents on "goodness of fit" of the two interventions, both mothers and fathers rated the C-FCT intervention as sustainable intervention for their family.

Parent-training modalities. Parent-implemented FCT has been demonstrated as efficacious for children when parents are coached by trained behavior consultants/experts (i.e., applied behavior analysts) across modalities, including either on-site (Derby et al., 1997; Wacker, et al., 1998) or remotely via telehealth (e.g., video conferencing, for an example see Wacker et al., 2013a). In the current review, home visits were the most frequently reported parent-training modality, reported for 24 participants (75%). Clinic visits (parents bringing children to clinic visits) was reported for 8 participants (25%).

Parent-implemented FCT and telehealth. The inclusion of a component of telehealth was reported for a total of 10 participants (31.3%). In this review, telehealth was broken into two components. Live coaching was defined as an interventionist connected remotely to a family (via a video-conferencing platform) both viewing and providing feedback to the parents while the procedures were implemented. Live coaching was reported for 6 participants (17.8%) of the sample. Telehealth with other components that did not include live coaching was defined as parents and/or interventionists reviewing videos and/or parents viewing online training videos. Other telehealth components meeting this definition were reported for 4 participants (12.5%).

Wacker and colleagues (2013) demonstrated the effectiveness of telehealth to conduct functional analyses (investigated through a multi-element designs) and FCT (investigated through a non-concurrent multiple baseline across participants) for young children with ASD. Six out of the 20 participants from this study were included in the current review. Participants were between the ages of 2.8 to 6.7 years old, 5 were male, and 4 had diagnoses of ASD and 2 had diagnoses of pervasive developmental disorder,

not otherwise specified. During the FA, socially mediated functions were identified for all of the included participants (n = 6, 18.8%) from the study included in the current review (and social functions were identified for 90% of the participants from Wacker et al., 2013 as a whole). All of the participants experienced reductions in destructive behavior during FCT. Four of the participants also had a demand fading condition to increase from 2 to 10 tasks prior to an opportunity to request a break; all participants continued to experience reductions during the demand fading. The researchers noted these results were similar to results obtained when participants received FA plus FCT with in vivo models (Wacker et al., 1998; Wacker et al., 2011).

Procedurally, the children's parents conducted the FAs and the FCT training in a clinic site with a trained 'parent assistant' present and with live, remote coaching via telehealth from a trained behavior consultant. The role of the parent assistant included tasks such preparing the clinic room for the family's visit.

Toward parent-implemented FCT for communication intervention and telehealth

Alhough telehealth is a growing area of research, only two of the studies included in the current systematic review included a component of telehealth. In one study, videotaped trainings were provided for parents (Derby et al., 1997). In a second study, interventionists coached parents live via video conferencing (Wacker et al., 2013). To provide a broader scope, I include a broader summary of the telehealth literature related to behavior analytic assessment and interventions for challenging behavior and communication for children with disabilities.

The World Health Organization defines telehealth as including:

> …surveillance, health promotion and public health functions. It is broader in definition than telemedicine as it includes computer-assisted telecommunications to support management, surveillance, literature and access to medical knowledge (WHO; December, 2015). Retrieved from http://www.who.int/trade/glossary/story021/en/.

Across multiple health disciplines, telehealth has been demonstrated as an efficacious modality to provide access to consultation, assessment, and intervention. Specific to applied behavior analytic assessment and intervention for children with disabilities, there is growing a growing literature base for telehealth. Through video-conferencing, telehealth has been used as a mechanism to provide training, coaching, and oversight to novice interventionists, including parents (Seuss et al., 2014; Vismara, Young, Stahmer, Griffith & Rogers, 2009; Wacker et al., 2013; Wacker et al., 2014), graduate students (Machalieck et al., 2009), and teachers (Barretto, Wacker, Harding, Lee, & Berg, 2006). Researchers have investigated telehealth across settings including connecting trained interventionists at a telehealth site with parents or providers in (1) satellite clinics (Wacker et al., 2013), (2) homes (Suess et al., 2014), and (3) schools (Baretto et al., 2006; Machalieck et al., 2009),). Although not consistently reported, various platforms have been utilized as technical components to videoconferencing, including (1) Skype™ (see Lee et al., 2015 for a detailed technical review on telehealth hardware, software, connectivity, and trouble shooting), and (2) the Iowa Communications Network (ICN; Barretto et al., 2006).

Applications of telehealth to applied behavior analytic assessment procedures have included implementation of preference assessments (Barretto et al., 2006) and functional analysis (Suess et al., 2014; Wacker et al., 2013a). Barretto et al. (2006) used telehealth to coach teachers through implementation of paired-choice preference assessments with three students with severe disabilities. Suess et al., (2014) and Wacker et al. (2013a) used telehealth to remotely coach parents to implement functional analysis prior to subsequent FCT to treat challenging behavior for children with ASD. Suess et al. (2014) demonstrated that parents' fidelity was high during FCT intervention during a retrospective analysis of three young boys (ages 2 and 3) with ASD. In the study, parents received telehealth coaching during 1-h sessions on FCT procedures until low rates of challenging behavior were observed and the parent implementing the intervention demonstrated high levels of fidelity to the FCT procedure. Parents also reported a high level of treatment acceptability (Seuss et al., 2014).

In a cost-benefit analysis, Wacker, Lee, and colleagues (2013) found the average cost per week for delivering the FA via telehealth compared to delivering FA with an interventionist driving to the home once per week was $57.95 (telehealth) compared to $335.09 (clinician traveling to home). The researchers also found that the effects for participants remained similar whether delivered in vivo delivery or via telehealth.

Machalicek and colleagues (2009) demonstrated efficacy using telehealth to coach interventionists in functional analyses and treatment of challenging behavior in a school setting with participants (ASD, ages 7 & 10). Novice graduate students served as interventionists with BCBA supervisors on-site to provide supervision. Both FAs

indicated that challenging behavior was maintained by socially mediated functions of escape and attention. In the second phase of the study, subsequent intervention derived from the FA was compared to instruction as usual during a multi-element design; adapted instruction consisted of access to preferred toys and adult attention between breaks in academic tasks. Decreases in challenging behavior and improvement in engagement occurred for both participants during the adapted instruction condition. There was insufficient information pertaining to how the telehealth coaching was delivered.

This early evidence supports efficacy of telehealth as a service delivery mechanism for behavioral analytic procedures, including preference assessments, functional analysis, and FCT. Additional research is needed to extend the investigation of telehealth-delivered interventions to promote communication in children with severe neurodevelopmental disabilities, particularly for children who are not verbal nor have a current means to traditionally communicate.

In this systematic review of the literature, I synthesized the current state of the extant research on parent-implemented FCT for children up to age 8 with developmental disabilities and moderate to severe communication impairment. The aims of the included participants in this review primarily focused on FCT as an intervention to decrease challenging behavior. Many studies simultaneously investigated the effects of FCT on measures of the alternative communicative response targeted. Only three studies (Falcomata et al., 2013; Tait et al., 2004; and Wacker, Harding, & Berg, 2008) had a primary focus on FCT as an intervention to increase early communication skills. There is, however, emerging evidence of FCT targeted towards functional reinforcers of

idiosyncratic responses as an early communication intervention both represented within this review (Tait et al., 2004) and outside of this review in non-parent implemented FCT (Drasgow et al., 1996) and other populations (Byiers, Dimian, & Symons, 2014). FCT as a parent-implemented intervention for early communication skills is an area that requires additional investigation.

There may be particular advantages to delivering a parent-implemented FCT package with live coaching via telehealth to (1) enhance the aspects of intervention delivery in the child's natural and family-centered setting, (2) to embed the assessment and intervention into natural routines for the child, and (3) to reach families and children residing outside of metro areas. In Chapter Three, I outline procedures that were used to investigate a parent-implemented intervention package that aimed to increase early communication through functional assessment, analysis, and FCT for young children with severe neurodevelopmental disabilities.

Chapter 3

METHODS

Participants and Settings

Three young girls with severe, neurodevelopmental disabilities participated in this IRB approved study. Participants met the following inclusion criteria, all (1) were between the ages of 3 and 4 years old, (2) had a clinical diagnosis of a neurodevelopmental disability (either ASD or Rett syndrome), (3) experienced severe communication impairment, defined as a parent report and pre-intervention assessment of significant delay in verbal communication skills (i.e., fewer than 5 spoken words or word approximations demonstrated within communication contexts), (4) did not use an augmentative assistive communication (AAC) system independently, consistently, or accurately (i.e., fewer than 5 independent and accurate AAC requests demonstrated within communication context approximately 80 percent accuracy across opportunities). Due to the use of remote telehealth coaching, it was necessary that the participants' parents, who implemented the intervention, understood English and had access to high speed internet in their homes.

Demographic information was collected pertaining to the participants' gender, age, comorbid motor or sensory impairment, scores on the Vineland Adaptive Behavior Scale (VABS; Sparrow, Cicchetti, & Balla, 2005), and participation in early intervention services (i.e., speech, educational, occupational therapy, or related services received within the past year).

Ella. Ella, 3.5 years old, was diagnosed with ASD, and received early childhood special education (ECSE) three mornings per week. She received clinic-based SLP services for one year prior to the study; however, services were discontinued during the study due to parental concerns over her lack of progress with her SLP goals. She had been on a waitlist for early intensive behavioral intervention (EIBI) services for 12 months. Her EIBI services began 2 weeks prior to the study and consisted of 3-9 hrs of in-home services per week. None of the outside providers implemented the study procedures or components of the intervention either during or outside of study activities. Ella scored in the low adaptive range in the VABS, Vineland II parental interview (defined as between 20 to 70 on the VABS; Sparrow, Cicchetti, & Balla, 2005).

Ella's parents reported that she babbled infrequently with consonant and vowel sounds and made several word approximations (i.e., "bye-bye"). Word approximations did not often occur within context (e.g., saying "bye-bye" when someone was leaving) and did not occur consistently (i.e., parents reported approximately 0-5 occurrences per day). Ella had previous exposure to three modalities of AAC: (1) the Picture Exchange Communication System (PECS; Bondy & Frost, 1994) which was discontinued due to lack of progress before the study began; (2) ASL signs (the sign for "more" and "all done"), and (3) a GoTalk speech-generating device with a 6-symbol array, which was used at her ECSE program prior to and throughout the study. Her parents reported that she did not use these systems independently or consistently and that she frequently threw the speech-generating device. Ella engaged in frequent tantrums that consisted of yelling,

throwing objects, dropping to the floor, elopement, and attempted biting and hitting of parents and siblings.

Study procedures were conducted in Ella's home at the table in the kitchen and in the living room areas, with either her mother or father serving as the interventionist. Ella's younger sibling was present for the sessions. Parents reported Ella aggressed towards her sibling at times; therefore, during sessions the sibling was either placed in her high chair within sight of the parent with an activity, or was tended to by an older sibling or the other parent in a different room.

Lily. Lily, 4 years old, was diagnosed with ASD and received ECSE three mornings per week for the first two weeks of the study. For the remainder of the study she was on summer break from ECSE. She received clinic-based private SLP, occupational, and physical therapy one morning per week for one hour each. She had been on a waitlist for EIBI for 16 months and remained on the waitlist for the duration of the study. While on the waitlist, her family received 1-hour per week of in-home EIBI consultation. Her service providers did not target the study procedures or intervention (her SLP had previously targeted the phrase "all done" but did not use picture cards with Lily). Lily scored in the low adaptive range in the VABS, Vineland II parental interview (Sparrow, Cicchetti, & Balla, 2005).

Lily's parents reported that she babbled frequently and used several word approximations (i.e., 'go' and 'three, four'); however these words were not often used in contextually relevant situations (e.g., she often said them when looking in the mirror or when viewing television shows) and she did not vocally imitate them (i.e., did not

respond consistently to the instruction "Say *'go'*"). During play she used the word 'go' within social games when her parent said, "Ready, set." Lily had previous exposure to two AAC systems: (1) ASL signs ("more", "all done", and "help"), and could independently make an approximation of the sign for "more" by clapping her hands together, although she did not consistently use this sign without prompting, and (2) a 2D symbol system that consisted of picture cards. She did not use either system independently or accurately to indicate her wants or needs. Her parent reported that she either threw the picture cards on the floor or played with them by tapping them against surfaces. Lily engaged in frequent tantrums that consisted of crying, screaming, throwing objects, dropping to the floor, and elopement.

Procedures were conducted in Lily's home with her mother serving as the interventionist. Sessions occurred at either the table in the kitchen or in the connected living room area. The family's nanny attended to Lily's older and younger siblings for the majority of the sessions.

Sidney. Sidney, 3.5 years old, was diagnosed with Rett Syndrome, and received ESCE four mornings per week. She also received private clinic-based SLP, occupational, and physical therapies twice per week. She was ambulatory; her gross motor skills consisted of the ability to walk, step up and down to navigate stairs with supervision, and to bend down and pick up or briefly hold small items. Sidney's hand function included the ability to self-feed small pieces of food, to pick up light items (e.g., pacifier, small book), and to press buttons to activate musical toys. She engaged in frequent repetitive behaviors of bringing her hands clasped together at midline, mouthing her hands, and

mouthing other objects such as her clothing or safe beaded jewelry. She often wore soft bands around her wrists to prevent tissue breakdown due to hand-mouthing of her wrists. Sidney scored in the low adaptive range on the VABS, Vineland II parental interview (Sparrow, Cicchetti, & Balla, 2005).

Sidney occasionally babbled sounds of "ma-ma" or "ba-ba." She had exposure to two forms of AAC: (1) a picture card-system in which caregivers would hold up several pictures of preferred items and she would reach for one of the pictures, and (2) a microswitch with voice-output that was placed at the bottom of the staircase for her to press to get access to the upstairs area. She made some prior progress with these methods, but did not use either method consistently, independently, or accurately. Sidney did not engage in frequent challenging behavior. Her parents reported that 6 months prior to the study she engaged in frequent screaming and occasional hand and wrist biting, but that these behaviors had reduced significantly. Researchers did not observe her engage in challenging behaviors during the study.

Procedures were conducted in Sidney's home with her mother or father serving as the interventionist. Sessions occurred at either the table in the kitchen while she was seated in her high chair or in the living room area. A grandparent attended to Sidney's younger sibling for the majority of the sessions; however, during some sessions there was not another adult present and the intervening parent needed to attend to both Lily and her sibling.

Response definitions and data collection

The first author identified idiosyncratic responses that were defined individually based on the observed behavior of each participant during the structured descriptive assessment. Idiosyncratic responses were measured during baseline and intervention sessions. The first author identified an AAC form that the participant could produce reliably following assessment; selection was based on the participant's motor skills and the parents' preference. AAC requests were measured during baseline and intervention sessions.

Ella. Idiosyncratic responses included (1) leading, defined as pushing a parent's hand or body towards or away from items or referents in the area (e.g., pulling her parent toward the refrigerator, or pushing a parent's hand towards the iPad), and (2) yelling, defined as loud vocalizations made with an open mouth and without consonant sounds. Ella's AAC responses were touching a PECS card or making a verbal approximation of the word (e.g., saying "mo" for "more"). If Ella threw the card, put it in her mouth, or brushed it onto the floor, it was not counted as an AAC request.

Lily. Idiosyncratic responses included (1) reaching, defined as extending one or both arms towards her parent or an item, not including if an item was being handed to her, (2) clapping (described by parents to be an approximation of the manual sign for 'more'), and (3) tantrums which included one or more of the following: crying, yelling, screaming, dropping to the floor, and aggression in the form of pushing, hitting, or pulling hair. Lily's AAC responses included touching a PECS card or picking up the PECS card and handing it to her parent as well as any verbal words or approximations

related to the item (e.g., “drink” or an approximation such as “swink” or a different but related word such as “juice”).

Sidney. Idiosyncratic responses included (1) hitting the tray of her high chair: making physical contact with the high chair tray with one or both hands, (2) reaching: extending one or both hands towards her parent or an item, not including if an item was being handed to her, and (3) approaching: walking towards parent within an arm’s length. Sidney’s AAC response was touching a Bigmack™ microswitch with enough force to activate voice output.

Dependent measures varied slightly across the participants in an effort to equalize sessions. For Ella, occurrence was selected as the dependent measure because all sessions were an equal number of minutes (5 min). For Lily, percent of trials with independent response was selected to keep a consistent measure across sessions because basing sessions on time was difficult to keep comparable opportunities for two reasons. First, she would often slowly consume the foods during the food condition (even with foods in small pieces, her consumption could take upwards 3 min during a single trial). Second, she engaged in crying during transitions within the session (e.g., her parent placing her tray on her high chair), which could take up a long period of the session time. For Sidney, responses per min was selected because session times varied from 2.5 to 5 min due to sessions being terminated early due to her rejecting items midway through the session.

Trained observers collected direct observation data on the occurrence (Ella), percentage of trials independent (Lily), and responses per min (Sidney) of both idiosyncratic responses and AAC requests throughout the study. Observers used event

recording for the dependent variables from video recordings of baseline and intervention sessions. For all AAC requests, a request was counted if (a) the participant made the request spontaneously and independently, or (b) the participant made the request while a parent made a verbal prompt towards the AAC stimuli (e.g., "you have to tell me what you want" or gestural (such as pointing at or tapping on the card or microswitch). A request was not counted if any partial or full physical assistance was used to prompt the request. The first author trained the observers during practice sessions using videotaped sessions of the participants until inter-observer agreement on the idiosyncratic and AAC requests reached a minimum of 90% agreement.

Indices of happiness (IOH). Secondary measures of IOH were used to determine collateral effects of the intervention on the participant's affect and social engagement with her parent(s). Operational definitions were created for each participant during the initial assessment procedures and were measured as occurrences within partial 6s intervals during the baseline and intervention sessions. *Ella's IOH* were defined as any instance of one or more of the following when challenging behavior was not occurring: (1) smiling or laughter, (2) babbling sounds including consonant sounds and word approximations, and not including yelling/screaming/crying, groaning, or clicking sounds, and (3) initiating physical closeness with other person (i.e., parent, sibling, family member, nanny), not including leading others, attempted aggression, or being picked up by parent or placed on parent's lap. *Lily's IOH* was the same as Ella's, with the additional inclusions of any instances of singing or humming sounds. *Sidney's IOH* included any instances of: (1) smiling or laughter, (2) vocal sounds including vowel or 1-or more

syllable consonant sounds not including guttural sounds, grinding teeth, groaning, or crying/screaming, and (3) approaching another person, bending or leaning in to look at another person, reaching arm or hand to touch another person, giving a "kiss" (bending her forehead towards the other person's face).

High-quality play (HQP). Secondary measures of HQP were used to determine collateral effects of the intervention on responsive and positive parent interaction with the participant during the session. HQP was defined as any occurrence of one or more of the following within a 6-s partial interval by the participant's parent: (1) smile or laughter, (2) initiating physical closeness not intended to block or interrupt challenging behavior, such as a hug, kiss, shoulder rub, picking up the child, tapping the child's head, placing the child in his or her lap, carrying the child, (3) praise, comments, or other language directed towards the child (e.g., "good job," "you're silly" or "look at the butterfly" and not including directives (e.g., "stack the blocks" or "come here") or reprimands (e.g., "don't throw those").

Table 3. *Operational Definitions of Participant Idiosyncratic Responses and Alternative and Augmentative Communication Requests*

Participant And Response Type	Response	Operational Definition
Ella		
	Idiosyncratic: Lead	Ella pushes a parent's hand or body towards or away from items or referents in the area (e.g., pulling her parent towards the fridge, or pushing a parent's hand towards the Ipad).
	Idiosyncratic: Yell/tantrum	Ella engages in loud vocalizations made with an open mouth and without consonant sounds including or in addition to attempted aggression towards parent (i.e., biting) or throwing items.
	AAC: Touch or hand picture card	Ella touches the picture card with one or both hands and/or hands the picture card to her parent, not including throwing, bending, or mouthing the picture card.
	AAC: Verbal approximation	Ella verbally states an approximation of the word or a similar word that would be appropriate for the context, including "more," "bye-bye" (for all done).
Lily		
	Idiosyncratic: Reach	Lily extends one or both arms towards her parent or an item, (not including if an item was being handed to her).
	Idiosyncratic: Clap	Lily brought both hands together multiple times (a 'more' sign approximation).
	Idiosyncratic: Tantrum	Lily engages in any one or more of the following, crying, screaming, pushing parent away or pulling parent's hair, or dropping to the floor.
	AAC: Touch picture card	Lily touches the picture card with one or both hands, or taps her fingers on the picture card, not including throwing or looking at the picture card.
	AAC: Verbal approximation	Lily verbally states the word or an approximation of the word or a similar word that would be appropriate for the context, including "food," "swink" (for drink), "more," "bubbles," "blow" (for bubbles).
Sidney		
	Idiosyncratic: Hit tray	Sidney hits on or taps her high chair tray with one or both hands.

Idiosyncratic: Reach	Sidney extends one or both arms towards her parent or an item, (not including if an item was being handed to her).
Idiosyncratic: Approach	Sidney walks or moves towards her parent within 1 arm's length of parent.
AAC: Press switch	Sidney presses a microswitch with one or both hands or forearm with enough force to activate voice output.

Interobserver Agreement. Interobserver agreement (IOA) was coded for a minimum of 25% of randomly selected videotaped sessions on occurrences on the idiosyncratic and AAC responses. Interobserver agreement on the idiosyncratic and AAC responses was calculated as a trial-by-trial agreement in event recording between two independent observers. The summed agreement for all participants on idiosyncratic and AAC responses was collected across a total of 30 percent of sessions (Ella and Sidney) and 25% of sessions (Lily). A breakdown of interobserver agreement across participants is presented in table 3.

Interobserver agreement on IOH and HQP was calculated as interval-by-interval agreement between the observers on the occurrence and non-occurrence of the defined response during 6-s partial interval recording. The summed agreement for all participants on IOH and HQP responses was collected across a total of 30 percent of sessions.

Table 4. *Interobserver agreement on dependent measures*

	Idiosyncratic response	**AAC request**	**Indices of happiness**	**High quality play**
Ella	Med = 91: (Range, 78 to 98%)	Med = 97: (Range, 92 to 100%)	Med = 91 (Range, 77 to 100%)	Med = 93 (Range, 88 to 100%)
Lily	Med = 95: (Range, 79 to 100%)	Med = 95: (Range, 80 to 100%)	Med = 88: (Range, 78 to 99%)	Med = 93: (Range, 85 to 100%)
Sidney	Med = 93: (Range, 89 to 100%)	Med = 97: (Range, 92 to 100%)	Med = 90: (Range, 77 to 95%)	Med= 96 (Range, 82 to 100%)

Notes. $Interobsever\ agreement = Agreement/\ Agreement + Disagreement\ x\ 100$.

Study sequence, experimental design, and data analysis

Before the study began, a functional assessment interview and preliminary observations of free play sessions were conducted. Next, a structured descriptive

assessment (SDA; Freeman, Anderson, & Scotti, 2000; Anderson & Long, 2002) was conducted. The purposes of the SDA were to identify idiosyncratic responses and to identify potential contexts and routines (e.g., snack time, activities of daily living such as hair brushing) with idiosyncratic responses occurring to embed the functional communication training intervention.

If challenging behavior was observed during the SDA, a consequent-based functional analysis (FA) was implemented using a multi-element design (Iwata, Dorsey, Slifer, Bauman, & Richman, 1984/1994) to provide evidence of functional relations between the challenging behavior and one or more social reinforcers. The FA involved manipulation of analog conditions in a counterbalanced manner with replication to demonstrate experimental control based on visual analysis of differentiated trend, level, and variability of the challenging behavior. A FA was conducted for Ella and Lily.

Communication intervention was examined through an adapted multiple-probe design (Gast & Ledford, 2014) across contexts/requests for each participant. The design involved collecting baseline data (i.e., differential reinforcement of the idiosyncratic response whilst the AAC request was placed on extinction) across three communicative contexts that were identified during the SDA and/or FA. The first context (e.g. snack time) was represented in the top panel of the figure, the second context (e.g., dinner time) was displayed in the middle panel, and the third context (e.g., access to TV) was displayed in the bottom panel. After a minimum of three baseline data points were collected in the first context (panel 1), FCT intervention (i.e., differential reinforcement of the AAC response; herein referred to as FCT) was introduced in that context. When

the intervention data met criterion (3 consecutive data points with the AAC request occurring at a higher level than the idiosyncratic request without data overlap), FCT intervention was introduced in the next context (panel 2) and this was repeated for the third context. On the first session of FCT, a signaled cue was provided in the form of a prompt (i.e., physically placing the participant's hand on the switch or picture card) on the first trial to indicate that the AAC response was now required for reinforcement. After this initial cue, a 10 s time delay with a most-to-least prompt hierarchy was used throughout the remainder of the FCT phase.

An ABAB (Birnbrauer, Peterson, & Solnick, 1974) was embedded into the first panel of the multiple probe design for all participants. The purpose of this was to strengthen the internal validity of the design by alternately replicating the effect of differential reinforcement on the idiosyncratic responses ('A') and AAC requests ('B'). In the ('A') conditions, differential reinforcement of the idiosyncratic response was conducted. Therefore, the reinforcer identified in the SDA or FA was delivered contingent on idiosyncratic behavior while the AAC response was on extinction (did not produce access to reinforcement). The AAC stimuli were present; however, for Sidney the voice activation on the switch was turned off. These sessions served as a baseline comparison for the FCT intervention ('B') phases. During the ('B') phases, differential reinforcement of the AAC response was conducted. Therefore, the same functional reinforcement was delivered contingent only on activation of the AAC request and the idiosyncratic response was placed on extinction. Minimums of three sessions were

conducted in each phase of the ABAB design to allow for established patterns of responding to be observed.

Data analysis. To investigate the primary research question single-subject experimental designs, in which the participants served as their own control, were used to establish experimental control and to analyze for within-participant treatment effects of the parent-implemented communication intervention. Following the conventions for single-subject experimental designs, each participant's direct observation data were plotted on line graphs. Visual inspection of the data was conducted by examining changes in level, trend, and variability of data both within and across phases.

The first author visually inspected the data in graphic format in order to draw conclusions during assessment with the SDA, FA, and during intervention with the adapted, multiple probe design. SDA data were analyzed through the number of different idiosyncratic responses occurring across contexts and changes in level of occurrence of idiosyncratic response across contexts. FA data were observed for changes in trend, level, and variability across analog consequent conditions. Intervention data were visually analyzed for changes in trend, level, and variability in idiosyncratic and AAC responses between baseline (i.e., DRA of the idiosyncratic response) and FCT (i.e., DRA of the AAC request) phases of the study.

To estimate a quantifiable magnitude of change for the primary research question, an effect size appropriate for single-subject designs was used through a calculation of non-overlap of all pairs (NAP; Parker & Vannest, 2009) of the idiosyncratic responses and AAC requests. NAP estimates the proportion of change of pairwise data comparisons

between baseline and intervention phases, with scores ranging from 0 (no change) to 1.0 (large change or no overlap between data points). Parker and Vannest (2009) recommend a tentative convention to interpreting magnitude of NAP effect size as follows: (1) small or weak effects (0-.65), medium effects (.66 to .92), and (3) large or strong effects (.93-1.0). NAP is a more precise effect size for single-subject designs with a closer estimate of magnitude than other non-overlapping indices (e.g., percentage of non-overlapping data; Parker & Vannest, 2009).

Materials

Telehealth equipment is described based on the materials used by the coaches in the University-based telehealth lab (i.e., the research team's equipment for delivering coaching, videotaping sessions, and data collection purposes) and by the family on the telehealth user-end (i.e., the equipment used by families to receive the coaching and to implement the procedures). AAC equipment and materials were provided to the family for the participants and used throughout the study.

Tele Lab equipment. The telehealth coaching sessions occurred in the Telepresence Behavior Lab (TBL) to connect the coach to the family via video conferencing equipment. The following equipment was used: screen-recording software (Debut) on a dedicated computer (Dell OptiPlex 3010 Desktop) with Dell 24in monitor, Logitech HD Pro Webcam C920, Logitech ClearChat Comfort/USB Headset H390, Polaroid 8"Heavy Duty Mini Tripod, secure Internet connection through the University server, and secure storing of data and files on the University system. The video conferencing software used was Google Hangout, a free, secure, web- based application.

The coach monitored session duration with a timer, and occasionally used examples of the picture cards (Ella and Lily) or a microswitch (Sidney) to demonstrate prompting techniques to the parent. The data coders used a Sper Scientific interval-recording timer set to 6-sec intervals for measures requiring partial interval recording (IOH and HQP coding).

Telehealth user equipment. The University of Minnesota Telepresence lab retained a lending library of telehealth equipment kits to provide to families for the duration of the study if they needed equipment. Due to the video quality and the broad view required to capture the participants, all of the participants used the Logitech HD Pro Webcam C920, instead of the internal webcameras on the computers.

Ella and Lily's families used webcameras with a tripod connected to their personal computers (both families had Macintosh desktop computers). Sidney's family used a full telehealth kit, which included a Dell Latitude E6430 premier laptop, Logitech HD Pro Webcam C920, 1090p, and a Polaroid 8in Heavy Duty Mini Tripod. The first author provided families with a University of Minnesota Telepresence Lab Manual that contained a task analyses with computer screen shot images for parents to reference for technology set-up and for technology trouble-shooting. The following training formats were given to parents: (1) a paper-copy of the manual, and/or (2) an electronic copy of the manual, and (3) an electronic copy of a video training module demonstrating connecting equipment (e.g., plugging in the webcam), answering video conferencing calls, and changing settings for connectivity bandwidth, audio, and video.

AAC equipment. The first author provided each participant with AAC equipment in modalities that matched her motor repertoire. Ella and Lily were provided with 2D picture communication cards. Ella used two cards depicting "more" and "all done." The cards were line drawings on white backgrounds with a colored boarder and were approximately 3.5" X 2.5". The "more" card had hands making a "more" sign and the "all done" card had a person's body making the sign for "all done". Lily used five cards. The cards were in color and contained either a photograph or a line drawing and were similar sizes (approximately 3" X 2.5") there were not colored backgrounds on the cards. Four of the cards had photographs as symbols ("food", "drink", "Playdoh™," and "bubbles") and one of the cards contained a line drawing for "all done" with the same symbol as Ella's. Sidney used a BigMack™ microswitch (5" x 6") without an icon displayed. The microswitch produced the digitized voice output of "more" when activated.

Procedures

Pre-intervention assessment. A functional assessment interview (FAI; O'Neill, Horner, Albin, Sprague, Storey, & Newton, 1997) was conducted through a phone call with one of the parents to identify idiosyncratic or challenging behaviors and to identify environmental contexts in which they occurred (O'Neill et al., 1997). The expanded interview form of the Vineland Adaptive Behavior Scales (VABS; Sparrow, Cicchetti, & Balla, 2005) was used to gather information about the participant's communication, functional, and motor skills; the VABS provides detailed information about communication, functional, and motor skills for individuals with severe disabilities.

Technology and environmental-safety check. In the first telehealth session, the coach met with the parent (s) via telehealth to determine the quality of the Internet connection and the set up of the telehealth equipment. First, the Internet connectivity was tested. The parent was coached via the telephone for how to answer the Google Hangout call and how to change settings on the equipment, if needed. Next, an environmental-safety check was conducted; this consisted of examining the home where sessions would be conducted. The safety of the environment where the session would be conducted was examined for potential areas that posed a safety hazard during incidents of challenging behavior (e.g., sharp edges, heavy or breakable items). Last, particulars to the intervention setup were examined, including the optimal angles of the webcamera to view the participant and the surroundings. At this time, the research team and parents discussed a plan for siblings (incidentally, all of the participants had baby siblings) during the sessions. The plan for siblings included having another adult, such as the other parent, an older sibling, or a babysitter present when possible and/or keeping the sibling in a high chair with an activity to prevent potential aggression towards the sibling (for Ella). The following camera placement and safety setups were identified during the environmental-safety check for each participant (see Table 4 for camera placement across communication contexts for each participant).

Structured descriptive assessment (SDA). Beginning in the second telehealth session, the coach instructed the parent through a SDA (Anderson & Long, 2002; English & Anderson, 2006; Freeman, Anderson, & Scotti, 2000) remotely via telehealth. The goal of the SDA was to document the occurrence of idiosyncratic responses, challenging

behavior, or both, across contexts. Each participant was exposed to 2.5 to 5 min sessions each of a variety of antecedent conditions or routines, designed to reflect parent report during the FAI. The coach instructed the parent to set up the antecedent condition (e.g., snacks, hair brushing) in a manner that reflected the typical routine of the participant (see Table 5 for specific details regarding the conditions for each participant with camera placement). No programmed consequences were provided; the coach instructed the parent to "respond [to the child] how you would normally would." The order of the conditions was presented in a counterbalanced manner.

For Ella the following conditions were observed: (1) restricted access to Playdoh™, (2) restricted access to snack and drink, (3) diverted parental attention, and (4) a task/demand with physical prompting for completion of a puzzle. For Lily the following conditions were observed: (1) restricted access to Playdoh™ and bubbles, (2) restricted access to food and drink, (3) diverted parental attention, and (4) a task/demand involving prompting to complete a color sorting task. For Sidney the following conditions were observed: (1) restricted access to food in the high chair during dinnertime, (2) restricted access to a dry snack while in the living room, and (3) diverted parental attention.

Functional analysis procedures (FA). A FA was conducted with Ella and Lily due to the occurrence of challenging behavior (in the form of tantrums). The observed parental responses to the challenging behavior during the SDA conditions was integrated into the programmed consequences of the FA in order to create conditions that were

analogous to and representative of the naturally occurring interactions. The coach instructed the parents remotely via telehealth.

The FA involved exposing the participant to up to 5 sessions each of a series of conditions designed to test specific social functions (e.g., access to social interaction/attention, removal of task/escape). The order of conditions was presented in a counterbalanced manner. All FA sessions lasted 5 -min with no more than 10 sessions (50 min) conducted in a single day. The coach provided the parent with more specific instructions than were present in the SDA and with live feedback during the sessions. The majority of instructions pertained to the parent: (1) presenting the establishing operation (e.g., withholding a preferred item), (2) providing immediate contingent access to the programmed consequence for challenging behavior, (3) withholding the programmed consequence in response to other forms of responding from the participant (e.g., withholding the programmed consequence for appropriate responding, such as the participant making the sign for "more"), and (4) the parent reinstating the establishing operation by restricting access or placing demands. A pattern of elevation in the challenging behavior (i.e., tantrums) within a particular condition was indicative of a functional relation. The FA continued until one or more social functions of tantrums was identified.

Parent-implemented functional communication training (FCT). The purpose of the intervention phase was to examine the extent to which the three participants acquired the aided AAC requests during parent-implemented FCT that was embedded into three contexts and coached via telehealth. The AAC requests were identified for each

participant across three contexts (see Table 5 for a detailed description of contexts and AAC requests). Up to 7 sessions were conducted per day and sessions lasted 5 min (Ella) for 3 trial blocks (Lily), and 2 to 5min (Sidney). Sessions were terminated early if the child refused the reinforcing item (e.g., food) for 1 min or longer follow parent attempts to re-engage the child in the item (e.g., holding the item closer to the participant, taking the lid off of the bubbles, etc).

Differential reinforcement of the idiosyncratic response (baseline). In the baseline phase for each routine, the coach instructed the parent via telehealth to reinforce the identified idiosyncratic response(s) and to keep any attempts to engage in the AAC response on extinction (see Appendix C for task analysis of baseline procedures). During the baseline sessions, the communicative context related to the social function of the idiosyncratic response was used in the intervention setting; therefore, the antecedent stimulus was presented (e.g., the participant was placed in their high chair and the caregiver held out snack out of participant's reach) and the maintaining social consequence was provided contingent on the idiosyncratic response (e.g., the caregiver gave the participant a bite of a snack). The AAC stimulus (card(s) or switch) was present in the baseline sessions but the participant was not prompted to engage in the AAC request, nor did occurrences of the AAC request produce access to the reinforcer (extinction). For Sidney, the vocal output on the microswitch was turned off during all baseline sessions.

Differential reinforcement of the AAC request: Functional communication training (FCT). Following baseline, the FCT intervention was embedded into the three

routines identified for each participant. The coach instructed the parent via telehealth to implement the routine and to deliver differential reinforcement contingent on the AAC request and extinction for the idiosyncratic response(s) (see Appendix D for task analysis of intervention procedures). During the FCT sessions, the communicative context related to the social function was used in the intervention setting; therefore, the antecedent stimulus was presented (e.g., the participant was placed in their high chair and the caregiver held out snack out of participant's reach) and the maintaining social consequence was provided contingent on the AAC request (e.g., the caregiver gave the participant a bite of a snack). The coach instructed the parents to use a most-to-least prompting hierarchy (Berkowitz, 1990; MacDuff, Krantz, & McClannahan, 2001) consisting of providing full physical assistance and to fade these prompts to partial physical assistance until the participant independently engaged in the response. The parent was instructed to begin the first trial with a full physical prompt. If the participant was successful in executing the AAC request, the next trial the parent was instructed to attempt a partial physical prompt. If the participant was successful, for the next trial the parent was coached to wait 30 sec and only provide a partial physical prompt if the participant had not engaged in a successful AAC request. If an error occurred (i.e., the participant did not respond with the AAC request within 30 sec), the parent was instructed to begin the next trial with a step higher in the prompting hierarchy (e.g., a more intrusive prompt).

These prompting procedures were combined with a time delay (Charlop, Schreibman, Garrison Thibodeau, 1985) for Ella ('food/drink', and 'video' contexts) and

Lily (‘food/drink, and ‘Playdoh™/bubbles’ contexts) following emergence of the participants engaging in verbal approximations of the targeted words on the picture cards in these contexts. Within time delay, following the card exchange the parent provided an additional 10 s wait time for the participant to say the word associated with the picture (‘more’ for Ella and “food/drink” or “Playdoh/bubbles” for Lily).

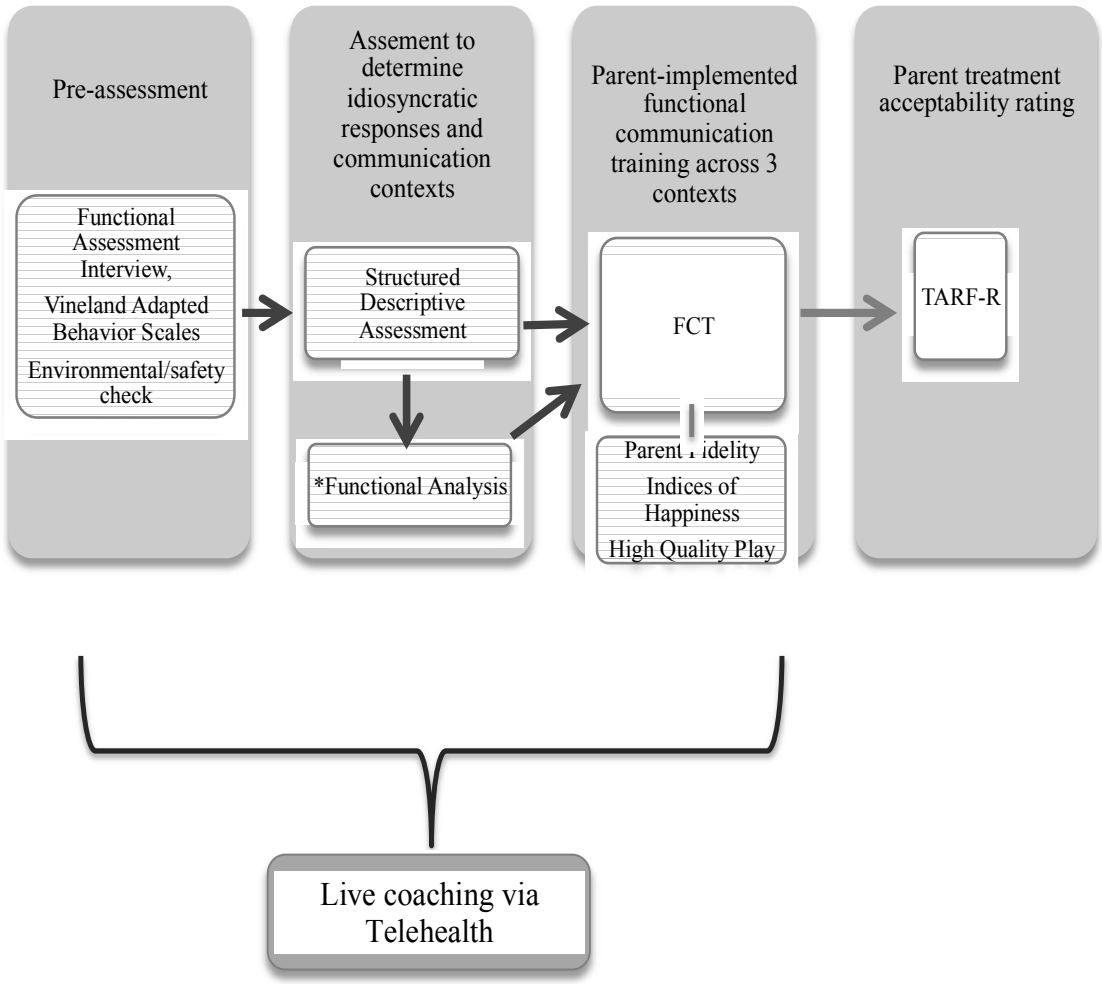

Figure 2. Procedural flowchart represents the timeline of the procedures of the study. Black lines depict activities related to the primary research question. Gray lines depict activities related to the secondary research questions. Note. An addition of a functional analysis was added to the assessment procedures for Ella and Lily due to challenging behavior within their topographies of idiosyncratic responses.

Table 5. Contexts, Requests, Camera Placement

Participant and Request	**AAC request**	**Context**	**Camera Placement**
Ella 'Snack'	Touch PECS card "More"	At kitchen table, in chair with parent in chair on her side	Camera on tripod on desk approximately 6 feet away
Ella 'Video'	Touch PECS card "More,"	At kitchen table, in chair, with parent in chair on her side	Camera on tripod on desk approximately 6 feet away
Ella 'Break'	Touch PECS card "Bye-bye"	At kitchen table in chair, with parent in chair on her side	Camera on tripod on desk approximately 6 feet away
Lily 'Food/Drink'	Touch PECS card from field of 2, "Food" or "Drink" or verbal approximation of either word	At kitchen table, in high chair, with parent seated next to her	Camera on tripod on desk, approximately 5 feet away
Lily 'Playdoh'	Touch PECS card from field of 1, "Playdoh™" or verbal approximation of "Playdoh™", "open," "more," "more Playdoh™"	Parent holding Playdoh™ and interacting with Lily, mirror placed at back of couch, Lily walking around or standing at table	Camera on tripod on desk, turned to follow her when needed, between 5-10 feet away
Lily 'Break'	Touch PECS card from field of 1, "All done" or verbal approximation of "all done"	Parent bringing Lily to table with task placed on it (sorting game, blocks to stack, beads to string)	Camera on tripod on desk approximately 5 feet away
Sidney 'Food/drink	Press BigMack™	Sidney seated in high chair with parent seated	Laptop on kitchen table with camera

	microswitch with voice output "more"	across from her. Sibling seated with grandparent or babysitter	on tripod in front of Sidney, camera approximately 2-3 feet away
Sidney 'Snack'	Press BigMack™ microswitch with voice output "more"	Sidney in living room, parent seated on floor next to her, microswitch placed on couch, sibling in living room or other room with other caretaker	Laptop on opposing couch, tripod on coffee table across from parent and Sidney, approximately 6 feet away
Sidney 'Parent attention'	Press BigMack™ microswitch with voice output "more"	Sidney in living room, parent seated on floor microswitch placed on couch, sibling in living room or other room with other caretaker.	Laptop on opposing couch, tripod on coffee table across from parent and Sidney, approximately 6 feet away

Parent Fidelity. Two coders (graduate students) independently scored parent fidelity to baseline and intervention procedures based off of task analyses (see Appendices C & D) from randomly selected videos of sessions. Fidelity to study procedures was measured during 20% of baseline and intervention sessions for each participant as a percentage of the critical steps of baseline and intervention sessions that were implemented. Despite slight variations across individualized protocols for the participants, broadly defined steps were listed in the task analyses of baseline (6 steps) and intervention (7 steps, with the inclusion of the prompting procedures) sessions for use with all three participants: (1) session set-up, (2) pre-session access to the preferred item/activity, (3) onset procedure to begin a trial, (4) execution of the prompting procedure (intervention only), (5) provision of immediate access to the reinforcer

contingent on either the idiosyncratic response (baseline) or the AAC response (intervention), and (6) extinction of either idiosyncratic response (intervention) or the AAC response (baseline), and (7) adherence to early session termination criteria (participant refusing item for longer than 1 min). The items could be scored as correct if either the coach prompted the parent to execute the step or the parent independently implemented the step. If any steps were skipped or a fidelity error occurred, the coach provided corrective feedback to the parent. Parent fidelity was as follows: Ella 96 % (range, 83 to 100), Lily 93 % (range, 71 to 100), and Sidney 94% (range, 83 to 100).

Parent ratings of treatment acceptability. Parent rating of treatment acceptability was measured and analyzed through descriptive methods. The modified version of the Treatment Acceptability Rating Form-Revised (TARF-R; Reimers & Wacker, 1988; Reimers, Wacker, & Cooper, 1991) was administered in a similar method to Suess and colleagues (2014). The TARF-R is a questionnaire that consists of 21 items in a 7-point Likert-type rating scale; 17 items are related to measures of parent's perception of acceptability and 3 items are related to parent's perception of the severity of the problem. In the current study, the TARF-R was slightly modified to include the terms *and/or communication* to items 4, 7, 10, 18, and 21. This modification was made to align the TARF-R with the communication aspect of the primary research question of the study

Chapter 4

RESULTS

The results of the primary research questions (SDA, FA, and intervention data) are reported in order of participants; the purpose of this was to align assessment decisions with intervention results. For each participant, SDA results (Figures 3, 6, and 9) are displayed in non-sequential groupings of assessed contexts; the purpose of this was to allow for visual analysis of overall levels of idiosyncratic response topographies within and between contexts. FA results for Ella (Figure 4) and Lily (Figure 7) are reported following their SDA data. Intervention results (Figures 5, 8, and 10) are reported last for each participant. For each participant, non-overlap of all pairs (NAP) scores for adjacent experimental conditions and combined overall medians of NAP scores are reported in Table 6.

Ella. Ella's pre-intervention assessment data are displayed in the SDA and FA Figures 3 and 4; intervention data are displayed in Figure 5.

Ella SDA (Figure 3). Ella's father (days 1 and 2) and mother (days 2, 3, 4) conducted the SDA, which was conducted across a total of 4 days and consisted of 17 total sessions across 5 contexts. In the SDA, Ella engaged in multiple topographies of idiosyncratic and potentially communicative responses across contexts. The three contexts with the highest level of overall idiosyncratic responding were: (1) restricted access to food (M = 4.8 responses/min), (2) restricted access to toys (M = 6 responses/min), and (3) demands (M = 2.2 responses/min). Leading parent was the most frequently observed topography for both restricted access to food (M = 2.0 responses/min) and restricted access to toys (M = 2.6). Yell and tantrum were the only

idiosyncratic topographies observed in the demand context; these responses occurred at the same level (M = 2.2 responses/min). It was noted that yelling preceded tantrums in most occurrences. Lower levels of overall idiosyncratic topographies were observed in both free play (M =. 5 responses/min) and diverted attention (M = 1.85 responses/min).

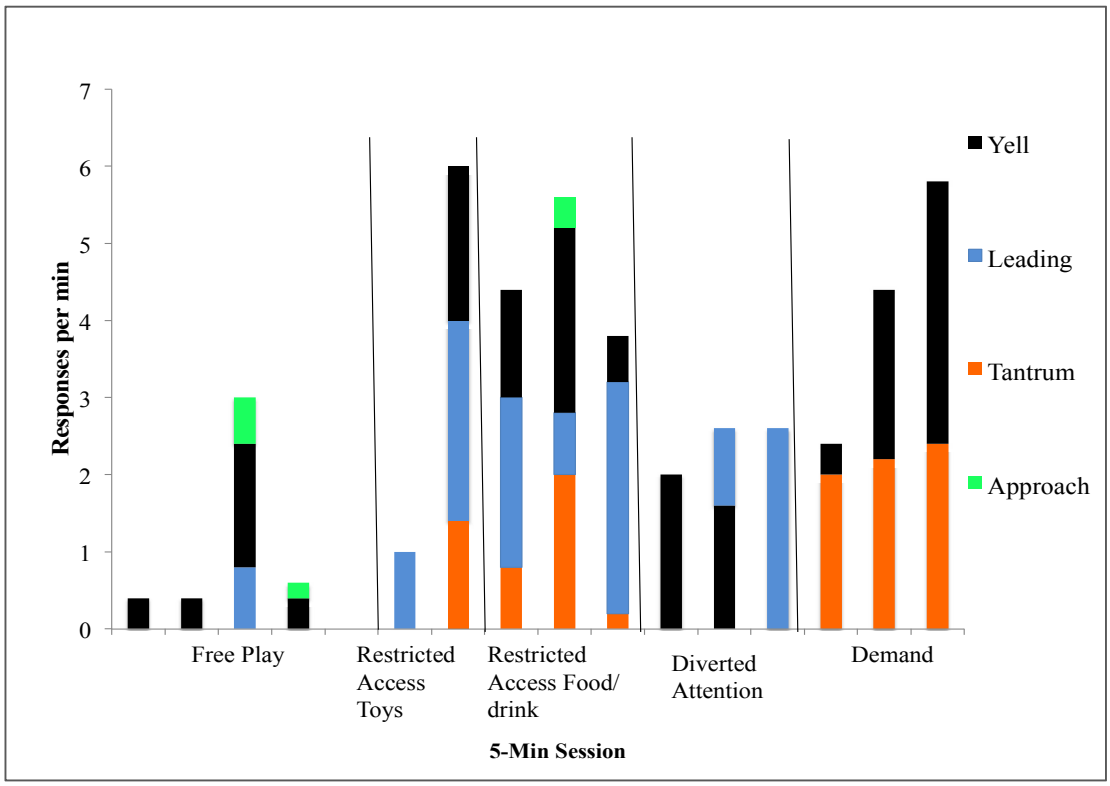

Figure 3. Results of Ella's structured descriptive assessment (SDA) of idiosyncratic response topographies across contexts of free play, restricted access to tangibles (Food/drink and videos), diverted parental attention, and demands (completing puzzle at the table with parent). Data are depicted in non-sequential order, by context, to aid in visual analysis of response topographies occurring in each context.

Ella FA (Figure 4). Due to the presence of challenging behavior in the form of tantrums during the SDA for Ella, an analog consequent-based FA was conducted. Ella's father (day 1) and mother (days 2, 3, 4) conducted the FA, which was conducted across 4 days and consisted of 14 sessions in 4 conditions. In the FA, contingent reinforcement was arranged for tantrums across analog conditions of free play, escape, tangible, and

attention conditions. Ella engaged in the highest number of tantrums during the escape condition (*M* = 6.7). An elevated level of tantrums was also observed in the tangible condition (*M* = 2.3). Low and stable levels of tantrums were observed in the attention (*M* = .7) and free play (*M* = .1) conditions. Based on the results of the FA, escape and tangible functions were identified for Ella's tantrums.

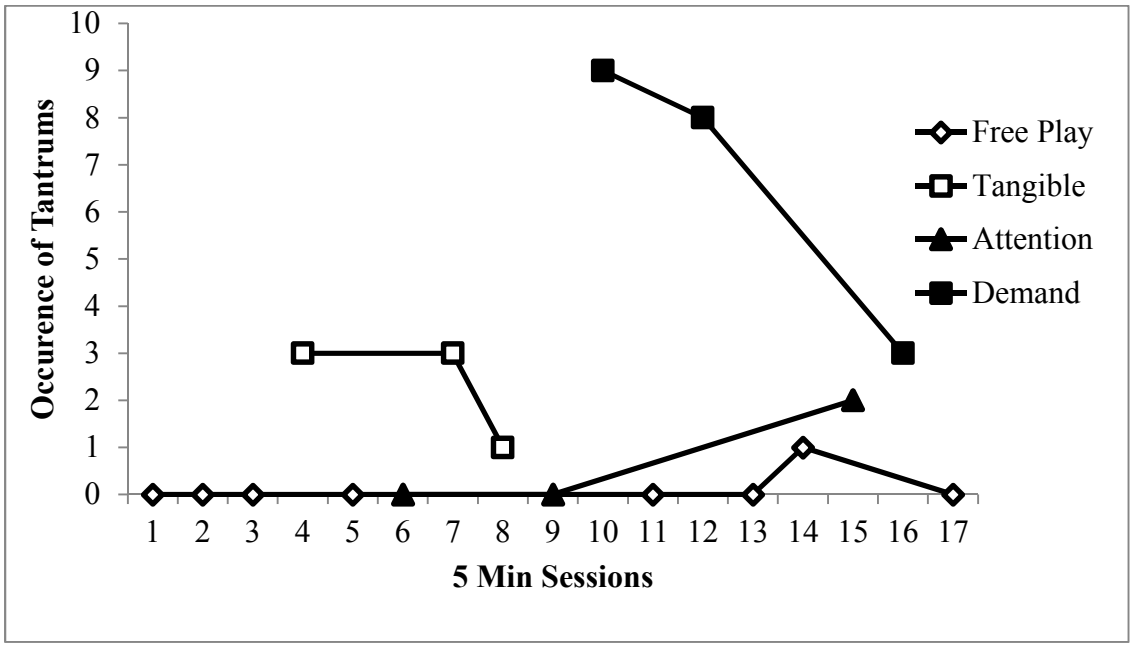

Figure 4. Consequent-based functional analysis (FA) of tantrums with Ella.

Ella parent-implemented FCT across contexts (Figure 5). For Ella, the three communicative contexts selected based on responses observed during the SDA and FA were (1) *access to snack/drink* (Figure 5, top panel), (2) *access to video* (Figure 5, middle panel), and (3) *escape from demand* (Figure 5, bottom panel). Ella's AAC requests consisted of exchanging a picture card and/or a verbal approximations of "more" during *access to food/drink*, exchanging a picture card of "more" during *access to a video* and exchanging a picture card and verbal approximations of "bye-bye" (i.e., break) during the *demand* context.

Snack/drink. In Baseline sessions there were low and stable occurrences of the AAC requests, higher levels of idiosyncratic responses, and differentiation between the two data paths. With the introduction of FCT to the *snack/drink* context, there was a small, immediate change in level of AAC requests, with an overall increasing trend (NAP = .98). An initial increasing trend in the idiosyncratic responses were observed (range, 0 to 2.8) until session 5. Beginning in session 6, there was a decreasing trend in idiosyncratic responses, which resulted in low and stable levels of responses, and lasted throughout the remainder of the intervention phase (NAP = .65).

A reversal to Baseline was introduced beginning in session 19. There was an immediate change in level in both the idiosyncratic responses and the AAC requests, and a high degree of variability and overlap between the two response forms during the first 4 sessions (sessions 19 to 23) of the reversal. Following session 23, improved stability and differentiated rates (a higher level of idiosyncratic responses and a lower level of AAC requests) were observed and remained in a similar pattern for the remainder of the reversal phase. With the reintroduction of FCT, there was an immediate change in level of occurrence of both the idiosyncratic response and the AAC. An overall level change with stable and differentiated responding was observed in all sessions of the final intervention phase with idiosyncratic responses never occurring, and AAC requests elevated (Idiosyncratic; $M = 0$; NAP = 1.0; AAC; $M = 2.2$: range, 1.2 to 2.8; NAP = .65).

Video. In Baseline, occurrences of AAC ($M = .1$) and idiosyncratic responses ($M = 1.5$) remained stable in the video context (middle panel) during Baseline sessions. In the first four sessions of FCT in the video context, AAC requests for “more” remained low and variable and idiosyncratic responses did not immediately change in level (NAP =

.97). However, beginning in session 5 and throughout the remainder of FCT, AAC requests increased and remained at high and stable levels. A decreasing trend in idiosyncratic responses was observed from the onset of FCT resulting in low to zero levels of responding throughout the remainder of this condition (NAP = .84).

All done. Idiosyncratic and AAC responses were probed across baseline sessions in the *all done* context (bottom panel). AAC responses of "bye-bye" never occurred during baseline and idiosyncratic responses were slightly variable (M = 1.1; range, 0 to 2). With the introduction of FCT for "bye-bye," AAC responses immediately increased in level (NAP = 1.0) and idiosyncratic requests quickly decreased to zero and rarely occurred in the remaining sessions (NAP = .71).

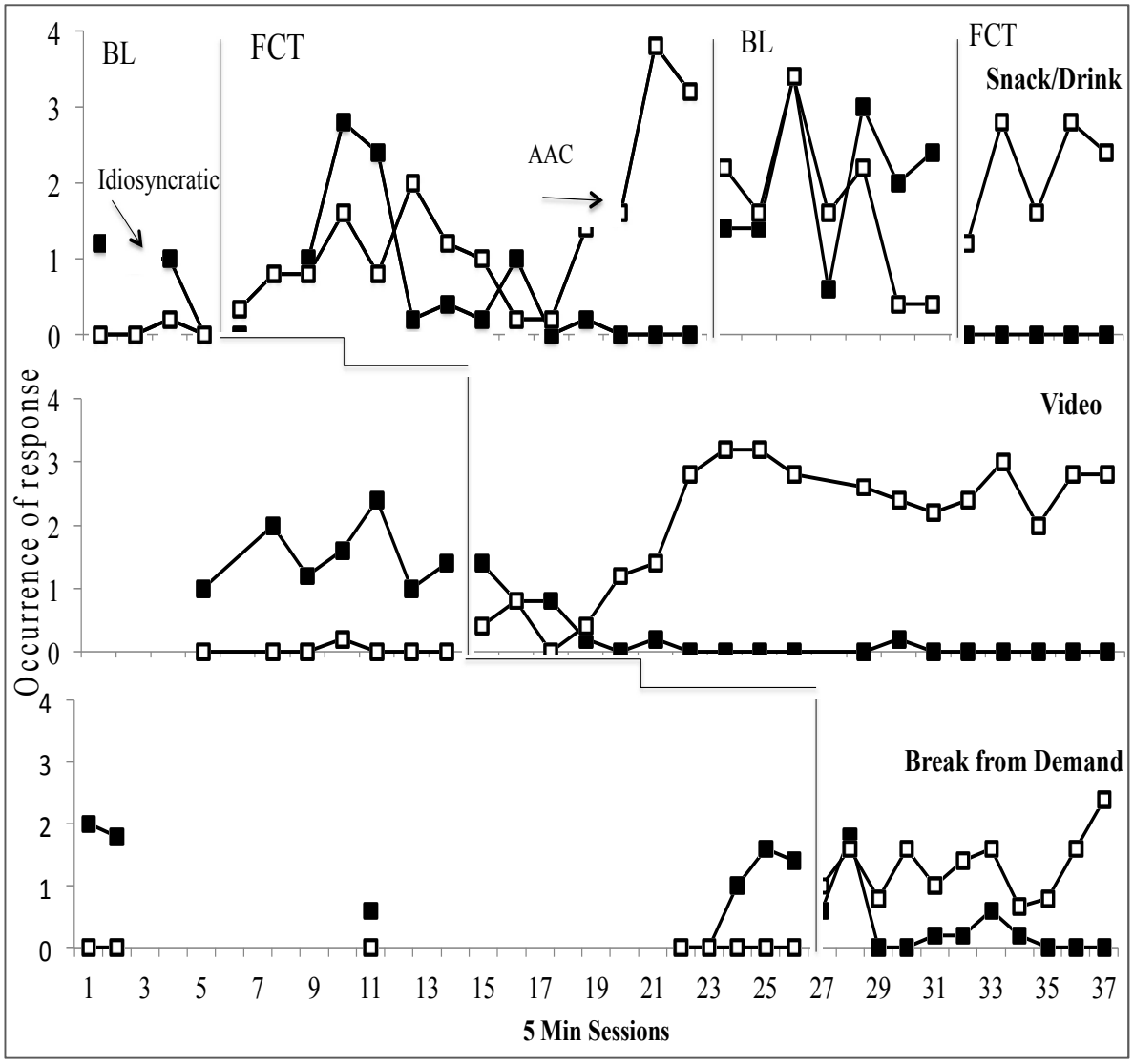

Figure 5. Ella MPD. Occurrences of responses of idiosyncratic responses (leading or tantrums) and AAC (touching or handing a PECS card and/or verbal approximation) across three contexts: ***Snack/drink:*** (panel 1; idiosyncratic = leading parent: AAC = PECS "more"), ***Video*** *(*panel 2; idiosyncratic = leading parent: AAC = PECS "more"), and ***Demand/break*** (panel 3; idiosyncratic = yelling: AAC = PECS "all done"). Baseline (BL) = differential reinforcement of alternative response (idiosyncratic response) in baseline and FCT = differential reinforcement of alternative response (AAC and/or verbal response).

Lily. Lily's pre-intervention assessment data are displayed in the SDA and FA Figures 6 and 7; intervention data are displayed in Figure 8.

***Lily SDA* (Figure 6).** Lily's mother conducted all of the SDA sessions, which occurred across 3 days and consisted of a total of 14 sessions across 5 contexts. Lily engaged in multiple topographies of idiosyncratic and potentially communicative responses across contexts. The three contexts with the highest rate of overall responding per min were: (1) *demand* ($M = 5.5$), (2) *restricted access to food* ($M = 3.1$), and (3) *restricted access to toys* ($M = .84$). Cry/tantrum were the most frequently observed topographies for the *demand* context ($M = 5.1$). Reach ($M = 1.6$) and clap ($M = 1$) occurred at the highest rate in the *restricted access to food* context. Reach occurred at the highest rate in the *restricted access to toys context* ($M = .93$). Lower rates of overall idiosyncratic topographies were observed in *diverted attention*, ($M = 1.6$), *restricted access to drink* ($M = 1.2$), and *free play* ($M = .34$).

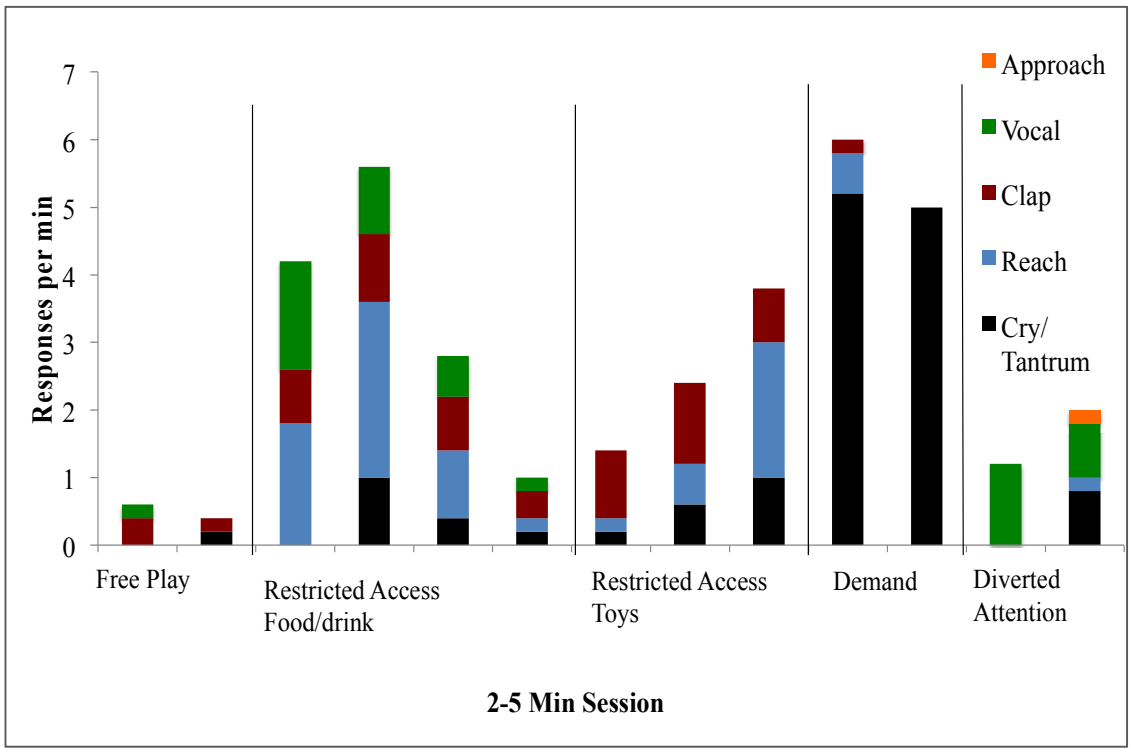

Figure 6. Results of Lily's structured descriptive assessment (SDA) of idiosyncratic response topographies across contexts of free play, restricted access to tangibles

(food/drink, bubbles, and Playdoh™ items), demands (completing sorting task at the table with parent), and diverted parental attention. Data are depicted in non-sequential order, by context, to aid in visual analysis of response topographies occurring in each condition type.

***Lily FA* (Figure 7).** Due to the presence of challenging behavior in the forms of crying and whining during the SDA, an analog FA was conducted. Lily's mother conducted all of the FA, which occurred across 3 days and consisted of a total of 14 sessions across 4 conditions. Her father assisted during the final 5 sessions. Contingent reinforcement was arranged for cry/whine behavior across analog conditions of free play, escape, tangible, and attention conditions during the FA. Lily's percentages of intervals with cry/whining were elevated most during the escape condition (M = 74%). Low and stable levels of cry/whine were observed across the other conditions, attention and tangible conditions both at (M = 10%), and free play (M = 2%). Based on the results of the FA, an escape function was identified for cry/whine.

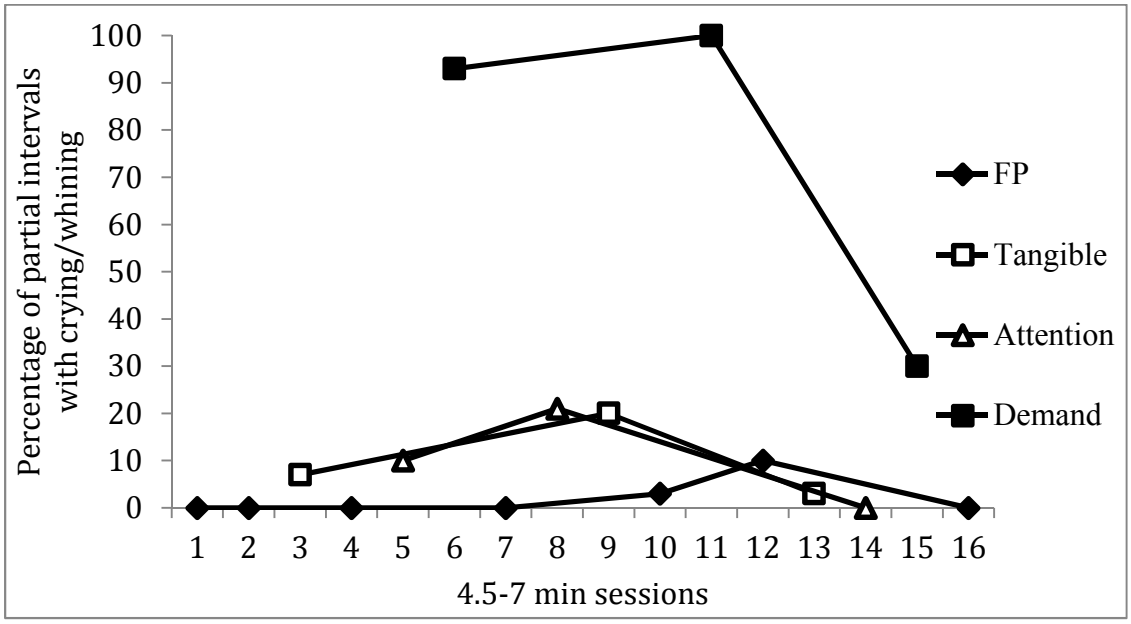

Figure 7. Consequent-based functional analysis (FA) results of crying and whining with Lily.

Lily parent-implemented FCT across contexts (Figure 8). The three communicative contexts selected from the SDA for Lily were (1) *access to food/drink* (*food/drink*: top panel), (2) *access to toys* (*toys*: middle panel), and (3) *break from demands* (*all done*: bottom panel). Lily's AAC requests consisted of touching a picture card of either and/or verbal approximations of "food" and "drink" during *food/drink*, selecting a Playdoh™ or bubbles card and/or verbal approximations of "playdoh" or "bubbles" during *toy*, and selecting a picture card and/or verbal approximations of "all done" during the *break* condition.

Food/drink. During Baseline, Lily rarely used the AAC requests and engaged in idiosyncratic responses in 70% or more of the trials in all but one session. Upon initial introduction of FCT, data for both AAC requests and idiosyncratic responses were highly variable. After session 11, AAC requests increased to 70% or more of the trials with independent AAC responses in all but one session, and idiosyncratic responding occurred in 30% or less of the trials in the majority of sessions. The overall mean for AAC responses during the first intervention phase was 87% (NAP = .96) whereas the overall mean for idiosyncratic responses was 14% (NAP = .96).

A reversal to Baseline occurred beginning in session 113 and lasted until session 121. There was an immediate decrease in the AAC requests to a lower percent (down from 100% to 33%), followed by an overall low level of AAC requests throughout the reversal phase (M = 29%). Idiosyncratic responses did not have an immediate level change (remained flat, 0% to 0 %); however, an increasing trend began on session 6 of the reversal phase and continued until it stabilized at a higher percentage throughout the remainder of the phase (M = 41%). There was a moderate degree of overlap between

AAC requests and idiosyncratic responses; overlap occurred for 3 out of the 9 reversal sessions. Upon reinstatement of FCT in the final phase, an immediate increase in AAC requests was observed (up from, 0% to 100%). The AAC requests remained high and stable for all sessions of the final intervention phase (NAP = .89); the percentage of idiosyncratic responses initially remained unchanged and then decreased and remained low (NAP = .44).

Toys. Probes of Baseline sessions of idiosyncratic responses and AAC requests were conducted in the baseline phase of the *toys* context (middle panel). Prior to intervention *toys*, idiosyncratic responses consistently occurred more than AAC responses occurred. Upon introduction of FCT, AAC requests for "play dough" immediately increased in occurrence and, despite some variability, remained elevated throughout the phase (NAP = .92). Upon introduction of FCT, idiosyncratic responses immediately decreased in level and despite some variability, remained low throughout the intervention phase (NAP = .98).

All done. Probes of Baseline sessions of idiosyncratic and AAC responses were conducted in the *all done* context (bottom panel). Upon introduction of FCT, idiosyncratic responses remained elevated and AAC responses did not occur for the first several sessions. After 7 sessions of the DRA schedule, AAC requests began to occur and increase in trend; idiosyncratic responses began to decrease. After a period of variability and overlap between the two responses, AAC requests increased to 100% (NAP = .68) and idiosyncratic responses decreased to lower levels (range, 0 to 30% of trials; NAP = .92).

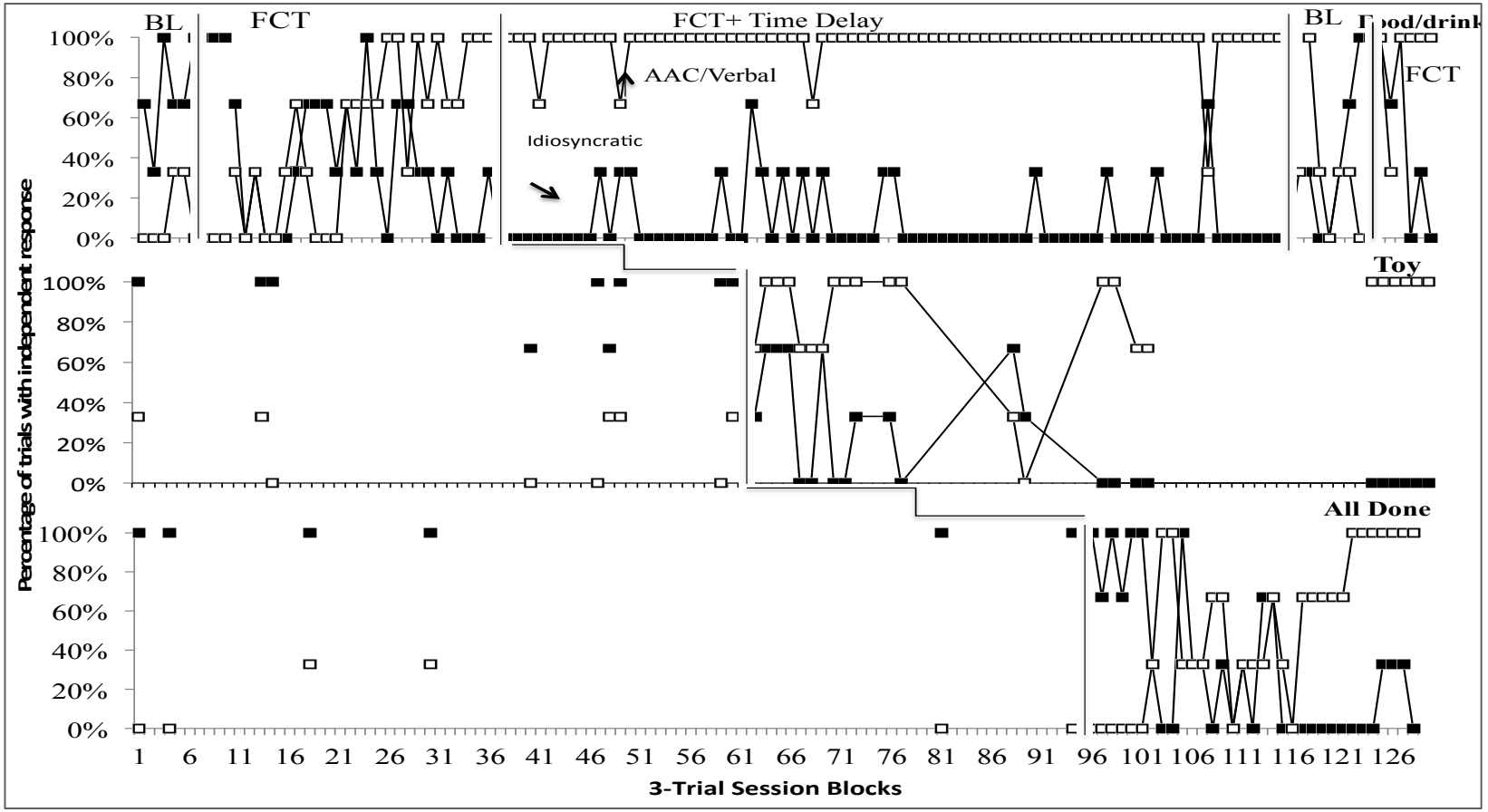

Figure 8. Lily MPD. Percentage of trials of idiosyncratic and potentially communicative response (reach, clap, and tantrums) and AAC response with (touching a PECS card or verbal approximations) across three contexts: ***Food/drink*** (panel 1: idiosyncratic =

leading: AAC = PECS “food” and “drink” and verbal approximations of either word or a related word (e.g., “juice”) ***Toy*** (panel 2: idiosyncratic = leading: AAC = PECS “Playdoh” and “bubbles” and verbal approximations of either word or related word (e.g., “blow”), and ***Demand/break*** (panel 3: idiosyncratic = tantrums: AAC = PECS “all done” or verbal approximation of word).

Sidney. Sidney's pre-intervention assessment data are displayed in the SDA in Figure 9; intervention data are displayed in Figure 10

Sidney SDA (Figure 9). Sidney's father (day 1) and mother (day 2) conducted the SDA, which occurred across 2 days and consisted of 11 sessions across 4 contexts. In the SDA, Sidney engaged in multiple topographies of idiosyncratic responses across contexts. The rate of overall idiosyncratic responding across contexts were: (1) *restricted access to snack in living room* (*snack in LR*: *M* = 8.6), (2) *restricted access to food in the high chair* (*food in HC*: *M* = 4.4), (3) *free play* (*M* = 2), and (4) *diverted parental attention* (*parental attention*: *M* = 1.9). Vocalizations were observed across all contexts at a high rate (*M* = 2.6 per context). Therefore, due to the likelihood that vocalizations may not have been socially mediated, the data were re-examined with the removal of vocalizations from the total. Without vocalizations, the rate of idiosyncratic responding were as follows across contexts: (1) *snack in LR* (*M* = 5.4), (2) *food in HC* (*M* = 2), (3) *parental attention* (*M* = 1.4), and (4) *free play* (*M* = .4). Reaching was the most common idiosyncratic topography in *snack in LR* (*M* = 1.6). Hit/tap items (the high chair tray) were the most common idiosyncratic topographies during *food in HC* (*M* = 2.5). Approach parent was the most common idiosyncratic topography in the *parental attention* context (*M* = 1.4).

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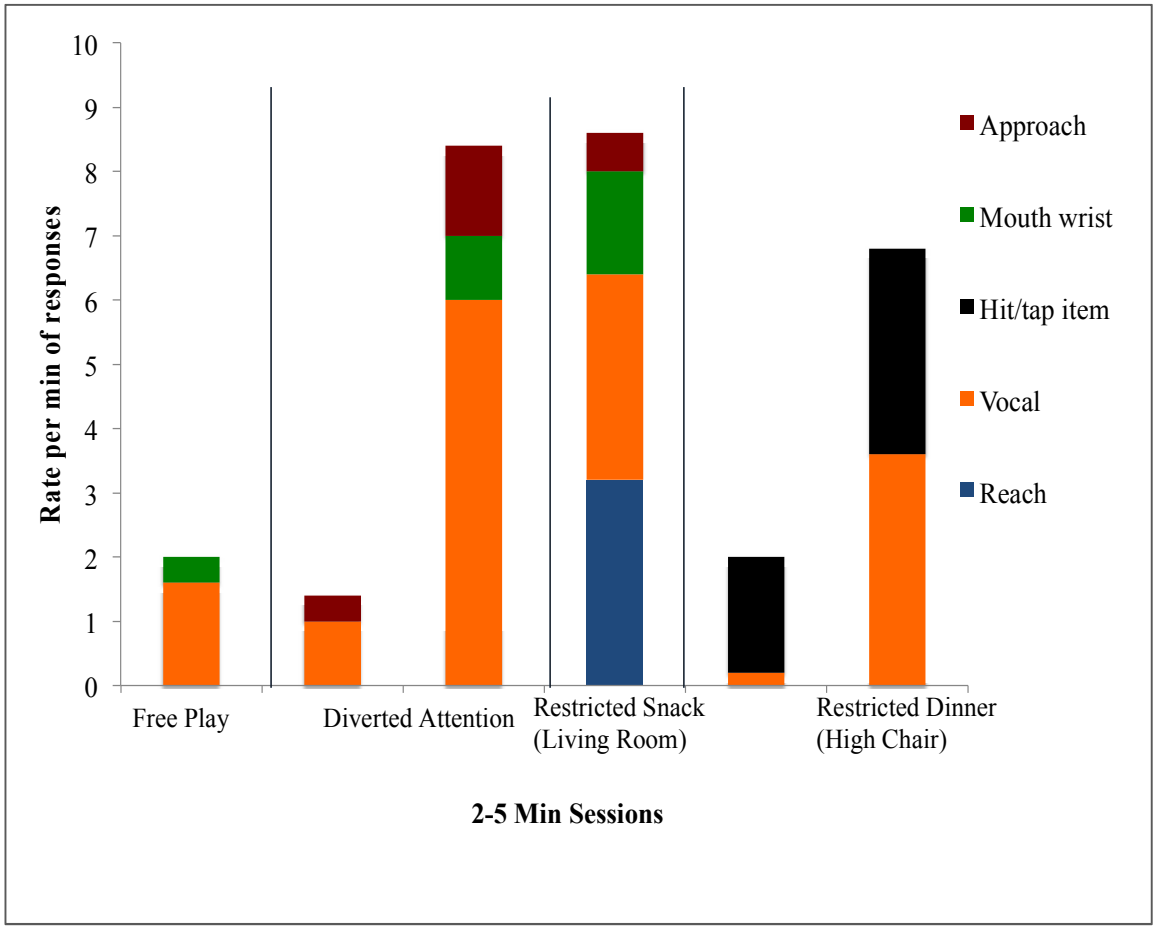

Figure 9. Results of Sidney's structured descriptive assessment (SDA) across idiosyncratic response topographies across contexts of free play, diverted parental attention, restricted access to tangibles (food in living room area and food in high chair during dinner). Data are depicted in non-sequential order, by condition, to aid in visual analysis of response topographies occurring in each condition type.

Sidney parent-implemented FCT across contexts (Figure 10). Based on the SDA results, the three communicative contexts selected for Sidney were (1) *access to food in high chair (Food in HC*: top panel), (2) *snack in the living room* (*Snack in LR*: middle panel), and (3) *parental attention* (bottom panel). Sidney's AAC requests consisted of pressing the microswitch for access to "more" (food, snack, or parental attention) across the three contexts.

Food in HC (top panel). During initial Baseline, both idiosyncratic responses and AAC requests occurred; however, idiosyncratic responses consistently occurred at a higher level. Upon instatement of FCT in *Food in HC* context, there was immediate and consistent elevation of AAC requests. Increase in AAC requests occurred at a higher rate than the baseline level (= 100%). There was a simultaneous immediate and sustained decrease in trend and level of the rate idiosyncratic responses (NAP = 1.0). No overlap occurred between AAC and idiosyncratic responding for any of the 8 intervention sessions.

A reversal to Baseline was implemented in sessions 12 through 16. AAC requests immediately decreased and consistently occurred at a lower level than idiosyncratic responses. No overlap occurred between the AAC and idiosyncratic responses for any of the 5 reversal sessions. Upon reinstatement of FCT in the final phase, the idiosyncratic responses immediately decreased in level of occurrences (from 12 to 0; NAP = .80) while AAC responses remained elevated with no overlap between the data paths (NAP = 1.0).

Snack in LR (middle panel). During Baseline, idiosyncratic responses consistently occurred at a higher level than AAC requests. Upon staggered introduction of FCT, idiosyncratic responses dropped to zero or near zero for the remainder of the sessions (NAP = 1.0). Beginning in the second intervention session, AAC requests increased in trend and level (NAP = 1.0). There was differentiation between the idiosyncratic responses and AAC requests beginning in the second intervention session and lasting throughout the remainder of the phase.

Parental attention (bottom panel). During Baseline, idiosyncratic responses occurred at an elevated and variable level; AAC requests were between 1 and zero levels. Upon staggered introduction of FCT, idiosyncratic responses immediately began a decreasing trend and remained at lower levels than baseline (NAP = .80). The AAC request slightly increased in trend and level and remained at a higher level than it occurred during baseline and a higher (although variable) level than the idiosyncratic responses (NAP = .98). Given the variability in both data paths, there was stable, albeit slight, differentiation between the two responses.

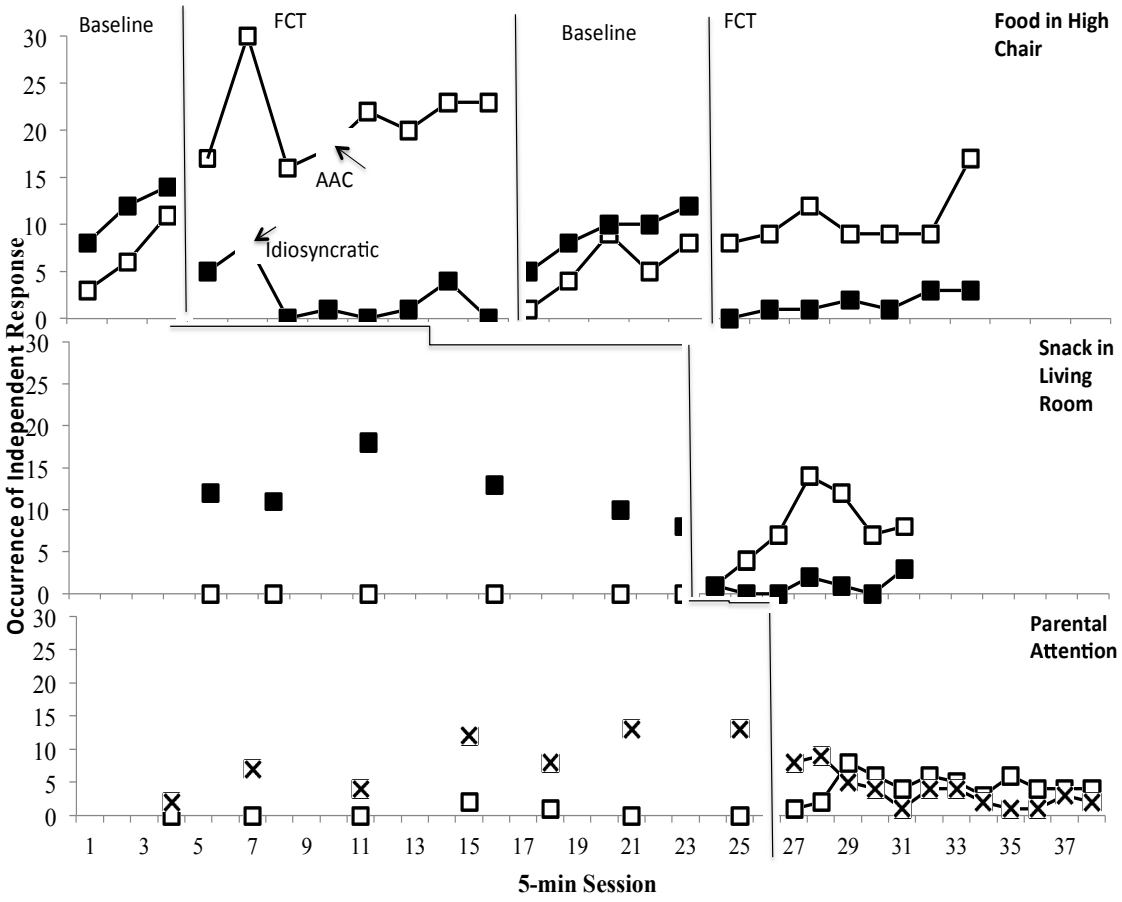

Figure 10. Sidney MPD. Occurrences of idiosyncratic and potentially communicative response (hit hand on high chair tray, reach, and approach) and AAC response (press a microswitch) across three contexts: ***Food in high chair context*** (panel 1: idiosyncratic = hit high chair tray: AAC = microswitch "more") ***Snack in living room context*** (panel 2:

idiosyncratic = reach: AAC = microswitch "more"), and ***Parental attention context*** (panel 3: idiosyncratic = approach parent: AAC = microswitch "more").

Combined overall effect sizes

The combined overall effect sizes for Ella, Lily, and Sidney were calculated with the median score from the four adjacent comparisons of FCT on the primary dependent variables of idiosyncratic responses and AAC requests within each participants' design (see Table 6). The combined overall effect sizes of FCT were as follows: (1) Ella (AAC; NAP = .90; idiosyncratic; NAP = .80), (2) Lily (AAC; NAP = .86; idiosyncratic; NAP = .83), and Sidney (AAC; NAP = .99.5; idiosyncratic; NAP = .90). From the visual analyses and NAP scores it is clear there was little overlap between Baseline and FCT conditions for idiosyncratic and AAC responses. All three of the participants acquired the AAC requests across all targeted contexts, as evidenced by increased trend and level in AAC requests and simultaneous reductions in idiosyncratic responses during FCT.

Table 6. Non-overlap of all pairs (NAP; Parker & Vannest, 2009)

Participant, Context	NAP	Interpretation of effects	Participant, Context	NAP	Interpretation of effects	Participant, Context	NAP	Interpretation of effects
Emma			**Lily**			**Sidney**		
Snack/drink			**Food/drink**			**Food in HC**		
Initial AB			***Initial AB***			***Initial AB***		
Idiosyncratic	.65	Weak	Idiosyncratic	.96	Large/strong	Idiosyncratic	1.00	Large/strong
AAC (PECS/Verbal)	.98	Large/strong	AAC (PECS/Verbal)	.96	Large/strong	AAC (switch)	1.00	Large/strong
Reversal AB			***Reversal AB***			***Reversal AB***		
Idiosyncratic	1.00	Large/strong	Idiosyncratic	.44	Weak	Idiosyncratic	.80	Medium
AAC (PECS/Verbal)	.65	Weak	AAC (PECS/Verbal)	.89	Medium	AAC (switch)	1.00	Large/strong
Video			**Toys**			**Snack in LR**		
Idiosyncratic	.84	Medium	Idiosyncratic	.98	Large/strong	Idiosyncratic	1.00	Large/strong
AAC (PECS)	.97	Large/strong	AAC	.92	Medium	AAC (switch)	1.00	Large/strong
All done			**All done**			**Parental attention**		
Idiosyncratic	.71	Medium	Idiosyncratic	.92	Medium	Idiosyncratic	.80	Medium
AAC (PECS)	1.00	Large/strong	AAC (PECS/Verbal)	.68	Weak	AAC (switch)	.98	Large/strong
Combined overall effects								
Emma			**Lily**			**Sidney**		
Idiosyncratic	.77.5	Medium	Idiosyncratic	.94	Large/strong	Idiosyncratic	.90	Medium
AAC (PECS/Verbal)	.97.5	Large/strong	AAC (PECS/Verbal)	.90.5	Medium	AAC (switch)	1.00	Large/strong

+Effect size interpretation of magnitude based on the (tentative) recommendations of Parker and Vannest (0-.65 weak effects; .66-.92 medium effects; .93-1.0 large/strong effects; Parker & Vannest, 2009).
Combined overall effects calculated by calculating the median of the NAP effect sizes of each dependent variable (idiosyncratic responding and AAC responding) across the four pairwise comparisons.

Indices of happiness (IOH) and High quality play (HQP)

The results for the secondary questions of collateral effects of FCT on the participants' levels of indices of happiness (IOH) and parental use of high quality play (HQP) are displayed in figures 11-13. IOH and HQP were measured from videos of initial Baseline and FCT conditions. IOH and HQP were not measured in the reversal and return to FCT phases. The rationale for excluding the reversal and reinstatement conditions was that these conditions were used for strengthening experimental investigation of the primary research questions and did not serve a purpose in clinical applications of FCT. Moreover, effects from procedures in the reversal may have impacted IOH and HQP in ways that would not have been observed if FCT were implemented as a clinical service (e.g., particularly considering parents were coached in extinction of the acquired AAC requests). IOH and HQP data were missing from a small number of sessions where video quality did not allow for coding IOH and HQP (e.g., if sound recorded poorly). Missed sessions were intentionally left as gaps on the figures.

Ella IOH and HQP (Figure 11). There were no notable differences in levels of IOH for Ella between Baseline and FCT across the *snack/drink* or *all done* contexts. Slightly increasing IOH was observed between Baseline (Mdn 20%; range, 5 to 44%) and FCT (Mdn 47%; range, 15 to 92%) in the *video* context.

Increases in percentage of intervals of HQP were observed across the three intervention contexts with Ella's parent. A difference in level of HQP were observed during Baseline and FCT for all three contexts as follows: (1) *snack/drink* (Baseline; Mdn 40; range, 23 to 51; FCT; Mdn 75; range, 34 to 90), (2) *video* (Baseline; Mdn 43; range,

27 to 72; FCT; Mdn 68; range, 47 to 81), (3) *all done* (Baseline; Mdn 55; range, 28 to 70; FCT; Mdn 71; range, 58 to 80).

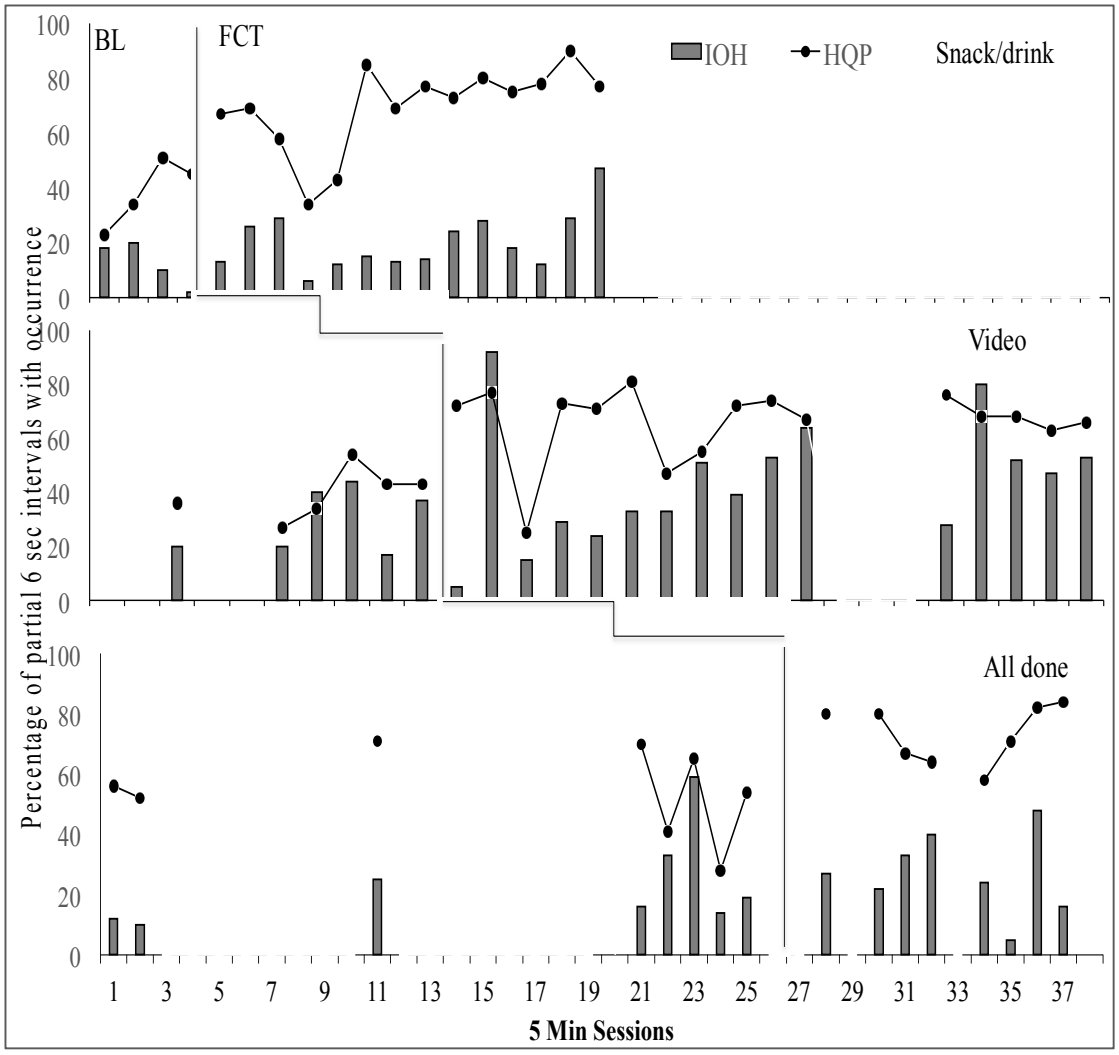

Figure 11. Ella. Percentage of 6-sec partial interval occurrences of indices of happiness responses (IOH) for Ella and use of high quality play (HQP) responses of Ella's parent. Collateral changes in IOH and HQP were measured across Baseline (BL) and Functional Communication Training (FCT) contexts of ***Snack/drink*** (panel 1), ***Video*** (panel 2), and ***All done*** (panel 3).

Lily IOH and HQP (Figure 12). Lily's IOH and HQP data were coded during time-based sessions of initial Baseline and FCT, which varied from measures of the primary questions for Lily, which were trial-based. The rationale for this variation was to

allow for coding to occur during times of the session that were not captured in Lily's trial-based sessions (e.g., time spent transitioning to the high chair during snack/drink). There were no notable differences in trend or level of IOH for Lily between Baseline and FCT across the *food/drink* (top panel) context. A slight overall level increases in IOH was observed across the other two intervention contexts as follows: (1) Toys (Baseline; Mdn 32%; range, 12 to 57%, FCT; Mdn 41%; range, 11 to 90%), (2) All done (Baseline; Mdn 13%; range, 9 to 21%; FCT; Mdn 29%; range, 7 to 72%).

There were no notable changes in trend or level of percentage of intervals of HQP with Lily's parent observed between Baseline and FCT for any of the three contexts.

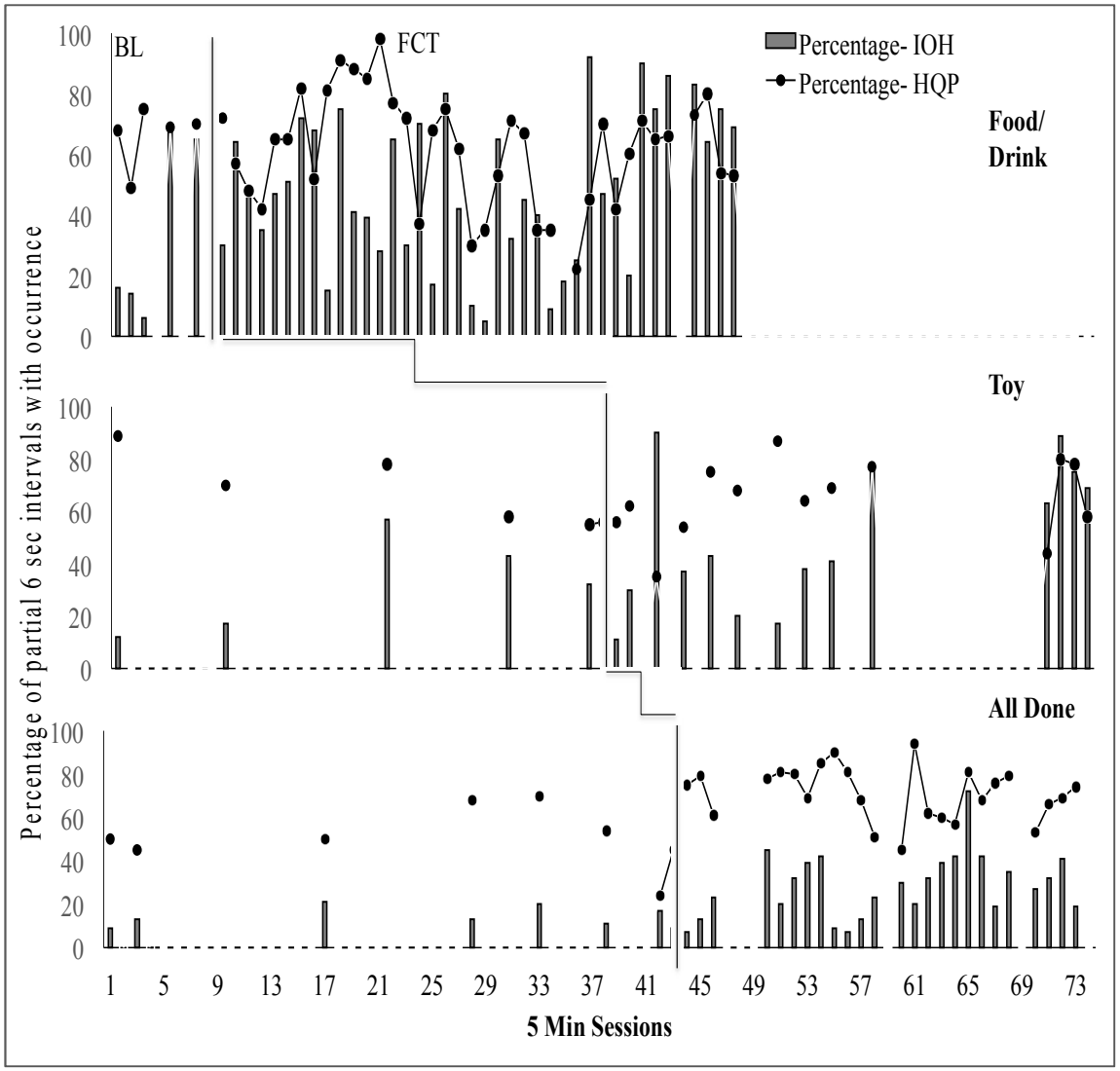

Figure 12. Lily. Percentage of 6-sec partial interval occurrences of indices of happiness responses (IOH) for Lily and use of high quality play (HQP) responses of Lily's parent. Collateral changes in IOH and HQP were measured across Baseline (BL) and Functional Communication Training (FCT) contexts of ***Food/drink*** (panel 1), ***Toy*** (panel 2), and ***All done*** (panel 3).

Sidney IOH and HQP (Figure 13). There were no notable differences in trend, level, or variability of either IOH with Sidney or HQP with Sidney's parent between Baseline and FCT across the *three intervention contexts (Food in HC*: top panel; *Snack in LR*: middle panel; and *Parental Attention*: bottom panel).

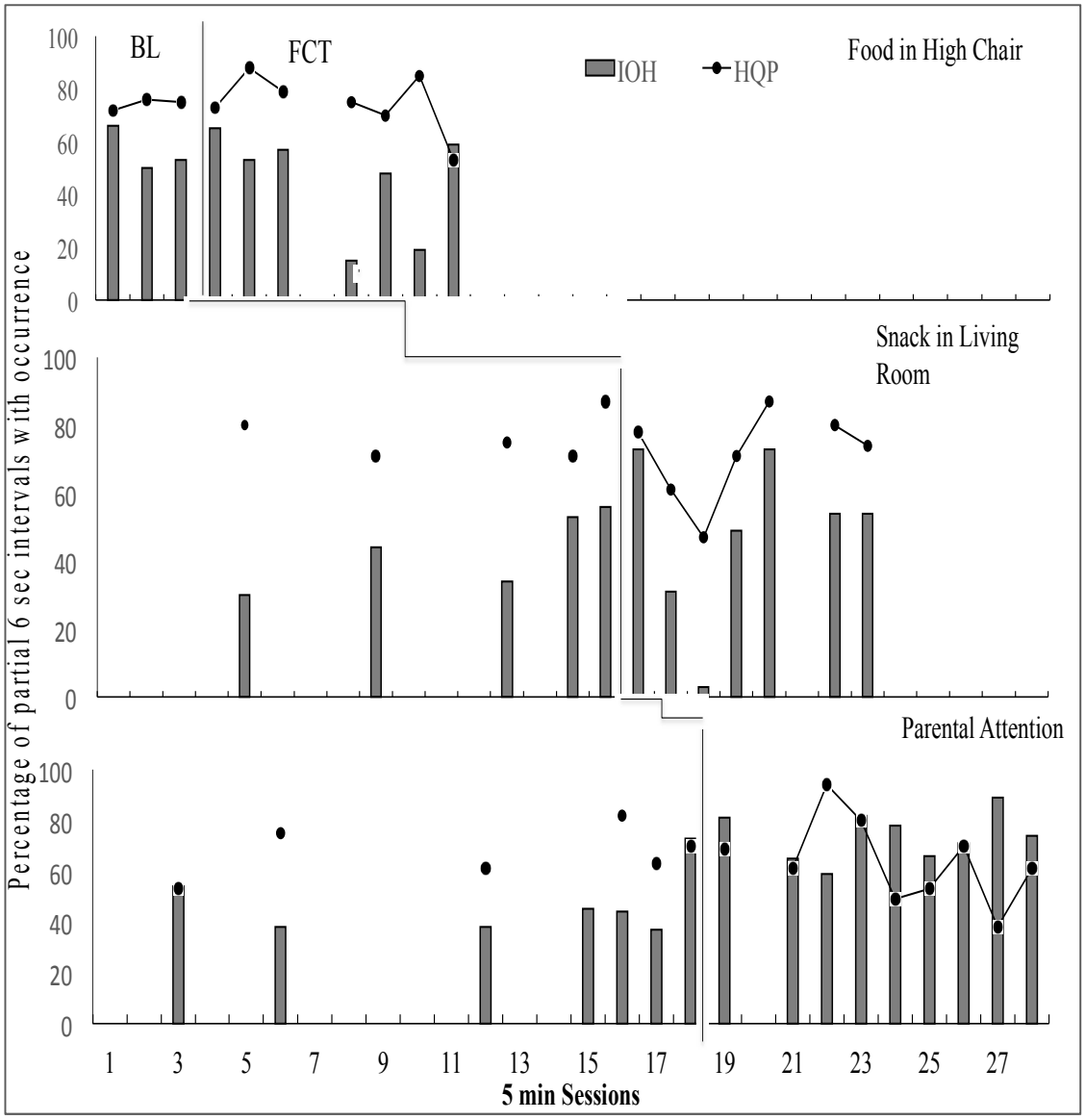

Figure 13. Sidney. Percentage of 6-sec partial interval occurrences of indices of happiness responses (IOH) for Sidney and use of high quality play (HQP) responses of Sidney's parent. Collateral changes in IOH and HQP were measured across Baseline and FCT of ***Food in high chair*** (panel 1), ***Snack*** (panel 2), and ***Parental attention*** (panel 3).

Parent ratings of treatment acceptability

For all participants, parents' rated overall treatment acceptability as 'highly acceptable' on the Treatment Acceptability Rating Form-Revised (TARF-R; Reimers & Wacker, 1988; Wacker et al., 2013) with an average score of 6.91 (range, 6.88 to 6.95).

Specifically, Ella's parents rated acceptability as an average of 6.95 (range on items, 6 to 7); Lily's parent rated acceptability as an average of 6.88 (range on items, 5 to 7); and Sidney's parent rated acceptability as 6.9 (range on items, 6 to 7). Parents' ratings of acceptability on items directly related to improvement in challenging behavior and/or communication (items 4, 7, 10, 18, 21) was an average of 7 or 'highly acceptable.'

Chapter 5

DISCUSSION

Primary research question

The current study examined the extent to which three young children with severe neurodevelopmental disabilities acquired AAC responses during parent-implemented FCT embedded across three contexts in which the children were previously displaying idiosyncratic and potentially communicative responses. Telehealth technology was used to coach parents live in implementation of assessment and intervention conditions. During functional assessment (Ella, Lily, & Sidney) and functional analysis (Ella & Lily) conditions, three contexts were easily identified in which the participants were displaying idiosyncratic responses. During baseline conditions, the identified idiosyncratic responses were differentially reinforced and occurred at higher levels than the AAC responses for all participants across all contexts. In subsequent FCT intervention phases, when reinforcement was delivered contingent on the AAC responses and withheld for the idiosyncratic responses, AAC responses were established or strengthened for all participants across all contexts. These results are among the first to demonstrate functional relations between idiosyncratic responses and maintaining reinforcers during FCT across multiple requests and contexts. Specifically, the AAC responses increased and the idiosyncratic responses decreased when differential reinforcement was applied to the AAC responses; this effect was demonstrated for all participants. Furthermore, all of the participants acquired the AAC responses as a result of the FCT intervention. This is a

promising finding, as all of the participants had no or few previous formal (i.e., verbal or AAC) communication responses in their repertoires.

In the functional assessment condition, the purpose of the SDA and FAI were to identify idiosyncratic responses and the corresponding communicative contexts/routines. For each participant, the SDA assessments were successful at both identifying forms of idiosyncratic and potentially communicative responses and identifying contexts with higher and lower idiosyncratic responding. In addition, the SDA provided a direct observational view of the family's naturally occurring routines (e.g., how the family executed snack time). With this information we embedded FCT into analog conditions that closely resembled the family and the child's naturally occurring routines.

The purpose of the FA was to identify the maintaining social reinforcers for challenging behavior when it was a response within the idiosyncratic repertoire (Ella and Lily). During the FA conditions, social functions were identified that maintained the challenging behavior topographies. For both participants, primarily escape functions were identified (with some elevation in tangible conditions, as well). Thus, during FCT, escape was targeted in the "all done" context (tangible contexts were addressed but focused on other idiosyncratic topographies that had the highest level of responding during the SDA).

Given that challenging behavior was a concern to the families and suppression of the challenging behavior was an important component of the intervention for two participants, the FA increased the likelihood that contexts would be selected that were functionally related to the challenging behavior typographies. For the contexts related to

idiosyncratic responses that were not challenging in nature (e.g., leading parent, reaching for items), the social reinforcers were also empirically validated through the adapted multiple probe design. However, with idiosyncratic responses, we were interested in less suppression of the responses for two reasons. One, few of the idiosyncratic responses were undesirable. Two, idiosyncratic responses remaining in the participants' repertoire may have provided the basis for increasing an existing repertoire of communicative responses for the social reinforcers in that context. It is possible that maintaining the idiosyncratic responses at a reduced, yet still present, level while the AAC response was acquired would allow the participant to attempt a number of different responses if the AAC response were exposed to extinction. For example, if the microswitch was not available at mealtime the participant could resort to leading her parent to the refrigerator. Though beyond the scope of this study, future research should investigate whether this layering of an AAC response into a pre-existing idiosyncratic communication repertoire would have a preventative nature to challenging behavior.

Secondary research questions

Collateral changes in indices of happiness (IOH) and high quality play (HQP). Overall, mixed and weak effects were obtained in changes to IOH and HQP for the participants and their parents. Improvement in IOH during intervention occurred in only a few contexts for two of the participants (Ella and Lily). Likewise, improvement in parental use of HQP occurred across all contexts for Ella, but did not occur for Lily or Sidney.

These results may be attributed to several reasons. First, individual operationalizing of IOH and HQP has not been validated in previous research in the manner that it was conducted in this study (e.g., Green & Reid, 1996). It is plausible that the operationalization of these two variables was done in a manner that did not capture the phenomena of participant 'happiness' or parent use of responsive play as well as previously validated procedures. For example, anecdotal changes in the participant's affect during sessions were reported by parents and observed by the telehealth coaches. Examples of this included increases in the participants' tolerance to being seated at the table and to engaging in non-preferred activities (Ella and Lily) and tolerance to a parent being in close proximity (Lily). An increase in verbal utterances by Ella and Lily was also observed during the intervention phase of the study. However, although all of these examples would fulfill the operationalized definitions of IOH used in the study, none of these changes were clearly captured, with only weak effects, if any, for both participants. By contrast, Sidney anecdotally appeared equally as 'happy' in both baseline and intervention phases of the study. The findings of 'no changes' in IOH for Sidney were likely an accurate reflection of her affect remaining stable across baseline and intervention phases. However, this raises the important question, 'if there were changes in affect observed for Ella and Lily, why were these changes not captured in the data collection?'

The operational definitions of IOH in the current study included multiple response topographies (e.g., smiling, physical closeness, verbalizations). The inclusiveness of the definitions may have masked the sensitivity of the measures. Previous research has

demonstrated improvement in IOH, defined only as changes in facial affect such as smiling, when preferred activities were provided to three adult participants with severe to profound disabilities (Green & Reid, 1996). Perhaps, in the current study, if IOH was restricted to *only* measuring affect, or if the topographies were measured separately (thus, separating affect, verbalizations, and physical closeness) the effects, if any, may have been easier to detect.

The conflicting findings between Green and Reid (1996) and the current study may also be attributed to the difference in participant characteristics (adults vs children). Moreover, Green and Reid (1996) focused on IOH as a primary dependent measure and implemented an intervention consisting of preferred activities with the intent to improve IOH. In the current study, IOH (and HQP) were investigated only as collateral variables. Therefore, the intervention components inherent to FCT involved components that may have been, at least temporarily, non-preferred activities for the children. Examples of these necessary FCT intervention components included (1) prompting (e.g., such as physical prompts) the child to use unfamiliar communication responses, (2) temporarily withholding preferred tangibles or parental attention, and (3) repeated exposure to a non-preferred demand (for Ella and Lily). It is possible that due to these temporarily less preferred components of the intervention, IOH did not change initially but may change over time as the children are routinely using the new communication responses. However, whether these effects would occur is speculative.

Likewise, previous research has demonstrated effects on parent responsivity during parent-implemented early communication intervention (e.g., Yoder & Warren,

1998; 2002). However, there are important differences between the previous investigations and the current investigation. Typically, previous investigations have examined parent responsivity on a more *micro* level, examining only measures that were closely related to the intervention being implemented by the parents. For example, Fey, Warren, Fairchild, Sokol, and Yoder (2006) investigated child and parent outcomes using Responsivity Education/Prelingusitic Milleu Language Training (RE/PMT) that was embedded into child routines. In their investigation, parent responsivity measures were defined as parents engaging in a practice of recoding (i.e., the parent verbally responding to the child's prelingusitic response by identifying the referent in the environment and the communication function). Limiting parent responsivity to recoding closely mapped the dependent measure to the parent behaviors the researchers expected to see changes in during the RE/PMT intervention. The current investigation could have been improved by restricting measurement of parental responsivity to the parents' use of contingent reinforcement or to parents' verbal language towards their child rather than combining multiple parent behaviors into one measure.

Unfortunately, the nature of the research design did not allow for analysis of the distal impact of FCT intervention on the participants' quality of life or on the parents' responsivity. However, it is likely that gaining communication skills and interacting in a more engaged manner with parents may lead to richer play (e.g., HQP) and higher quality of life (e.g., IOH) over time. Keen, Couzens, Muspratt and Roger (2009) found that parental stress and feelings of self-efficacy were improved for parents with young children with ASD when they were provided with parent-training that involved

intervention embedded into family routines. Importantly, greater improvement on these stress and self-efficacy was found with parents who participated in a workshop and home visits than parents who completed a self-directed video training. The impact of interventions delivered via telehealth on parent and child outcomes related to quality of life and parent responsivity are unknown. Future research should investigate parent-implemented FCT on measures of both quality of life and parental responsivity using methodology better suited to distal or more latent effects.

Treatment acceptability and parent fidelity. Parents rated the intervention overall as 'highly acceptable.' Consistent with previous investigations (Suess et al., 2014; Wacker et al., 1998, 2011), parents scored parent-implemented FCT as overall 'highly acceptable' treatment on the TARF-R (Reimers & Wacker, 1988). In addition, parents scored all items as 'highly acceptable' related to the feasibility of the intervention for their family and the perceived effectiveness of the intervention on their child's challenging behavior and/or communication.

Parents implemented the interventions with an acceptable and high level of fidelity while being coached on steps via telehealth. These results are consistent with previous findings that parents can conduct FCT with acceptable levels of fidelity, when delivered in-home with interventionists in person (Moes & Frea, 2002), in-clinic with interventionists via telehealth (Wacker, 2013b), and in-home with interventionists via telehealth (Suess et al., 2014). In the current investigation, the effects of this intervention on parental adherence (i.e., how parents would implement intervention steps without being monitored) to treatment are unknown, as we do not have data on implementation

outside of live coaching sessions. Previous findings have linked parent training to maintenance of treatment gains (Koegel, Schreibman, Britten, Burke, & O'Neill, 1982). Parents also rate routines-based FCT as having a greater contextual fit to their lives than traditional FCT (Moes & Frea, 2002). Future investigations should include adherence and maintenance factors.

Parents in the current investigation were provided with a training model that included several key practices of parent-training for early intervention (Barton and Fettig, 2013), which may have been related to both efficacy of the intervention and parent fidelity. Consistent with Suess and colleagues (2014), parents were provided with live coaching. Coaching encompassed both modeling of procedures and performance-based feedback. For example, when parents were required to prompt a response, the coach would model the prompting technique with identical AAC materials via telehealth. Likewise, when parents implemented the intervention steps, coaches would provide live feedback either reinforcing that a step was conducted correctly (e.g., "that was perfect") or correcting a step that was done incorrectly (e.g., "next time let's wait to give her the snack").

Another important training practice that may have contributed to efficacy and fidelity was that parents were provided with a high number of opportunities to practice. Intervention days occurred for between six to ten weeks, two to five days per week, with multiple sessions per day, and multiple opportunities (i.e., trials) per session. Parents received live instructions and feedback throughout each opportunity. Treatment intensity as defined by Warren, Fey, and Yoder (2007) breaks the delivery of treatment into

multiple factors, including: (1) the distribution of intervention episodes (massed or distributed), (2) the length of the intervention sessions, (3) the setting of the intervention sessions, (4) frequency of intervention sessions per week, and (5) total duration of the intervention. In the current investigation, the parents received massed intervention episodes of training, with relatively shorter sessions (often less than an hour) and higher numbers of sessions per week than would likely occur in a clinic or workshop-based setting.

Likewise, the children received what may be considered a moderate level of treatment intensity. In comparison to comprehensive models of early intervention (e.g., early and intensive behavioral intervention; Eldevik et al., 2009), the current investigation would likely be described as a low dose (lower length, lower frequency, and lower total duration of intervention). However, in comparison to other studies on FCT (e.g., Suess et al., 2014; Wacker et al., 2011), the current investigation would likely be considered moderate to high dose (lower length, higher frequency, higher overall duration). A potential advantage of telehealth was that it allowed for intervention to be delivered for shorter intervention lengths and an increased frequency of sessions per week. This may have been advantageous particularly for the young age of the participants. In comparison, due to travel and scheduling constrictions, many other clinic or home-based FCT interventions are conducted once per week with longer session lengths. The participants in the current study resided a range of approximately 40 to 92 miles round-trip from the University of Minnesota. If parents or interventionists had been required to travel, multiple sessions per week would not likely have been feasible.

Finally, perhaps the most unique aspect of parent training in the current investigation was embedding FCT into routines. Interventions were likely easier for parents to implement, as they reflected their natural routines. For example, the *food* contexts with all of the participants occurred in the individualized manner reflecting the natural routine of that child's family. The parent and child were at the table with the normal foods the child preferred to eat. Children were in their high chairs and infant siblings were often given a snack at the same time, while in their highchairs. This routine was relatively easy for the parent to conduct and the addition of FCT involved minimal steps (prompting, prompt fading, and reinforcement of the AAC response). These results support the nascent literature on FCT embedded into family routine (Derby et al., 1997; Moes & Frea, 2002; Tait et al., 2004). Applying evidence-based interventions into practices that increase feasibility are an important area of continued research. Routines-based and family-centered interventions are key foundations in best practice in early intervention (IDEA, 2004; NRC, 2001; AAP, 2007; Horn, Lieber, Sandall, Schwartz, & Worley, 2002) and are a requirement of IDEA Parts C (EI; ages birth to 2) and B (ECSE; ages 3 to 5; IDEA; 2004).

Limitations

Limitations to the current investigation are related to generalizability, the high level of participant involvement required, the lack of information on parent demographics, the lack of maintenance data, and the lack of comparison with a non-telehealth control group. First, the three participants were fairly homogenous; all were very close in age (3.5 to 4 years old), all were female, and all had similar communication

repertoires. Ella and Lily were diagnosed with ASD and Sidney was diagnosed with RTT. Sidney had several motor impairments; however, she was relatively early in the regression stages of RTT and retained a stable level of moderate control of her hands and ambulatory skills over the course of the study. It is reasonable to expect that a child or adult with more severe motor impairments (e.g., further into or more affected by regression in RTT) may experience greater difficulty with the AAC responses. Likewise, a parent interventionist may experience greater difficulty with teaching a more complex AAC response (e.g., eye-gaze on a high technology speech generating device).

Second, there was a high level of parental involvement in this study. All of the participating children lived in two-parent households. During many intervention sessions, one parent served as the interventionist as the other parent or another caregiver assisted with siblings. If the parent had to serve as an interventionist without assistance it would have likely made implementing the procedures more challenging, although parents of all three participants did successfully manage both the participant and an infant sibling during several sessions when another caregiver was not available.

Third, there was not further demographic information collected on the parents (e.g., education level, income, cultural or linguistic background) therefore it is unknown if this intervention would have similar effects with parents with differing characteristics. Similar to the limitations of other parent-implemented interventions (e.g., Suess et al., 2014) parents opted-in to this study on a voluntary basis. Therefore, it is reasonable to believe the parents were highly motivated to participate, which may have influenced their

acceptability ratings, fidelity to procedures, and the outcomes experienced by their children.

Forth, the lasting effects of the intervention are unknown, as no maintenance data were collected. However, during the reversal phase of the study, the AAC response was placed on extinction and reinforcement was provided for the idiosyncratic responses. Under this arrangement, the AAC responses persisted for a limited number of sessions for Lily and Ella (7 and 4 sessions, respectively) and did not persist for Sidney (0 sessions). Although this response pattern would be predicted by the FR1 schedule, it is suggestive of how important fidelity to the differential reinforcement schedule would be following intervention. It is also plausible that, for two participants, challenging behavior response forms were inadvertently strengthened when reinforcement was applied to the baseline and reversal phases and when AAC responses were introduced to a response hierarchy that included challenging behavior. These limitations highlight the need for investigation of intervention fading strategies (e.g., thinning the reinforcement schedule, demand fading) during parent-implemented FCT to cultivate maintenance and generalization of intervention effects.

Fifth, the findings related to telehealth are limited to examining it as a component of the parent-implemented intervention package; this was not an investigation of telehealth as an independent variable. The effects of the parent-implemented FCT delivered via telehealth versus a traditional in-person model of FCT are unknown. Although previous studies have not empirically investigated direct comparisons between the two models, similar reductions of challenging behavior have been reported with FA +

FCT delivered in clinic with an interventionist in person (Suess et al., 2014; Wacker et al., 2011) as with an interventionist connected via telehealth (Suess et al., 2014; Wacker et al., 2013a). Furthermore, Lindgren and colleagues (2016) reported similar reductions of challenging behavior in extant data of 107 children with ASD or developmental disabilities from three models of FA + FCT service delivery (in-home, clinic via tehealth, and home via telehealth).

Conclusions

FCT as an early communication intervention. FCT is well established as an effective and robust intervention for improving challenging behavior (Tiger, Hanley, & Bruzek, 2008). The results of the current investigation contribute to the nascent literature on parent-implemented FCT as an efficacious communication intervention to teach early requesting skills (Byiers, Dimian, & Symons, 2014; Falcomata et al., 2013; Tait et al., 2004; Wacker, Harding, Berg, 2008). The findings of the current investigation are promising; all of the participants acquired the AAC responses and a functional relation was identified between the idiosyncratic responses and social reinforcers. Prior to intervention, none of the participants engaged in reliable or formal communication forms. Furthermore, two participants acquired multiple AAC responses across three contexts/routines throughout their day (Ella & Lily) and one participant acquired a generalized AAC response across three contexts/routines throughout her day (Sidney).

The success of the current study builds on the work of Drasgow and colleagues (1996), who indicated that idiosyncratic responses may serve as "behavioral indicators" for where to begin to embed early communication intervention to teach requesting skills

(Drasgow, Halle, Ostrosky, & Harbers, 1996; Keen, Sigafoos, Woodyatt, 2001). The findings are also consistent with Byiers, Dimian, and Symons (2014) in that a functional relation was demonstrated between idiosyncratic responding and maintaining reinforcers. Additionally, these effects were demonstrated across multiple contexts. There were also novel findings from the current investigation of efficacy of FCT as a communication intervention. First, the participants were young children (4 and younger), including a young child with RTT. Second, participants acquired multiple requests (Ella & Lily) across multiple contexts (Ella, Lily, & Sidney). Third, potential idiosyncratic responses and contexts were identified through functional assessment, which included a SDA. Fourth, telehealth was a successful platform to deliver parent coaching in assessment and intervention.

Interestingly, for Ella and Lily, there was often overlap between the idiosyncratic and AAC responses at the beginning of the first phase of differential reinforcement of the AAC response. Several potential reasons for this pattern may be related to the functional equivalence of the effort of the responses. First, the participants were physically capable of producing the AAC response but required initial prompting to engage in the AAC response correctly at the trial onset. Second, intermittent reinforcement schedules can cause the idiosyncratic response to persist. In the current investigation, although the idiosyncratic responses did not produce reinforcement during experimental sessions, those responses did produce reinforcement in the same contexts outside of experimental sessions. In addition, while some idiosyncratic response forms were on extinction in one context (e.g., intervention in the first context), they were reinforced in another context

(e.g., baseline in the second context), possibly making it difficult to immediately discriminate the change in contingencies at the onset of a new phase. Third, functional equivalence is a fundamental principle of FCT intervention. For an alternative behavior (e.g., AAC response) to effectively compete with a response (e.g., idiosyncratic response) the responses should be similar in response effort. In cases where it took several sessions before the idiosyncratic response decreased, it may have been less effortful than the AAC response or it may have become chained with the AAC response (e.g., the participant first attempted the idiosyncratic response prior to the AAC response). Clearly, the idiosyncratic responses had a longer reinforcement history than the AAC responses; therefore one might expect them to persist longer. These speculations point to the need to further examine the findings of the current investigation and whether this approach would be effective for more subtle and more or less effortful response forms (e.g., eye gaze).

In addition to the acquired AAC responses, Ella and Lily both produced collateral increases in verbal responding during the intervention, even though exchanging of a picture card was the response that was initially prompted and differentially reinforced. For Ella, the verbal responding was more modest, in that it occurred only several times throughout the intervention phases and was only for the words “more” and “bye-bye.” For Lily, the verbal responding occurred across all of the intervention phases, and it became the predominant response for the words “food,” “drink,” “playdoh,” “bubbles,” and “blow bubbles.” These exciting findings are consistent with previous studies demonstrating collateral increases in verbal responding during picture card use (Charlop-Christy, Carpenter, Le., LeBlanc, & Kellet, 2002; Ganz & Simpson, 2004).

It should be noted that extinction was implemented in the differential reinforcement arrangement in order to (a) teach the AAC response and (b) examine the functional relation between the idiosyncratic response, the AAC response, and the maintaining reinforcer. It was not necessarily our intent to extinguish the idiosyncratic responses. Rather, intervention goals were to (a) provide the participants with a more formal, easily recognizable communication response that might be more likely to produce reinforcement with unfamiliar caregivers such as babysitters or teachers, (b) provide an alternative response to undesirable behavior (in this case, tantrums and crying/whining) that often produce reinforcement and occasionally occur in the absence of formal, recognizable forms of communication, and (c) to expand the participants' social communication repertoire rather than narrow it to a single response that may not always be available (e.g., when the battery in the microswitch does not work or the PECs card gets left behind when the family goes on an outing). Future research should examine persistence, resurgence, and reinstatement of multiple response forms that have produced the same functional reinforcer under various conditions.

Telehealth coached interventions. The current investigation extends the pioneering work on FA + FCT intervention via telehealth by Wacker and colleagues (2013a; 2013b) by examining FCT as an early communication intervention. There were also novel contributions of the current investigation to the FA + FCT via telehealth literature. A SDA was included in functional assessment to identify potential idiosyncratic responses and contexts to embed communication intervention. Idiosyncratic and AAC responses were observed as dependent measures to investigate the functional

relation between the two when under reinforcement and extinction arrangements, and when a new response was introduced to the participant's repertoire. Most importantly, the current investigation demonstrated evidence of increasing AAC responses across multiple contexts in the child's day during parent-implemented intervention delivered with coaching via telehealth. The embedding of the FCT intervention into natural contexts for the child and family allowed for routines-based intervention. Telehealth helped to accomplish this routines-based purpose. Sessions were planned for naturally occurring times in the day (e.g., dinner time) with less need to contrive situations. Parents also did not need to prepare the home for visitors or to have an interventionist on-site. Examining routines-based communication intervention via telehealth was an important contribution of this study.

Potential implications for future research for telehealth as a service delivery mechanism in early communication interventions may be a reduction in cost and resources. Wacker and colleagues (2013) found a significant cost reduction when delivering FA via telehealth versus a clinician traveling to the family's home. For example, in their study, the average cost per week for delivering the FA via telehealth compared to an interventionist driving to the home was $57.95 (telehealth) compared to $335.09 (clinician traveling to home). In a 2016 cost-benefit analysis, Lindgren, Wacker, Suess and colleagues demonstrated that both models of service delivery that involved remote coaching via telehealth (in the clinic and in children's homes) were significantly less costly than interventionists traveling to family homes to deliver intervention, without a degradation in effectiveness of treatment.

Although only an approximation of costs, if interventionists were required to travel to participant homes in the current study, the cost would have ranged from $23 to $53 in mileage per trip, given the standard mileage rate in 2015 of 57.5 cents per mile, (IRS; retrieved from https://www.irs.gov/credits-deductions/individuals/standard-mileage-rates-glance). Given two to five trips per week ranging in mileage costs of $46 to $265, savings in mileage alone may have ranged from an estimated $276 to $2,385 over the six to ten week intervention periods. These are estimates only and do not take into account costs or savings for interventionist time, clinic space, telehealth equipment, or other related expenses. Future research should conduct cost-benefit analyses of early communication intervention delivered via telehealth versus traditional models of service delivery.

Children and families encounter many barriers to accessing needed early intervention services (Majnemer, Shevell, Rosenbaum, & Abrahamowicz, 2002; Stahmer & Gist, 2001). These experiences are exemplified for families residing outside of major metropolitan areas, with even less access to intervention services (Symon, 2001; Thomas, Ellis, McLaurin, Daniels, & Morrissey, 2007). Parent-implemented FCT would not likely take the place of comprehensive intervention packages for young children with neurodevelopmental disabilities, It may, however, have implications as a supplemental intervention that is used in conjunction with or while families are waiting for more comprehensive interventions.

Finally, future research should examine the conditions under which telehealth can be an effective service delivery mechanism to train and support service providers in rural

areas and to provide intervention and support for children with low incidence disorders (such as RTT). Due to the paucity of research on communication intervention with children with RTT and related complex communication needs, it remains challenging for families to access high quality interventions and providers with expertise with these populations (Horn & Kang, 2012; Sigafoos et al., 2009; Snell, Chen, & Hoover, 2006). One participant in the current investigation had RTT and her parents were easily able to implement the assessment and intervention conditions with coaching. This implementation led to efficacious results for their daughter. These findings have implications for how telehealth may be used as a vital tool to connect with and to train local service providers on interventions for children with low incidence disabilities and complex communication needs.

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Appendix A
STUDY INFORMATION BROCHURE

FAQs

What is the purpose of the studies?
We are interested in examining the effects of behavior assessment and communication training on reduction of challenging behavior and acquisition of communicative behavior for individuals with developmental disabilities and impaired communication.

Where do these studies take place?
Assessment and training of communication is often most beneficial when studies take place in the natural settings of the individual. Therefore, assessment and intervention sessions will take place in homes and other natural settings. If your family lives out of the metro area materials may be mailed to you to set up remote, tele-sessions from your home with University personnel.

What do tele-health sessions look like?
Tele-health sessions use video-conferencing software to connect you in your home remotely with study personnel at the University to receive assessment, observation, and coaching on communication training.

Are there any costs to participating?
There is no cost to participate in any of the studies. All materials will be provided free of charge, and research staff will travel to you or set up telehealth sessions with you.

Are there potential benefits to participating? There may be potential benefits to participating through possible reduction of challenging behavior and/or increase in appropriate or communicative behavior.

Contact us!

To participate, get additional information or ask a question, please contact Jessica Simacek, at

612-626-7653 or
sima0034@umn.edu

University of Minnesota
Department of Educational Psychology

56 E River Pkwy, Room 250
Minneapolis, MN 55418

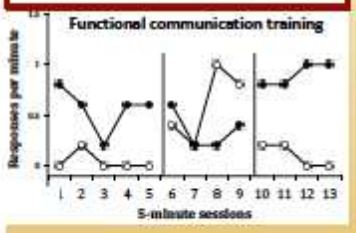
Challenging behavior: Tailoring treatment to communication need

Health and Behavior Studies

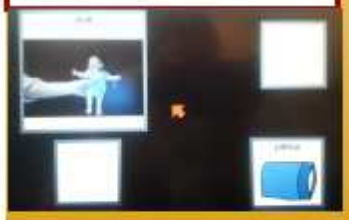
UNIVERSITY OF MINNESOTA
Driven to Discover℠

Study Activity Descriptions

Functional Assessment and Communication Training Sessions



Augmentative and Alternative Communication



Functional assessment and functional communication training: Functional assessment can be used to identify the communicative functions of challenging behaviors, and to develop effective interventions to decrease such behaviors and increase appropriate communication.

Augmentative and Alternative communication (AAC): We are interested in learning how different teaching methods can be used to teach individuals to use pictures or other non-verbal systems to communicate during functional communication training.

Durability of functional communication training and challenging behavior interventions: We are interested in learning how individuals maintain communicative behaviors and decreases in challenging behavior over time, as the intervention is faded. We may ask to follow up with individuals via observation sessions either in person or via telehealth sessions.

Assessment, Observation, Caregiver Coaching and Consultation via Telehealth: Telehealth uses video-conferencing technology to connect University research personnel with individuals in their homes via the Internet. We are interested in the effectiveness of assessment, observation, and coaching parents/care-providers during the functional assessment and functional communication training process via telehealth for individuals outside of the metro area.

Appendix B
INFORMED CONSENT

PARENT/LEGAL GUARDIAN CONSENT FORM
Challenging behavior: Tailoring treatment based on communication needs

Your child/ward is invited to participate in a research study testing the assessment of and treatment of challenging behavior. Your child/ward was selected as a possible participant in the study because a care provider referred you to the study. We ask that you read this form and ask any questions you may have before agreeing to have your child/ward participate in the study.

Jennifer McComas, PhD, professor of Educational Psychology at the University of Minnesota and Frank Symons, PhD, professor of Educational Psychology at the University of Minnesota are conducting this study.

Study Purpose
The purpose of the study is to identify effective and lasting behavioral treatment for challenging behavior (including, self-injury, aggressive, and destructive behavior) of individuals with intellectual and developmental disabilities in their natural environment, that is, in their home or community setting. The goal is to decrease challenging behavior and increase appropriate communication behaviors, and to test different treatment components to see which work well over time and have lasting effects that keep challenging behavior low and keep apporpiate communication behavior occuring once treatment has been stopped.

Another goal of this study is to test the assessment and treatment of challenging behavior for children or adults who live outsie of the metro area through telehealth technology. The use of telehealth technology would connect research staff with parents/care providers through password protected internet and video conferencing.

Study Procedures
If you agree to participate in this study, we would ask you to do the following:

Observations: We would like permission for our research staff to conduct weekly observations of your child/ward to identify any patterns to when challenging behavior occurs, what typically happens before and after challenging behavior, and other factors that appear to influence challenging behavior.

Indirect and Direct Assessment: We will begin by asking you questions in a brief interview about your child/ward's challenging behavior and communication behavior. After the interview, we will talk with you about what types of naturally occurring activities and routines we want to observe and what we will ask you to do during those observations. We will use the information you tell us to complete an assessment of your child/ward's challenging behavior and his or her communication skills. The assessment will involve observation of your child/ward's behavior in a number of different situations and naturally occurring routines to help us look into more detail

about the specific kinds of challenging behavior and the times/places the behavior tends to happen or not happen. We will videotape the observations to allow us to review the observations for the purposes of assessment and treatment planning. Each observation will last between 5 and 15 min we will conduct 3-5 observations per day. The initial assessment is expected to last up to 10 days.

Treatment: After that, we will start a behavioral treatment that is based on the results of the initial assessment and we will observe the effects of the treatment monthly for up to 36 months, during which time we will make any adjustments necessary to improve the lasting effects of the treatment.

It is likely that you (or other care-providers who regularly work with your child/ward) will be the one directly working with your child/ward while we coach you on what to do. The reason for this is that treatments that are designed in the context in which the child/ward engages in challenging behavior often work the best. We will do some 'practice sessions' with you until you are comfortable with the procedures before you do any assessment or treatment sessions with your child. After the initial assessment is complete and we design the treatment with your input and based on the results of the initial assessment, we will teach you and/or other care-providers what to do when your child/ward engages in challenging behavior and to teach your child a new way to communicate appropriately what he or she wants; this may include ways to ask for a break, or for something s/he wants. The communication training is designed to decrease the likelihood that challenging behavior will happen. We will select a communication behavior that is easy for your child to do (this could include a gesture, pointing to a picture, or a vocal response) to use as the communicative behavior to teach your child/ward. We will have practice sessions and give you feedback to increase the chances the treatment you are implementing is effective for both increasing communication skills and at the same time, decreasing challenging behavior. We will also give you a written report of the assessment findings and instructions for treatment.

Teleheath Technology: If you live outside the immediate Twin Cities area, we will primarily work with you remotely with telehealth technology via a password-protected web browser. Telehealth technology will involve equipment that we will provide if you do not have it: (a) laptop computer, (b) Ethernet connection and cables, (c) external web camera, (d) external microphones, (e) videotaping equipment. If we use teleheath technology for your child/ward, we will provide directions and support to assist you.

Risks of Study Participation

The study has the following risks. We anticipate that during sessions, your child/ward will engage in challenging behavior that we are trying to treat. There is a small chance that he /or she, parents and/or care providers will experience an injury as a result of the challenging behavior: this chance should not be greater than it would be if we were not trying to treat the behavior. During this study there is a small risk of loss of privacy. To address this risk we will give your child/ward a number for the study. Your child/ward's information will be linked to this number and stored in a locked, and encrypted database. There will be no identifying information used in any publications from this study. Because assessment and treatment will be conducted in child/ward's home or community settings, or over password protected video conferencing

(telehealth), there is a possibility that the individual or family will feel that their privacy is invaded.

Benefits of Study Participation

There are possible direct benefits to study participation to your child/ward through improvement in challenging behavior and appropriate communicative behavior. There is also the possibility of benefit for parents/care providers through training and knowledge of how to assess and improve challenging behavior and communication for your child/ward and other individuals in the future.

Alternative to Study Participation: The alternative to participating in this study is to decline participation. You can say 'no' to participation in this study. You can also remove your consent to participate at any time.

Study Costs/Compensation
There are no costs to you or your child/ward for participating in this study, and there is no compensation to you or your child/ward as a part of this study.

Research Related Injury: In the event that this research activity results in injury, treatment will be available, including first-aid, emergency treatment, and follow-up care as needed. Care for such injuries will be billed in the ordinary manner, to you or your child/ward's insurance company. If you think your child/ward has suffered a research-related injury let the study researchers know right away.

Confidentiality
The records of this study will be kept private. In any publications or presentations, we will not include any information that will make it possible to identify your child/ward or family as a subject. Your record for the study may, however, be reviewed by departments at the University with appropriate regulatory oversight. Your child/ward's confidentiality will be maintained by keeping all raw data and videos in locked cabinets in a locked office. Electronic data will be stored on a secure database and will only be accessible to project personnel. Your child/ward will be assigned a study number and the identifying information linked to this number will be stored in a secure database. Telehealth technology use may result in data being transmitted via the internet. To protect confidentiality, the study personnel will use password-protected, secured web-browsers. Verification of security patches and updates will be installed within 30 days of the release from the vendor. Data will be stored on university-secured file servers, on university-owned computers. USB and other forms of removable data will be encrypted. Study records may be reviewed by departments and other agencies with regulatory oversight in the institution, and to that end, confidentiality may not be complete.

Protected Health Information

Your child/ward's PHI created or received for the purposes of this study is protected under the federal regulation known as HIPAA. Refer to the attached HIPAA authorization for details concerning the use of this information.

Voluntary Nature of the Study

Participation in this study is voluntary. Choosing not to participate will not affect your relationship with the University of Minnesota. You may withdraw at any time.

Contacts and Questions

Dr. Jennifer McComas is the primary researcher for this study at the University of Minnesota and you may contact her about the study at any time. You may ask questions now, or if you have questions later, you may contact Dr. Jennifer McComas via email at jmccomas@umn.edu .

If you have any questions or concerns regarding the study and would like to talk to someone other than the researcher(s), you are encouraged to contact the Fairview Research Helpline at telephone number 612-672-7692 or toll free at 866-508-6961. You may also contact this office in writing or in person at *Fairview Research Administration, 2344 Energy Park Drive, St. Paul, MN 55108.*

You will be given a copy of this form to keep for your records.

Statement of Consent

I have read the above information. I have asked questions and have received answers. I consent to participate in the study.

Signature of Parent/Legal Guardian_____

Date_____

Signature of Person Obtaining Consent_____

Date_____

Appendix C

HIPPA FORM

HIPAA authorization
IRB Version Date:11.26.2013

HIPAA[1] AUTHORIZATION TO USE AND DISCLOSE
INDIVIDUAL HEALTH INFORMATION FOR RESEARCH PURPOSES
Challenging behavior: Tailoring treatment to communication needs

1. Purpose. As a research participant, I authorize Jennifer McComas, PhD and the researcher's staff to use and disclose my individual health information for the purpose of conducting the research project entitled Challenging behavior: Tailoring treatment to communication needs, IRB# 1404M49782 .

2. Individual Health Information to be Used or Disclosed. My individual health information that may be used or disclosed to conduct this research includes: Demographic information, diagnosis of disability and diagnostic assessment information, information related to current or previous services received related to challenging behavior and/or communication skills, information related to potential other developmental domains of impairment, such as ambulation, fine motor control, sight, or hearing.

3. Parties Who May Disclose My Individual Health Information. The researcher and the researcher's staff may obtain my individual health information from:
Hospitals:
Clinics:
Other Providers:
Health Plan: N/A
and from hospitals, clinics, health care providers and health plans that provide my health care during the study.

4. Parties Who May Receive or Use My Individual Health Information. The individual health information disclosed by parties listed in item 3 and information disclosed by me during the course of the research may be received and used by Jennifer McComas, PhD and the researcher's staff and
.

5. Right to Refuse to Sign this Authorization. I do not have to sign this Authorization. If I decide not to sign the Authorization, I may not be allowed to participate in this study or receive any research related treatment that is provided through the study. However, my decision not

to sign this
authorization will not affect any other treatment, payment, or enrollment in health plans or
eligibility for benefits.
6. Right to Revoke. I can change my mind and withdraw this authorization at any time by sending
a written notice to :
Jennifer McComas, PhD
250 Department of Educational Psychology
University of Minnesota
1 HIPAA is the Health Insurance Portability and Accountability Act of 1996, a federal law related to privacy of health information.
HIPAA authorization
IRB Version date: 11.23.2013 2
56 East River Rd.
Minneapolis, MN 55455 to inform the researcher of my decision. If I withdraw this authorization,
the researcher may only use and disclose the protected health information already collected for this
research study. No further health information about me will be collected by or disclosed to the
researcher for this study.
7. Potential for Re-disclosure. Once my health information is disclosed under this authorization,
there is a potential that it will be re-disclosed outside this study and no longer covered by this
authorization. However, the research team and the University's Institutional Review Board (the
committee that reviews studies to be sure that the rights and safety of study participants are
protected) are very careful to protect your privacy and limit the disclosure of identifying information about you.
7A. Also, there are other laws that may require my individual health information to be disclosed
for public purposes. Examples include potential disclosures if required for mandated reporting
of abuse or neglect, judicial proceedings, health oversight activities and public health measures.
This authorization does not have an expiration date.
I am the research participant or personal representative authorized to act on behalf of the participant.
I have read this information, and I will receive a copy of this authorization form after it is signed.

_____ _____
signature of research participant or research participant's date
personal representative

_____ _____

printed name of research participant or research participant's description of personal representative's authority to act on behalf personal representative of the research participant

Appendix D

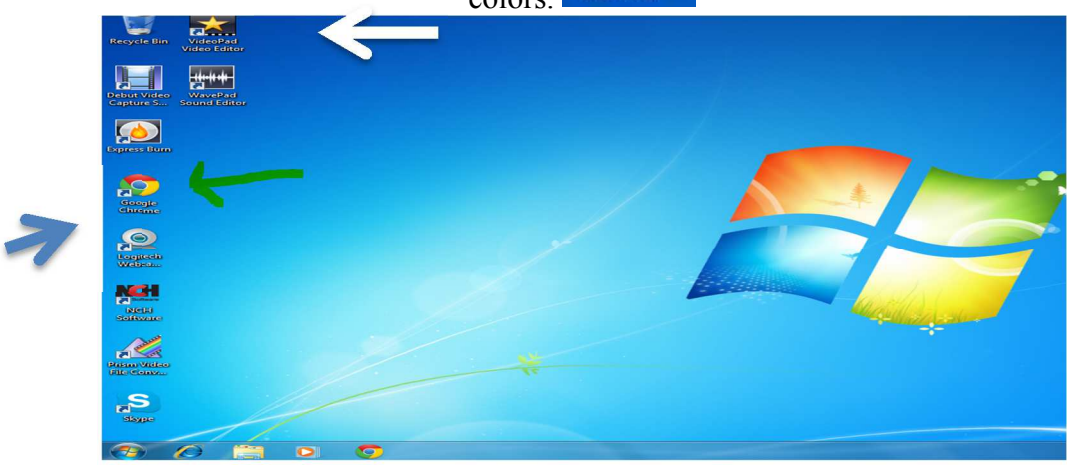
TELEHEALTH SET-UP TASK ANALYSIS

Created by Dimian, A. F. (2014)

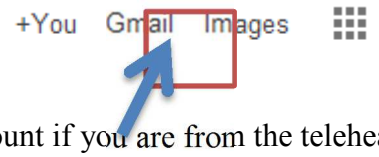
1. Log onto the computer (using your UMN account or if you are on the laptop use the information on the post-it note)

***** Talk to ahead of time****

2. Connect to either an Ethernet or wireless Internet by selecting the icon in the lower right corner on the tool bar that looks like bars. Find the wireless network you will be using if you do not have an Ethernet connection and login.
3. Attach the Logitech web camera to the mini tripod.
4. Plug in the Logitech web camera into the computer's USB port and position the camera so we can see you.
5. Open google chrome by selecting the icon on the desktop that looks like a circle with colors.

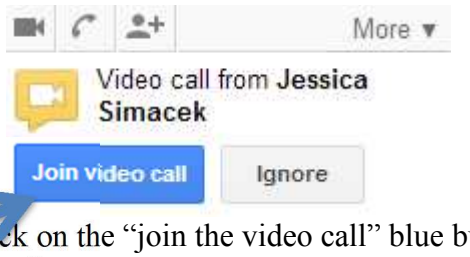


6. Select the gmail option on the upper right part of the screen once chrome opens

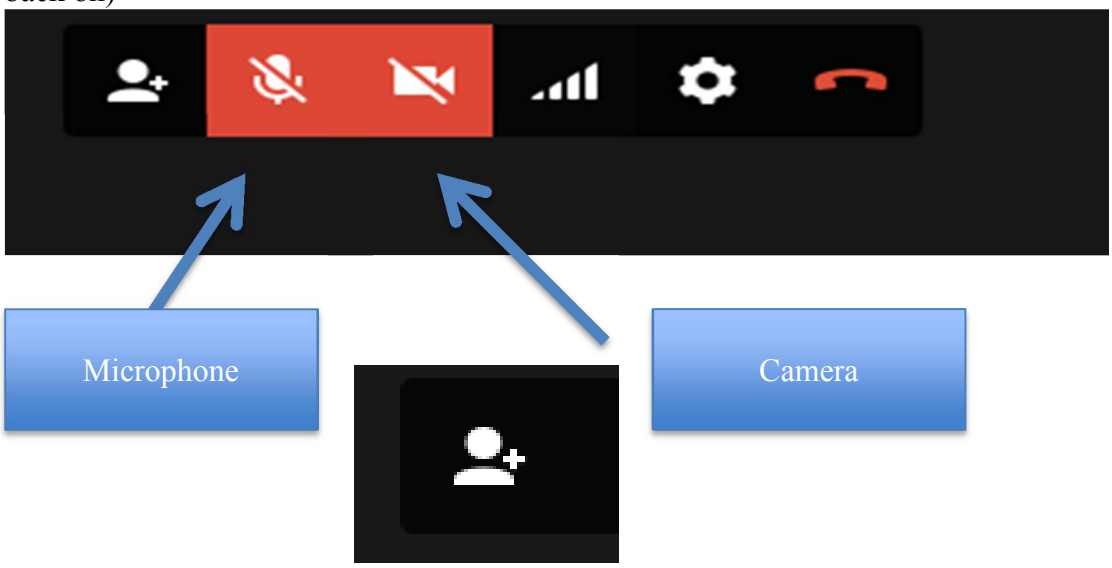


7. Login using your UMN account if you are from the telehealth lab. If you are not use account information given to you by the team. (username & password)
6. Once you get access select mail on the upper right corner if gmail doesn't open automatically.

7. When you are in gmail you should receive an invite to start a google hangout from the team.



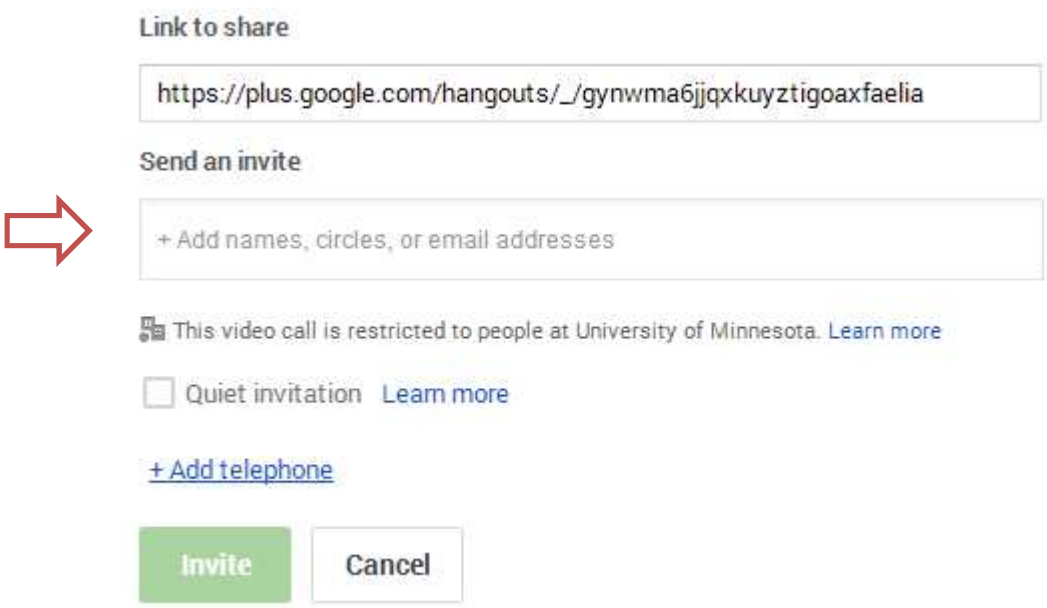
8. To join the video call click on the "join the video call" blue button.
9. Once you join the video call- you will see a large picture of the team across your screen with and a small picture of yourself in the bottom right corner.
10. The team may ask you to check to see if your microphone and camera are on. You can view the microphone and camera in the top of your computer screen: If one or both are highlighted in RED they are muted/turned off (you can click them 1 time to turn back on)



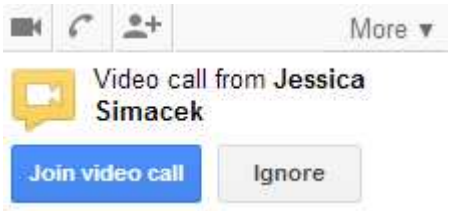
If neither the microphone or camera are highlighted in red they should both be on, however the team may ask you to switch them on and off (by clicking them) as a troubleshoot if needed.

Starting a video chat (Google Hangout)

1. You can start a video chat by selecting the video icon once in gmail on left side of the screen that looks like this 
2. Next you will be prompted to invite people to your video hangout, type in the assigned email account for the case.

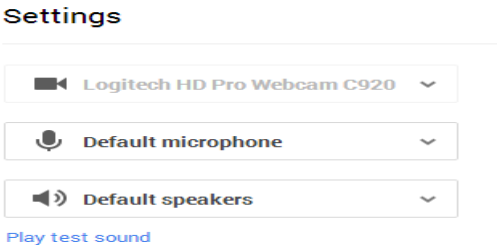


3. The individual receiving the invite will see the following box pop up in gmail:



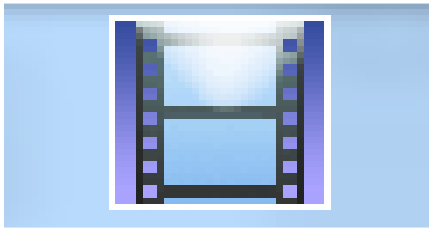
4. Once you are in the hangout, you can change the setting if you need by selecting the white wheel icon next to the red phone (hang up button) on the top of the screen. You should see yourself if your camera is connected at this point.

5. If you need to change the microphone or video setting just select the drop down menus located under settings (the white wagon wheel icon)



6. If you need to adjust the bandwidth because the connection is slow select this icon 
7. Your microphone and camera will be muted if the icons are red like this

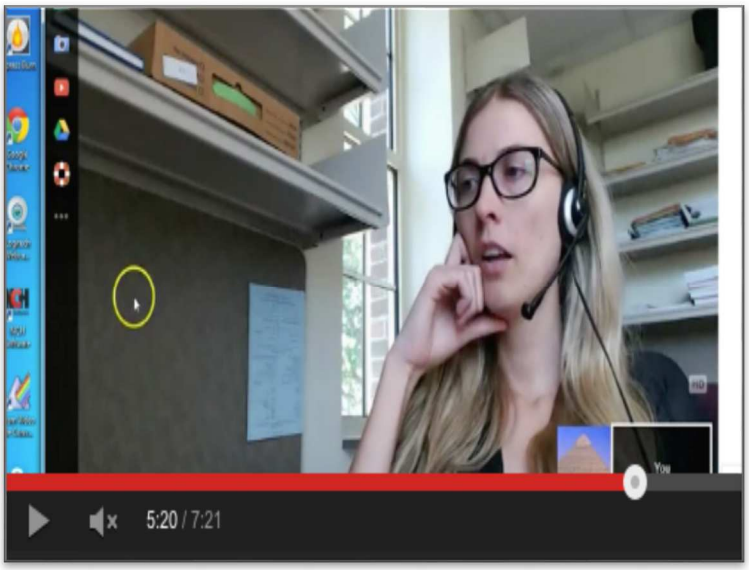
8. If you are recording the session, start debut by selecting the icon on the desktop.



9. Make sure you log out of your account when you are all finished with the session in chrome.

Appendix E

SCREEN SHOT OF TELEHEALTH SET UP VIDEO MODULE PROVIDED TO FAMILIES



Appendix F

TECHNOLOGY AND SAFETY CHECK LAB-END STEPS

1. Call parent and introduce yourself. Discuss the goals of the session.

2. Ask parent if they are at the computer we sent them?
    a. Walk through turning on the computer if it is not on.
    b. Tell them how to log onto computer.
    c. Have them plug in the mouse if they want to use it, if they don't know how to plug it in wait until you have the hang out working.
    d. Now make sure they know how to connect to the internet.

3. Ask parent to open a web browser and try to search something in Google to check that they are online.

4. Ask if they know what web browser you are using?

5. Tell them they are going to stay on the phone until we are connected in Google hangout.

6. Ask them to log into Google/Gmail using the account information assigned to them.

7. Once in Gmail, orient them to the box on the left side and ask them if they see you as a contact in the list.

8. Have them click on your name and once they see the camera icon in the box click it to start a hang out.

9. Once both you and the parent have entered the hang out, hang up the phone if they can hear you over their speakers.

10. Ask if the parent has the camera we sent them plugged in.
    a. If not, ask them if they know how to plug it in. walk through the usb port and plug in.
    b. Once the camera is plugged in it should be blue, if not make sure you open the settings with them to make sure

11. Have the parent open up the settings at the top of the screen in hang out and ask them what camera says is connected. If it is not the Logitech camera, have them select it from the drop down menu.

12. Check what microphone and speakers are selected as well.

13. Explain how you might ask them to use headphones at some parts through out the assessment.

14. Review the mute audio button in the tool bar.

15. Review with them the camera off button in the tool bar and explain that again at times we will turn off our camera so we can just observe them.

16. Have them do a movement test by waving their hands and talking at the same time and then have them move the camera back and forth quickly. If it is choppy show them how to change their bandwidth to medium or ideally low.
    a. Troubleshoot any other audio or camera issues as well.

17. Have them click on their video or picture to show them you can make that one the main window.

18. You can use screen share to walk family through certain steps as well.

19. Visually examine placement of camera and area in the home to work in, check for potential dangers (e.g., sharp, heavy, breakable items nearby) or areas that may provide difficulty (e.g., open space for child to run, easy access to toys, etc)

20. Practice placing camera and computer equipment in the areas you will have them during sessions. Check visibility (can you see enough of the intervention space, is the camera too close? Too far?)

21. Other feasibility concerns? Siblings? Time of day?

Provide caregiver communication instructions for SDA

Information to prep parents prior to meeting:

1. **Give information verbally over the phone (during FAI or during previous session)**

2. **Provide follow-up email with a summary to parents prior to first SDA session**

"For our first assessment procedure, we will observe (child) during several different kinds of activities and situations. We want to see how (child) responds to these situations before we start interventions, this helps us to determine what different ways to further assess and test and also helps us to begin to assess communication"

This assessment will look like setting up a few different situations for (5 min) sessions and us observing over tele. For example, if we are looking at a snack-time situation, we will have you give (child) the snack at different intervals/time-points. We just want you to respond as normal to (child) without coaching from us, because we want to capture (child's) communication and challenging behavior as it is normally occurring in the environment."

Materials parents need to have ready

3. Send directions to the parent in an email about what they should have ready along with any special instructions (please try to avoid giving him/her a snack for about 20 min before the session..etc..).

> "For this assessment, we will have you provide (tangible from FAI), (task/demand from FAI), and (freeplay materials from FAI). Please have those ready before the session starts, or nearby."

Prior SDA set-up information for parents:

4. Remember to remind parent in an email about how the room/computer/camera/entrance/exits should be set up prior to the session

> "In order to minimize potential safety concerns, we want you to have the set up that we designated during the environmental check
>
> - Add what that is, (i.e., in living room, couch pushed between living room and kitchen, mirror temporarily taken down, minimal hard toys within reach).
> - If there need to be multiple set-ups for the different situations (i.e., snack in kitchen, other conditions in living room) give parent prior knowledge of that so they can plan for it.
> - Give simple instructions as to where materials will be during session
>   - i.e., "when we run the snack time condition, we will sit at the table, (child) will be in high chair, and we will have the Cheetos in a bowl. I will have you give (child) 1 at a time, and have you keep the bowl by yourself (out of child's reach)."
>   - Also remind them, you will discuss these instructions again before and during the session (so they do not feel overwhelmed, it is a lot to remember).

5. Termination criteria

> Safety criteria must be set ahead of time for parents to know when a session must be terminated (i.e., the skin breaks, or other unsafe situation related to the challenging behavior topography).
>
> Parents must also know what to do if termination criteria are met
>
> - They should be instructed to respond however they normally would, follow whatever protocol they normally would, or other.
>
> Parents ALWAYS have the right to terminate at any point they feel they are, the child is, someone else is, or the situation is uncomfortable /unsafe and should be reminded of this each day of sessions.

Interventionists also may terminate at any point they feel the situation is uncomfortable or unsafe.

Appendix G

SDA TASK ANALYSIS

Step #	**Step**
1.	Parents have been given prior info (see above) and are given a brief description of the sessic instructions for 5 min prior to beginning ****Parents are reminded about any specific termination criteria (i.e., if skin is broken), AND reminded they can opt to terminate at ANY time they are uncomfortable**
2.	Interventionist gives brief preview of an estimation of sessions for the day. We will run about 4 or 5, 5-minute sessions today. So, this should take about 45 min to an hour by the time we are all done. Then we will do a quick check in for the last 5 minutes. **Example:** "We will do sessions with restricted access to the snack (e.g.., you holding the bowl of Cheetos out of reach) **(Restricted access to tangible),** with (child) playing with legos **(Free play),** of homework time **(task/demand),** and of when you are pretending to be on the phone **(diverted attention)."**
3.	Sessions are set to a constant time (or if unable to hold sessions to constant time, calculate a rate or percentage for the DV). (Common times, 5 -20 min..)
4.	1st session begins, coach begins recording, sets timer, and gives parent the "go ahead and start"
5.	Coach provides a prompt to parent when to do each "trial" or when to re-set trial. Ex: "Okay, go ahead and walk away from (child) again"
6.	Coach provides intermittent praise to parent, or a brief count down of 'we've only got 2 min left, you're doing great"
7.	When session is over, coach stops debut recording, quickly check it recorded (lets parent know – okay just a min here while I check the recording)
8.	Coach gives parent a brief preview of next upcoming session (less than 1 min), answers any questions/concerns Coach begins Debut recording, starts timer, and instructs parent to begin
9.	When session is over, coach stops debut recording, quickly check it recorded (lets parent know – okay just a min here while I check the recording)
10.	Coach continues this process until all sessions are complete for the day: 1) gives parent brief instruction 2) begins Debut & timer 3) gives intermittent praise 4) ends recording, quick check in with parent, quick video check
11.	Coach systematically executes session order

	Can include: *Counterbalancing (not always running sessions in a specific order) *Randomization of session order * Comparing adjacencies (to compare effects of different sessions they need to occur next to each other, ex: ABA)
12.	At the end of the sessions, coach has child end with fun activity . Coach stays on the line (tele or phone) with parent until challenging behavior episode is over. (Never disconnect while challenging behavior is occurring)
13.	Once the child is calm, coach checks in with parent for several minutes regarding any questions, concerns, and the schedule/plan for the next day of sessions.

Session notes
Plan for next day of sessions:

Appendix H

PARENT FIDELITY TASK ANALYSIS OF BASELINE PROCEDURES

Step description	**<u>Please mark if:</u>** **Independent:** (Parent initiates step on their own) **Prompted:** (Interventionist prompts parent) **Error or other:** Step is skipped
1. Set up: Needed materials present, reinforcer, AAC stimuli present (PECS card or switch)	I _____ P _____ E _____ or N/A
2. Establishing operation at session start: Parent gives child with a small amount of access to the item/activity (approximately 30 sec to a min) or 1 bite/drink of food, or child is playing before starting demand	I _____ P _____ E _____ or N/A
3. Trial onset: Parent restricts access to the reinforcer and makes a statement such as "do you want some more?" **Preferred item/Activity* Removes access to the item activity as has been instructed (pulling item back/out of reach of the child or placing the item out of reach on the table **Demand (for break)* Places demand (instructs child to begin activity, providing prompts and states such as "lets do your puzzle") **Parental Attention* Turn away from/ turns back to child/puts head down/engages in other activity while giving the child minimal attention ***<u>If 80% or higher of trials correct, mark step #3 as yes</u>***	Trial 1 Trial 2 I _____ I _____ P _____ P _____ E/O _____ E/O _____ Trial 3 Trial 4 I _____ I _____ P _____ P _____ E/O _____ E/O _____ Trial 5 Trial 6 I _____ I _____ P _____ P _____ E/O _____ E/O _____ Trial 7 Trial 8 I _____ I _____ P _____ P _____ E/O _____ E/O _____ Trial 9 Trial 10 I _____ I _____ P _____ P _____ E/O _____ E/O _____
	# of Independent

	# of Prompted # of Errors
4. Reinforcer delivered contingent on idiosyncratic response: Child receives access to the item/activity/attention or the demand is removed immediately following pre-identified idiosyncratic response **Ella:** Leading (food/drink/video) Cry/yell (demand) **Lily:** Reaching for item or parent/clapping hands together (food/drink/playdoh/bubbles) Tantrum (demand) **Sidney:** Hitting highchair tray (Food in HC) Reaching for item or parent (snack in LR) Approach parent w/in 1 arms length ***<u>If 80% or higher of trials correct, mark step #4 as yes</u>***	Trial 1 Trial 2 I _____ I _____ P _____ P _____ E/O _____ E/O _____ Trial 3 Trial 4 I _____ I _____ P _____ P _____ E/O _____ E/O _____ Trial 5 Trial 6 I _____ I _____ P _____ P _____ E/O _____ E/O _____ Trial 7 Trial 8 I _____ I _____ P _____ P _____ E/O _____ E/O _____ Trial 9 Trial 10 I _____ I _____ P _____ P _____ E/O _____ E/O _____
	# of Independent # of Prompted # of Errors
5. Contingent access is NOT given for the AAC response ***<u>If 80% or higher of trials correct, mark step #5 as yes</u>***	Trial 1 Trial 2 I _____ I _____ P _____ P _____ E/O _____ E/O _____ Trial 3 Trial 4 I _____ I _____ P _____ P _____ E/O _____ E/O _____ Trial 5 Trial 6 I _____ I _____ P _____ P _____ E/O _____ E/O _____ Trial 7 Trial 8 I _____ I _____ P _____ P _____

	E/O _____ E/O _____ Trial 9 Trial 10 I _____ I _____ P _____ P _____ E/O _____ E/O _____
	# of Independent # of Prompted # of Errors
6. If child disinterested or rejecting item/activity (running away from area, pushing item away, refusing to consume item, etc) parent attempts to re-establish EO by showing item to child/shaking item/getting different food/drink/toy or putting item closer to child/playing with child with item for 1 min. If child continues to reject item for longer than 1 min session is terminated.	I _____ P _____ E/O _____
Total steps executed correctly (minus errors) ___ / _____ Total steps executed correctly and independently (minus prompts and errors) _____/_____	

Session notes

Appendix I

PARENT FIDELITY TASK ANALYSIS OF FCT PROCEDURES

Step #	**Step description**	**Please mark if:** **Independent:** (Parent initiates step on their own) **Prompted:** (Interventionist prompts parent) **Error or other:** Step is skipped
1.	**Set up:** Needed materials present, reinforcer, AAC stimuli present (PECS card or switch)	I _____ P _____ E/O _____
2.	**Establishing operation at session start:** Parent gives child with a small amount of access to the item/activity (approximately 30 sec to a min) or 1 bite/drink of food, or child is playing before starting demand	I _____ P _____ E/O _____
3.	**Trial onset:** Parent restricts access to the reinforcer within 30-60 sec and makes a statement such as "do you want some more?" **Preferred item/Activity* Removes access to the item activity as has been instructed (pulling item back/out of reach of the child or placing the item out of reach on the table **Demand (for break)* Places demand (instructs child to begin activity, providing prompts and states such as "lets do your puzzle") **Parental Attention* Turn away from/ turns back to child/puts head down/engages in other activity while giving the child minimal attention	Trial 1 / Trial 2 I _____ / I _____ P _____ / P _____ E/O _____ / E/O _____ Trial 3 / Trial 4 I _____ / I _____ P _____ / P _____ E/O _____ / E/O _____ Trial 5 / Trial 6 I _____ / I _____ P _____ / P _____ E/O _____ / E/O _____ Trial 7 / Trial 8 I _____ / I _____ P _____ / P _____ E/O _____ / E/O _____ Trial 9 / Trial 10 I _____ / I _____ P _____ / P _____ E/O _____ / E/O _____

4.	**Prompting** protocol is followed. New response: physical prompt is provided on 1st trial If successful, next trial a partial prompt is provided If successful, fading guidance is provided (parent implements delay a minimum of 30 sec prior to providing physical prompting) Prompting using verbal, gestures, or item position are used throughout session (not counted as prompts)	Trial 1 Trial 2 I _____ I _____ P _____ P _____ E/O _____ E/O _____ Trial 3 Trial 4 I _____ I _____ P _____ P _____ E/O _____ E/O _____ Trial 5 Trial 6 I _____ I _____ P _____ P _____ E/O _____ E/O _____ Trial 7 Trial 8 I _____ I _____ P _____ P _____ E/O _____ E/O _____ Trial 9 Trial 10 I _____ I _____ P _____ P _____ E/O _____ E/O _____
5.	**Contingent Access or removal**: Child receives access to the item/activity/attention or the demand is removed immediately following prompted correct or independent response. **Ella:** Touches PECS card, says "more" or "bye bye" approximation **Lily:** Touches PECS card, says word approximation related to the item/activity (e.g., "food/drink/more") **Sidney:** Touches microswitch with enough force to activate voice-output	Trial 1 Trial 2 I _____ I _____ P _____ P _____ E/O _____ E/O _____ Trial 3 Trial 4 I _____ I _____ P _____ P _____ E/O _____ E/O _____ Trial 5 Trial 6 I _____ I _____ P _____ P _____ E/O _____ E/O _____ Trial 7 Trial 8 I _____ I _____ P _____ P _____ E/O _____ E/O _____ Trial 9 Trial 10

		I _____ I _____ P _____ P _____ E/O _____ E/O _____
6.	Contingent access is NOT given for the Idiosyncratic response *If 80% or higher of trials correct, mark step #5 as yes*	Trial 1 Trial 2 I _____ I _____ P _____ P _____ E/O _____ E/O _____ Trial 3 Trial 4 I _____ I _____ P _____ P _____ E/O _____ E/O _____ Trial 5 Trial 6 I _____ I _____ P _____ P _____ E/O _____ E/O _____ Trial 7 Trial 8 I _____ I _____ P _____ P _____ E/O _____ E/O _____ Trial 9 Trial 10 I _____ I _____ P _____ P _____ E/O _____ E/O _____
7.	If child disinterested or rejecting item/activity (running away from area, pushing item away, refusing to consume item, etc) parent attempts to re-establish EO by showing item to child/shaking item/getting different food/drink/toy or putting item closer to child/playing with child with item for 1 min. If child continues to reject item for longer than 1 min session is terminated.	I _____ P _____ E/O _____
Total steps executed correctly (Independent and prompted, minus errors) ___ / 7 Total steps executed independently (independent ONLY, minus prompts and errors) _____/7		

Session notes